SKILL 1 TEACHER NOTES

Ordered Pairs

OBJECTIVE: Graph ordered pairs on the coordinate plane. (Strand: Algebra)

USING THE TRANSPARENCY: Divide the class into groups and give each group a map of your state. Prepare a list of towns for the students to find. Have the students describe the location of the towns by using ordered pairs.

USING THE STUDENT WORKBOOK: Ask students to explain the difference between (4, –3) and (–3, 4). Ask them to graph and label each point.

EXTENSION: Challenge students to give the coordinates of key points that form a polygon, such as a parallelogram or a pentagon.

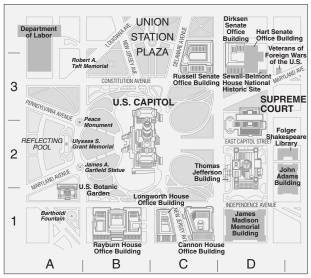
Transparency, Skill 1

SKILL 1 WARM UP

Ordered Pairs

Danielle and Paul are visiting Washington, D.C. They use a map to help them locate the sights of the city.

To help people find places on a map, most maps have letters along the horizontal edge and numbers along the vertical edge. A location on the map can be described as being above a certain letter and across from a certain number. The location can be given as an ordered pair by naming the letter from the horizontal edge first and the number from the vertical edge second.



What is located in section (B, 1)?

The Rayburn House Office Building is located above the B and across from the 1 and is therefore located in section (B, 1).

Where is the Supreme Court Building located?

The Supreme Court Building is above the D and across from the 2. It is located at (D, 2).

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Student Workbook, p. 1

SKILL 1 Name ____________ Date ______

Ordered Pairs

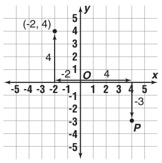
A horizontal number line and a vertical number line meet at their zero points to form a **coordinate system**. The horizontal line is the ***x*-axis**. The vertical line is the ***y*-axis**. The location of a point in the coordinate system can be named using an ordered pair of numbers.

(*x*, *y*)

x-coordinate —— *y*-coordinate

EXAMPLE *Name the ordered pair for point P.*

Start at *O*. Move along the *x*-axis until you are above point *P*. Then move down until you reach point *P*. Since you moved 4 units to the right and 3 units down, the ordered pair for point *P* is (4, −3).

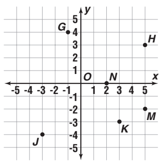


Graph point (−2, 4).

Start at O. Move 2 units left on the *x*-axis. Then move 4 units up parallel to the *y*-axis to locate the point.

EXERCISES *Name the ordered pair for each point.*

1. *G* **(−1, 4)**
2. *H* **(5, 3)**
3. *J* **(−3, −4)**
4. *K* **(3, −3)**
5. *M* **(5, −2)**
6. *N* **(2, 0)**

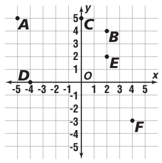


Glencoe/McGraw-Hill 1 Course 3 Intervention

Student Workbook, p. 2

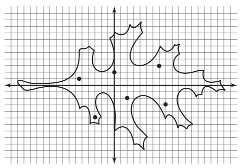
Graph and label each point.

7. *A*(−5, 5)
8. *B*(2, 4)
9. *C*(0, 5)
10. *D*(−4, 0)
11. *E*(2, 2)
12. *F*(4, −3)

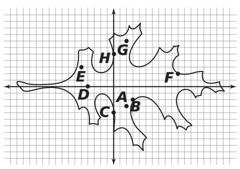


APPLICATIONS ***A botanist is interested in what part of a certain leaf is being infested by an insect that leaves black spots. She places a clear coordinate plane over several leaves that are about the same size and shape. Complete each of the following.***

13. Find the coordinates of the black spots on the leaf at the right.
(0, 2), (2, –2)
(7, 3), (8, –3)
($-5\frac{1}{2}$, 1), (–3, –5)



14. Draw and label the spots having the following coordinates on the leaf at the right.
A(2, –3) *B*(3, –2) *C*(0, –4) *D*(–4, 0)
E(–5, 3) *F*(10, 2) *G*(2, 7) *H*(0, 5)



Glencoe/McGraw-Hill 2 Course 3 Intervention

SKILL 2

TEACHER NOTES

Make Tables

OBJECTIVE: Solve problems by making a table or chart. (Strand: Problem Solving)

USING THE TRANSPARENCY: Have students describe how they would use a table to find all of the ways to make $1.05 using United States coins.

USING THE STUDENT WORKBOOK: Have students work in pairs. Have one student draw a table that can be used to solve the problem and the other student fill in the table. Have both students use the completed table to decide upon the solution. Then have students reverse roles.

EXTENSION: Write different amounts of money on a set of 3″ × 5″ cards. Have small groups of students draw a card and work together to find all of the ways to make the amount on the card using United States coins.

Transparency, Skill 2

SKILL 2 **WARM UP**

Make Tables

The cost of shipping a package to Canada using Surface Parcel Post is $4.85 for the first 2 pounds and $1.45 for each additional pound up to 66 pounds. What is the cost of shipping a package that weighs 10 pounds?

This problem can be solved by making a table. Put the weight of the package in the first column of the table and the shipping cost in the second column. In the shipping column, start with $4.85 for 2 pounds. Then add $1.45 to the shipping cost for each pound.

Package Weight (lb)	Shipping Cost (dollars)
2	4.85
3	4.85 + 1.45 = 6.30
4	6.30 + 1.45 = 7.75
5	7.75 + 1.45 = 9.20
6	9.20 + 1.45 = 10.65
7	10.65 + 1.45 = 12.10
8	12.10 + 1.45 = 13.55
9	13.55 + 1.45 = 15.00
10	15.00 + 1.45 = 16.45

The cost of shipping a package that weighs 10 pounds is $16.45.

Glencoe/McGraw-Hill Course 3 Intervention

Student Workbook, p. 3

SKILL 2 Name ______________________ Date __________

Make Tables

Tables can help you organize information so it can be understood easier.

EXAMPLE ***Shauna needed to give a customer $1.40 in change. The customer requested that she not give him any bills. He also did not want to be able to make change for a dime or a nickel. She gave the customer 10 United States coins. What ten coins did Shauna give the customer?***

This problem can be solved by making a table. Try to find different combinations of ten coins that make $1.40 and do *not* include change for 10¢ or 5¢.

pennies	nickels	dimes	quarters	total
5	1	3	1	$0.65
0	3	6	1	$1.00
0	1	7	2	$1.25
0	1	6	3	$1.40

The combination in the last row satisfies the requirements. There are 10 coins in the group, the coins have a value of $1.40, and you cannot make change for 10¢ or 5¢. Shauna gave the customer 1 nickel, 6 dimes, and 3 quarters.

EXERCISES ***Solve. Make a table.***

1. How many ways can you make change for a $50-bill using only $5-, $10-, and $20-bills?

   12 ways

2. Gregg has a penny, a nickel, a dime, and a quarter in his pocket. Without looking, Gregg picks two coins out of his pocket. How many different amounts of money could he choose?

   6 amounts

Glencoe/McGraw-Hill 3 Course 3 Intervention

Student Workbook, p. 4

3. Norma's Repair Shop charges $35 for a service call and $25 an hour for each hour of labor. How much does she charge for an 8-hour service call?

   $235

APPLICATIONS ***Jake and June Washington started a college fund for their daughter. They started the fund by depositing $800 at the beginning of the first month. They plan to add $75 to the fund at the end of every month. Use this information to answer Exercises 4–6.***

4. How much will be in the account after
   a. 1 month? **$875**
   b. 6 months? **$1,250**
   c. 1 year? **$1,700**
   d. 2 years? **$2,600**

5. How can you extend your table from Exercise 4 to find out how much will be in the account after every year?
   Add $900 to the previous year's amount.

6. Suppose the Washingtons deposited $800 at the end of the first month and then $75 at the end of every month after that. How would this change your table?
   The amounts would all be reduced by $75.

7. Find out how much your long distance phone company charges for calls. How much would it cost you to make a 15-minute long distance phone call?
   Answers may vary.

Glencoe/McGraw-Hill 4 Course 3 Intervention

SKILL 3

TEACHER NOTES

Problem-Solving Strategies

OBJECTIVE: Choose the best problem-solving strategy. (Strand: Problem Solving)

USING THE TRANSPARENCY: Explain to the students that another strategy for solving this problem is to act it out. Make a number line on the floor. Have one student represent Bud and one represent Jacob. Ask the students to stand on the number line to show the location of each boy at each half-hour interval.

USING THE STUDENT WORKBOOK: Explain to students that there are many strategies for solving problems and that students can use different strategies to solve the same problem.

EXTENSION: Have students make up a problem that can be solved in two or more ways. Ask them to explain the strategies that can be used to solve the problem.

Transparency, Skill 3

SKILL 3 **WARM UP**

Problem-Solving Strategies

Bud left camp at 9:00 A.M. riding his bicycle at 10 miles per hour. Jacob left camp at 9:30 A.M. riding his bicycle at 12 miles per hour in the same direction. At what time will Jacob catch up with Bud?

You could solve this problem by making a chart.

Time	9:30	10:00	10:30	11:00	11:30	12:00
Miles Bud has ridden	5	10	15	20	25	30
Miles Jacob has ridden	0	6	12	18	24	30

According to the chart, Jacob will catch up with Bud at 12:00 noon.

You could also solve this problem by using logical reasoning.

Each half hour, Bud travels 5 miles and Jacob travels 6 miles. In other words, Jacob travels 1 more mile than Bud every half hour. However, Jacob must make up the 5 miles Bud traveled between 9:00 and 9:30. It will take Jacob 5 half hours to make up the 5 miles, so Jacob will catch up with Bud $2\frac{1}{2}$ hours after Jacob's starting time of 9:30. Jacob will catch up with Bud at 12:00 noon.

Problems can often be solved using different strategies. For each problem you solve, you must decide which strategy would work best for you.

Glencoe/McGraw-Hill Course 3 Intervention

Student Workbook, p. 5

SKILL 3 Name ______________________ Date __________

Problem-Solving Strategies

There are many strategies that can be used to solve a problem. A few of these strategies are listed below.

- Draw a diagram
- Use a matrix or chart
- Make a list
- Use logical reasoning
- Draw a picture
- Guess and check

For each problem you solve, you must decide which strategy would work best for you.

EXAMPLE ***A 1-inch spool holds 100 inches of line, a 2-inch spool holds 400 inches of line, and a 3-inch spool holds 900 inches of line. How many inches of line are on a 5-inch spool?***

First make a chart.

Spool Size	Inches of Line
1 in.	100
2 in.	400
3 in.	900

Study the chart. You know that $1^2 = 1$, $2^2 = 4$, and $3^2 = 9$. Using logical reasoning, a 5-inch spool holds $5^2 \times 100$ or 2,500 inches.

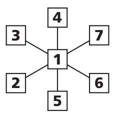
EXERCISES ***Solve using any strategy.***

1. Juan has a mixture of pennies and dimes worth $2.28. He has between 39 and 56 pennies. How many dimes does Juan have? **18 dimes**

Glencoe/McGraw-Hill 5 Course 3 Intervention

Student Workbook, p. 6

2. Arrange the digits 1 through 7 in the squares so that the sum along any line is 10.



3. There are three cubes each measuring a different whole number of inches on an edge. When the cubes are stacked, the stack is six inches high. What is the length of the edge of each cube? **1 in., 2 in., and 3 in.**

APPLICATIONS

4. Mr. Patel asked five of his students to line up by height. Juan is *not* the shortest and is *not* standing next to Pamela. Tad is the tallest and is *not* standing next to Juan. Marco is taller than Pamela and Caroline is next to Tad. Who is standing in the middle? **Juan**
5. If it takes 20 seconds to inflate a balloon with helium from a tank, how many balloons can be inflated in 6 minutes? **18 balloons**
6. A vending machine dispenses products that each cost 60¢. It accepts quarters, dimes, and nickels only. If it only accepts exact change, how many different combinations of coins must the machine be programmed to accept? **13 combinations**
7. The bus leaves the downtown for the mall at 7:35 A.M., 8:10 A.M., 8:45 A.M., and 9:20 A.M.. If the bus continues to run on this schedule, what time does the bus leave between 10:00 A.M. and 11:00 A.M.? **10:30 A.M.**
8. Bob needs to go to the bank, the post office, and the bicycle shop. In how many different orders can he do his errands? **6 different orders**
9. Ronda spent 22 minutes on the telephone talking long-distance to her cousin. If the rate is $0.20 for each of the first 3 minutes and $0.15 for each minute after that, how much did the call cost? **$3.45**

Glencoe/McGraw-Hill 6 Course 3 Intervention

SKILL 4

TEACHER NOTES

Slope of a Line

OBJECTIVE: Determine the slope of a line graphed in the coordinate plane. (Strand: Algebra)

USING THE TRANSPARENCY: Draw the graphs of the lines $y = \frac{1}{4}x$, $y = \frac{1}{2}x$, $y = 2x$, and $y = 4x$ on a coordinate grid on a transparency. Have students find the slopes.

USING THE STUDENT WORKBOOK: Give students a list of slopes to chose from for each graph in Exercises 1–4. Have them choose the correct slope.

EXTENSION: Have students lay a piece of spaghetti on a graph and find the slope of the line.

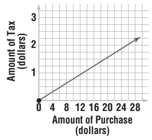
Transparency, Skill 4

SKILL 4 **WARM UP**

Slope of a Line

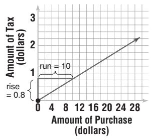
The graph below shows the amount of sales tax charged in Tulsa, Oklahoma on different purchases. What is the percent of sales tax?

Sales Tax
Tulsa, Oklahoma



You can find the percent of sales tax by finding the **slope** of the line. To find the slope, choose any two points on the line. Draw a vertical line and then a horizontal line to connect the two points. Find the length of the vertical line to find the rise. Find the length of the horizontal line to find the run. The slope is the rise divided by the run.

Sales Tax
Tulsa, Oklahoma



$$\text{slope} = \frac{\text{rise}}{\text{run}}$$
$$= \frac{0.8}{10} \text{ or } 0.08$$

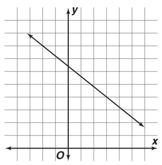
The sales tax is 8%.

Student Workbook, p. 7

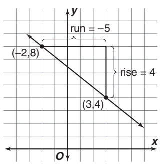
SKILL 4 Name ____________ Date ________

Slope of a Line

The graph of a line is shown below.



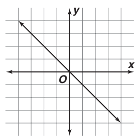
EXAMPLE ***Find the slope of the line. Follow these steps to find the slope.***

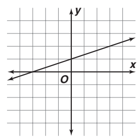


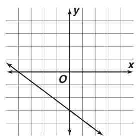
1. Choose any two points on the line. The points chosen at the right have coordinates (3, 4) and (–2, 8).
2. Draw a vertical line and then a horizontal line to connect the two points.
3. Find the length of the vertical line to find the rise. The rise is 4 units up or 4.
4. Find the length of the horizontal line to find the run. The run is 5 units to the left or –5.
5. slope $= \frac{\text{rise}}{\text{run}} = \frac{4}{-5}$

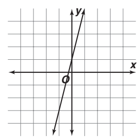
Student Workbook, p. 8

EXERCISES *Find the slope of each line shown.*

1.  **1**

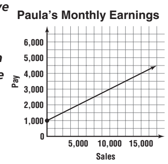
2.  $\mathbf{\frac{1}{3}}$

3.  $\mathbf{\frac{3}{4}}$

4.  **4**

APPLICATIONS *Paula works as a sales representative for a computer manufacturer. She earns a base pay of $1,000 each month. She also earns a commission based on her sales. The graph at the right shows her possible monthly earnings. Use the graph to answer Exercises 5–8.*

Paula's Monthly Earnings



5. What is the slope of the line? $\mathbf{\frac{1}{5}}$
6. What information is given by the slope of the line?
   The rate of commission Paula earns is $\frac{1}{5}$ or 20% of her sales.
7. If Paula's base pay changed to $1,100, would it change
   a. the graph? Why or why not?
      Yes, the entire line would move up 100 units.
   b. the slope? Why or why not?
      No, the rate of commission would not change.
8. If Paula's rate of commission changed to 25%, would it change the graph? Why or why not?
   Yes, the slope would be $\frac{1}{4}$.

SKILL 5

TEACHER NOTES

Solve Two-Step Equations

OBJECTIVE: Solve two-step equations. (Strand: Algebra)

USING THE TRANSPARENCY: Have students write an equation for and solve the following problem: *Eight more than half a number is 15.*

USING THE STUDENT WORKBOOK: Guide students to undo operations in reverse order of the order of operations. Point out how this is done in each of the examples.

EXTENSION: Create a set of index cards for students to use in creating two step equations to solve.

Transparency, Skill 5

SKILL 5 **WARM UP**

Solve Two-Step Equations

At Frosty's, one more than 3 times as many chocolate ice cream cones were sold as vanilla on a certain day. If 217 vanilla cones were sold, how many chocolate cones were sold?

First write an equation using the information given.

Let c represent the number of chocolate cones sold that day.

1 more than	3 times as many chocolate cones		number of vanila cones
1	$+3c$	$=$	217

Therefore, the equation is $1 + 3c = 217$.

Now solve the equation.

$1 + 3c = 217$

$1 + 3c - 1 = 217 - 1$ *Subtract 1 from each side.*

$3c = 216$

$\frac{3c}{3} = \frac{216}{3}$ *Divide each side by 3.*

$c = 72$

There were 72 chocolate cones sold that day.

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Student Workbook, p. 9

SKILL 5 Name ______________ Date ________

Solve Two-Step Equations

To solve two-step equations, you need to add or subtract first. You also need to multiply or divide.

EXAMPLES *Solve each equation.*

$7v - 3 = 25$

$7v - 3 + 3 = 25 + 3$ *Add 3 to each side.*

$7v = 28$

$\frac{7v}{7} = \frac{28}{7}$ *Divide each side by 7.*

$v = 4$

The solution is 4.

$\frac{1}{6}(r - 3) = -5$

$6 \times \frac{1}{6}(r - 3) = 6 \times -5$ *Multiply each side by 6.*

$r - 3 = -30$

$r - 3 + 3 = -30 + 3$ *Add 3 to each side.*

$r = -27$

The solution is –27.

EXERCISES *Name the first step in solving each equation. Then solve each equation.*

1. $6n - 2 = 22$
   Add 2 to each side; 4
2. $\frac{1}{2}(y - 3) = 12$
   Multiply each side by 2; 27

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Student Workbook, p. 10

Solve each equation.

3. $-5t - 5 = -5$ **0**
4. $4x - 5 = 15$ **5**
5. $24 = 17 - 2c$ **–3.5**
6. $-5h - 6 = 24$ **–6**
7. $6 - 3b = -9$ **5**
8. $12 - 4n = 4$ **2**
9. $7 + \frac{k}{4} = 9$ **8**
10. $\frac{5}{7}(d + 20) = -10$ **–34**
11. $\frac{2}{3}(a - 18) = -6$ **9**

Translate each sentence into an equation. Then solve the equation.

12. Six less than a number divided by 3 is 12.
    $\boldsymbol{\frac{n}{3} - 6 = 12; 54}$
13. The sum of a number and four, times 3, is negative twelve.
    $\boldsymbol{3(n + 4) = -12; -8}$
14. Three times a number plus negative five is negative eleven.
    $\boldsymbol{3n + (-5) = -11; -2}$

APPLICATIONS

15. On a July day in Detroit, Michigan, the temperature rose to 80°F. Find this temperature in degrees Celsius. ($F = \frac{9}{5}C + 32$)
    about 26.7°C
16. Aardvark Taxis charge $1.50 for the first half mile and then $0.25 for each additional quarter of a mile. What would the cost be for a 2-mile trip?
    $3
17. Three pens cost $1.55 including $0.08 sales tax. How much did each pen cost?
    $0.49

Glencoe/McGraw-Hill 10 Course 3 Intervention

SKILL 6 TEACHER NOTES

Slope-Intercept Form

OBJECTIVE: Transform equations into slope-intercept form. (Strand: Algebra)

USING THE TRANSPARENCY: Encourage students to examine the scale of a graph carefully. Discuss how the scale of this graph is different from graphs in the student workbook.

USING THE STUDENT WORKBOOK: Have students discuss activities and the rates at which they do them. How quickly can they walk a mile? How many miles could they walk in an hour?

EXTENSION: Have students find information on the latest winners of a triathlon and graph the different rates of the race segments for a particular participant.

Transparency, Skill 6

SKILL 6 WARM UP

Slope-Intercept Form

Jeremie and Joel are discussing their recent typing tests. Jeremie said he types 45 words per minute. Joel said his rate is $y - 58x = 0$. Write both rates in slope-intercept form and graph.

Joel

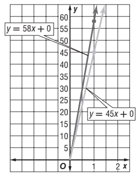
$y - 58x = 0$ Add $58x$ to both sides.

$y - 58x + 58x = 0 + 58x$

$y = 58x + 0$

Jeremie

$y = 45x + 0$



The steeper line shows Joel's rate of 58 words per minute. The equations both pass through (0,0) because they each type 0 words at 0 minutes.

Student Workbook, p. 11

SKILL 6 Name ______________ Date ________

Slope-Intercept Form

An equation in **slope-intercept form** looks like the following.

$$y = mx + b$$

The variables are x and y. The m and b are used to represent constants. In a particular equation, m and b would be specific numbers. An example of an equation in slope-intercept form is $y = 3x + 8$.

The **slope** is m. This can also be thought of as, the value y changes each time the value of x increases by 1. In a graph of the equation, the slope is how steep the line is.

The **y-intercept** is b, or the value of y when $x = 0$. In a graph of the equation, the y-intercept is the place where the line crosses the y axis

EXAMPLE *Rewrite the equation $3y - 15x = 4$ in slope-intercept form.*

Rearrange the equation by doing the same thing to each side until the equation is in the form you want.

$3y - 15x = 4$

$3y = 15x + 4$ Add $15x$ to each side.

$\frac{3}{3}y = \left(\frac{15}{3}\right)x + \frac{4}{3}$ Divide each side by 3.

$y = 5x + \frac{4}{3}$ Simplify.

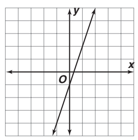
EXERCISES *Rewrite each equation in slope-intercept form.*

1. $x + y = 16$ **$y = -x + 16$**
2. $8x - y = 5$ **$y = 8x - 5$**
3. $x + 2y = 12$ **$y = -\frac{1}{2}x + 6$**
4. $5y - x = 10$ **$y = \frac{1}{5}x + 2$**
5. $y + 5x = -20$ **$y = -5x - 20$**
6. $y - 2 = 4x$ **$y = 4x + 2$**
7. $9x - 4y = -12$ **$y = \frac{9}{4}x + 3$**
8. $15x = 18 - 9y$ **$y = -\frac{5}{3}x + 2$**

Student Workbook, p. 12

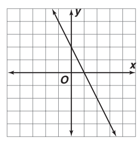
EXERCISES *Identify the slope and y-intercept of each graph. Then write the equation that corresponds to each graph. Write the equations in slope-intercept form.*

9.



Slope (m)	**3**
y-intercept (b)	**−1**
Equation	**$y = 3x - 1$**

10.



Slope (m)	**−2**
y-intercept (b)	**2**
Equation	**$y = -2x + 2$**

APPLICATIONS *Kate can walk 4 miles per hour. She can go 13 miles per hour on her bicycle. Use this information to answer Exercises 11–13.*

11. Does Kate travel faster on foot or on her bicycle? **on her bicycle**
12. Complete the input-output tables. In the following tables, d represents the distance she travels, and t represents the time it takes her to go that distance.

Distance Kate Can Travel (in miles) on Foot				
Time (t)	0 hours	1 hour	2 hours	3 hours
Distance (d)	**0 miles**	**4 miles**	**8 miles**	**12 miles**

Distance Kate Can Travel (in miles) by Bicycle				
Time (t)	0 hours	1 hour	2 hours	3 hours
Distance (d)	**0 miles**	**13 miles**	**26 miles**	**39 miles**

13. If you graphed the data from each input-output table, what would you label the horizontal axis, t or d? **The horizontal axis would be *t*.**
14. What does the slope of the graph represent in the story? Why does one of the graphs have a steeper slope than the other? **How fast she goes. She goes faster on the bicycle than on foot.**

SKILL 7

TEACHER NOTES

Graphing Functions

OBJECTIVE: Graph functions from function tables. (Strand: Algebra)

USING THE TRANSPARENCY: Draw two graphs on the chalkboard. One graph should be a function, and the other should not be a function. Have students describe the graphs and explain why one graph is a function and the other is not a function.

USING THE STUDENT WORKBOOK: Have students work in pairs. Have one student draw and label the axes and the other student draw the graph. Then have students reverse roles.

EXTENSION: Have students work in pairs. Have one student draw a graph of a function and the other student suggest data that the graph could possibly show.

Transparency, Skill 7

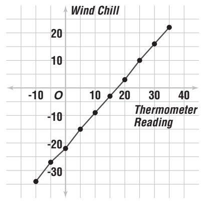
SKILL 7 WARM UP

Graphing Functions

The function table at the right shows wind chill factors for a wind speed of 10 miles per hour. Graph the function.

Thermometer Reading (°F)	Wind Chill (°F)
35	22
30	16
25	10
20	3
15	−3
10	−9
5	−15
0	−22
−5	−27
−10	−34

To graph the function, first label the axes and graph the points named by the data. Then connect the points to complete the graph of the function. The completed graph is shown below.



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Student Workbook, p. 13

SKILL 7 Name ______ Date ______

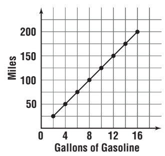
Graphing Functions

Carin's motor home averages about 25 miles on two gallons of gasoline. The function table at the right shows this relationship.

Gallons of Gasoline	Miles
2	25
4	50
6	75
8	100
10	125
12	150
14	175
16	200

EXAMPLE *Graph the function.*

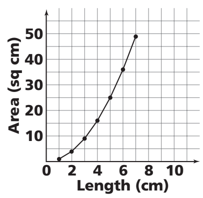
To graph the function, first label the axes and graph the points named by the data. Then connect the points as shown in the graph at the right.



EXERCISES *Graph each function.*

1.

Length of Side (cm)	Area (sq cm)
1	1
2	4
3	9
4	16
5	25
6	36
7	49



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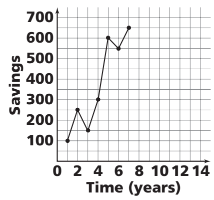
Student Workbook, p. 14

2.

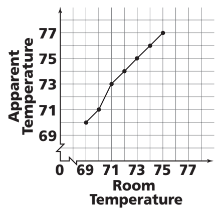
Time (years)	Savings (dollars)
1	100
2	250
3	150
4	300
5	600
6	550
7	650



APPLICATIONS *The function table at the right shows the apparent temperature for the given room temperatures for a relative humidity of 80%. Use the data to answer Exercises 3–5.*

Room Temperature (in °F)	Apparent Temperature (in °F)
69	70
70	71
71	73
72	74
73	75
74	76
75	77

3. Graph the function.



4. If this pattern continues, what would you expect the apparent temperature to be for a room temperature of 68°F?

69°F

5. Where does a change in the pattern of the function occur? Why do you think this change occurs?

The changes occurs between the room temperatures of 70°F and 71°F; Answers will vary.

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SKILL 8 TEACHER NOTES

Using Statistics to Make Predictions

OBJECTIVE: Use best-fit lines to make predictions based on data collected. (Strand: Data Analysis and Probability)

USING THE TRANSPARENCY: Review the concepts of slope, *y*-intercept, and slope-intercept form with students.

USING THE STUDENT WORKBOOK: Remind students that answers given are sample answers and may differ from their answers because of use of differing ordered pairs.

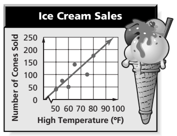
EXTENSION: Have students survey other students of varying ages and gather data on age and height. Use this data to predict the height for a 16-year-old.

Transparency, Skill 8

SKILL 8 WARM UP

Using Statistics to Make Predictions

A **best-fit line** is a line that is very close to most of the data points.



Use the information from the graph to write an equation in slope-intercept form for the best-fit line and then predict the number of ice cream cones sold in a day when the high temperature for the day is 92°F.

Step 1 First, select two points on the line and find the slope. Use (50, 40) and (80, 175).

$m = \frac{y_2 - y_1}{x_2 - x_1}$ *Definition of slope*

$= \frac{175 - 40}{80 - 50}$ $x_1 = 50, y_1 = 40, x_2 = 80, y_2 = 175$

$= 4.5$ *Simplify.*

Step 2 Find the *y*-intercept.

$y = mx + b$ *Slope-intercept form*

$175 = 4.5(80) + b$ $y = 175, m = 4.5, x = 80$

$-185 = b$ *Simplify.*

Step 3 Write the equation.

$y = mx + b$ *Slope-intercept form*

$y = 4.5x - 185$ $m = 4.5, b = -185$

Step 4 Predict the number of cones sold on a day where the high temperature is 92°F.

$y = 4.5(92) - 185$ $x = 92$

$= 229$ *Simplify.*

A prediction for the number of ice cream cones sold on a day when the high temperature is 92°F is 229 cones.

Student Workbook, p. 15

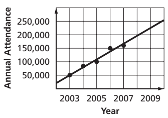
SKILL 8 Name ________________ Date ________

Using Statistics to Make Predictions

When real-life data are collected in a statistical experiment, the points graphed usually do not form a straight line. They may, however, approximate a linear relationship. A **best-fit line** can be used to show such a relationship. A best-fit line is a line that is very close to most of the data points.

EXAMPLE ***Use the best-fit line to predict the annual attendance at Fun Times Amusement Park in 2009.***

Draw a line so that the points are as close as possible to the line. Extend the line so that you can find the *y* value for an *x* value of 2009. The *y* value for 2009 is about 225,000.



So, the predicted annual attendance at Fun Times Amusement Park in 2009 is 225,000 people.

You can also write an equation of a best-fit line.

EXAMPLE ***Use the information from the example above. Write an equation in slope-intercept form for the best-fit line and then predict the annual attendance in 2008.***

Step 1 First, select two points on the line and find the slope. Choose (2004, 90,000) and (2006, 150,000).

$m = \frac{y_2 - y_1}{x_2 - x_1}$ *Definition of slope*

$= \frac{150{,}000 - 90{,}000}{2006 - 2004}$ $x_1 = 2004, y_1 = 90{,}000$

$x_2 = 2006, y_2 = 150{,}000$

$= 30{,}000$ *Simplify.*

Step 2 Find the *y*-intercept.

$y = mx + b$ *Slope-intercept form*

$90{,}000 = 30{,}000(2004) + b$ $y = 90{,}000, m = 30{,}000, x = 2004$

$b = -60{,}030{,}000$ *Simplify.*

Student Workbook, p. 16

Step 3 Write the equation.

$y = mx + b$ *Slope-intercept form*

$y = 30{,}000x - 60{,}030{,}000$ $m = 30{,}000, b = -60{,}030{,}000$

Step 4 Solve the equation.

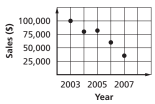
$y = 30{,}000(2008) - 60{,}030{,}000$ $x = 2008$

$= 210{,}000$ *Simplify.*

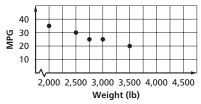
The predicted annual attendance at Fun Times Amusement Park in 2008 is 210,000.

EXERCISES

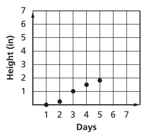
1. Predict the sales figure for 2009.
$25,000



2. What is the gas mileage for a car weighing 4,500 pounds? **12 miles per gallon**



3. How tall would a tomato plant be ten days after planting the seed? **3.5 inches**



APPLICATIONS

4. Use the graph in Exercise 2. Determine the equation of the best-fit line. Use it to predict the gas mileage for a car weighing 4,000 pounds.
Sample answer: $y = -0.01x + 53$; 13 miles per gallon

5. Use the graph in Exercise 3. Determine the equation of the best-fit line. Use it to predict the height of the tomato plant 8 days after planting.
Sample answer: $y = 0.25x + 0.25$; 2.25 inches

SKILL 9

TEACHER NOTES

Angles

OBJECTIVE: Measure, draw, and classify angles. (Strand: Geometry)

USING THE TRANSPARENCY: Have students find angles in the classroom. Challenge them to find angles that are not right angles.

USING THE STUDENT WORKBOOK: Guide students to recognize that angles less than the corner of a page are less than 90° and that those greater than the corner of a page are greater than 90°. This will help them to remember to read the correct scale on their protractors.

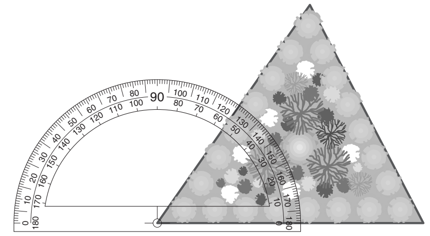
EXTENSION: Draw several angles on the chalkboard. Ask the students to estimate their measures. Have students check their estimates using a protractor.

Transparency, Skill 9

SKILL 9 WARM UP

Angles

Charlis is a landscape architect. She is designing a triangular flower garden. A scale drawing of her plan is shown below. What is the measure of the angle in the lower left corner of the flower garden?



To measure an angle, place the center of a protractor on the vertex of the angle. Place the zero mark of the scale along one side of the angle. Read the angle measure where the other side of the angle crosses the scale.

The measure of the angle is 55°.

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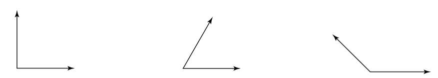
Student Workbook, p. 17

SKILL 9 Name ______________________ Date __________

Angles

An angle is formed by two rays with a common endpoint called the **vertex**. Angles are often measured in **degrees** and can be classified according to their measure.



Right angles measure 90°.

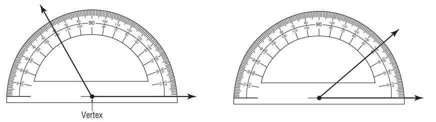
Acute angles measure between 0° and 90°.

Obtuse angles measure between 90° and 180°.

A protractor may be used to measure an angle.

EXAMPLE *Measure each angle. Classify each angle as right, acute, or obtuse.*

To measure an angle, place the center of the protractor on the vertex of the angle. Place the zero mark of the scale along one side of the angle. Find the place where the other side crosses the scale and read the measure.



The measure of the angle is 120°. Therefore, it is obtuse.

The measure of the angle is 40°. Therefore, it is acute.

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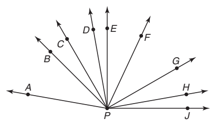
Student Workbook, p. 18

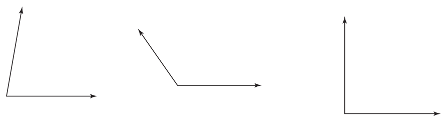
EXERCISES *Use the figure at the right to find the measure of each angle. Then classify each angle as right, acute, or obtuse.*

1. ∠FPJ **65°; acute**
2. ∠DPJ **100°; obtuse**
3. ∠BPJ **135°; obtuse**
4. ∠EPJ **90°; right**
5. ∠BPF **70°; acute**
6. ∠APG **140°; obtuse**
7. ∠DPH **90°; right**
8. ∠EPG **60°; acute**



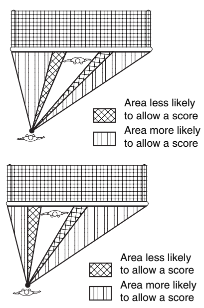
Use a protractor to draw angles with the following measures.

9. 80°
10. 125°
11. 90°



APPLICATIONS *Soccer is a game of angles. Study the diagrams of a player shooting against a goalkeeper to answer Exercises 12–14.*

12. In the first diagram, would the player increase her chances of scoring a goal by moving closer to the goalkeeper? **yes**
13. The player forces the goalkeeper to the left as shown in the second diagram. Will the player have a better chance of making a goal? **yes**
14. If the goalkeeper moves closer to the player, will the player have a better chance of making a goal? **no**



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SKILL 10 TEACHER NOTES

Angle Relationships

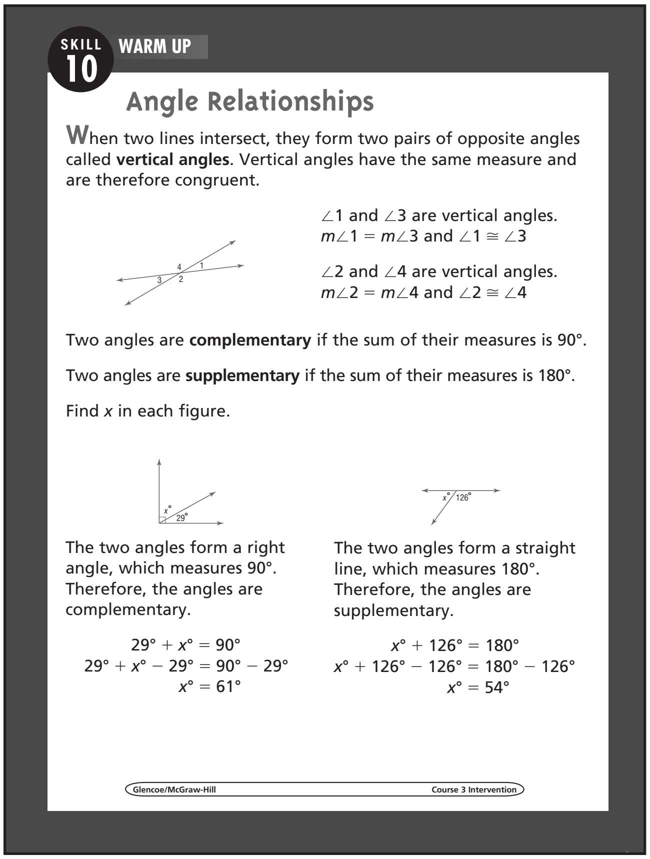
OBJECTIVE: Investigate vertical, complementary, and supplementary angles. (Strand: Geometry)

USING THE TRANSPARENCY: When beginning the discussion of angle relationships, emphasize that only *pairs* of angles can be vertical, complimentary, or supplementary.

USING THE STUDENT WORKBOOK: Have students estimate their answers using a protractor to find the missing angle measures.

EXTENSION: Have students look up the everyday meanings of *complement* and *supplement*. Ask students what they think these definitions mean with respect to angles.

Transparency, Skill 10



SKILL 10 WARM UP

Angle Relationships

When two lines intersect, they form two pairs of opposite angles called **vertical angles**. Vertical angles have the same measure and are therefore congruent.

$\angle 1$ and $\angle 3$ are vertical angles.
$m\angle 1 = m\angle 3$ and $\angle 1 \cong \angle 3$

$\angle 2$ and $\angle 4$ are vertical angles.
$m\angle 2 = m\angle 4$ and $\angle 2 \cong \angle 4$

Two angles are **complementary** if the sum of their measures is 90°.

Two angles are **supplementary** if the sum of their measures is 180°.

Find x in each figure.

The two angles form a right angle, which measures 90°. Therefore, the angles are complementary.

$$29° + x° = 90°$$
$$29° + x° - 29° = 90° - 29°$$
$$x° = 61°$$

The two angles form a straight line, which measures 180°. Therefore, the angles are supplementary.

$$x° + 126° = 180°$$
$$x° + 126° - 126° = 180° - 126°$$
$$x° = 54°$$

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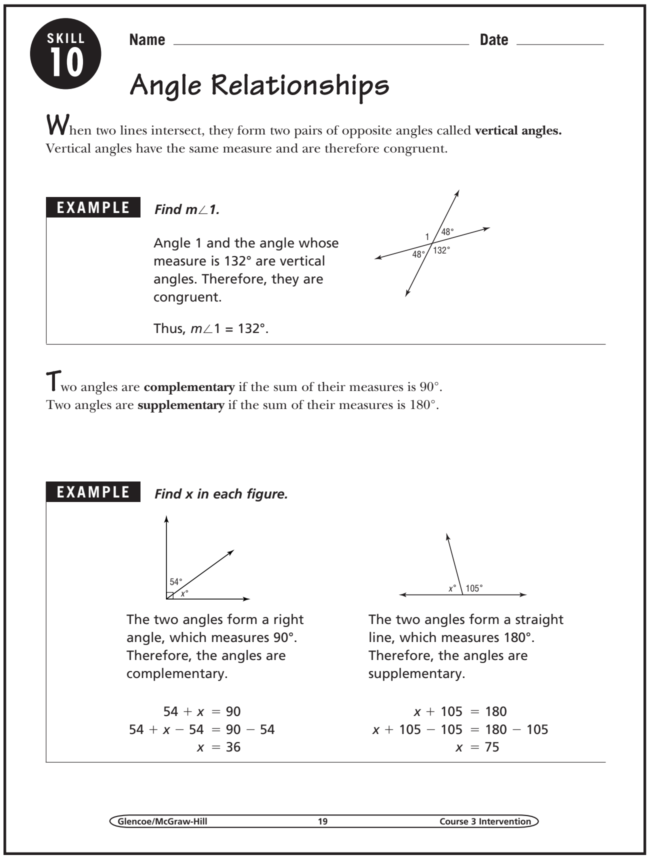
Student Workbook, p. 19



SKILL 10 Name ____________ Date ______

Angle Relationships

When two lines intersect, they form two pairs of opposite angles called **vertical angles.** Vertical angles have the same measure and are therefore congruent.

EXAMPLE *Find $m\angle 1$.*

Angle 1 and the angle whose measure is 132° are vertical angles. Therefore, they are congruent.

Thus, $m\angle 1 = 132°$.

Two angles are **complementary** if the sum of their measures is 90°. Two angles are **supplementary** if the sum of their measures is 180°.

EXAMPLE *Find x in each figure.*

The two angles form a right angle, which measures 90°. Therefore, the angles are complementary.

$$54 + x = 90$$
$$54 + x - 54 = 90 - 54$$
$$x = 36$$

The two angles form a straight line, which measures 180°. Therefore, the angles are supplementary.

$$x + 105 = 180$$
$$x + 105 - 105 = 180 - 105$$
$$x = 75$$

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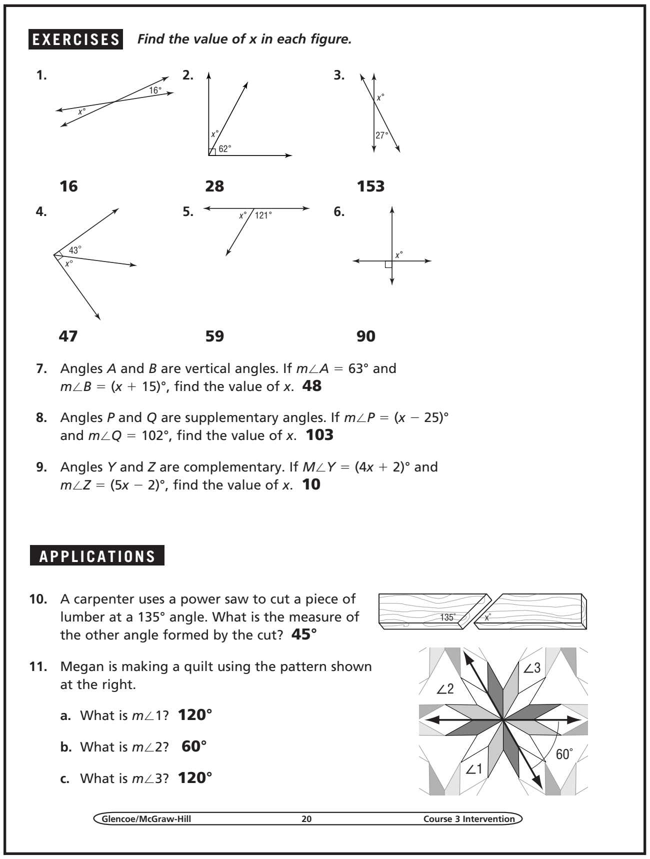
Student Workbook, p. 20



EXERCISES *Find the value of x in each figure.*

1. 16
2. 28
3. 153
4. 47
5. 59
6. 90
7. Angles A and B are vertical angles. If $m\angle A = 63°$ and $m\angle B = (x + 15)°$, find the value of x. **48**
8. Angles P and Q are supplementary angles. If $m\angle P = (x - 25)°$ and $m\angle Q = 102°$, find the value of x. **103**
9. Angles Y and Z are complementary. If $M\angle Y = (4x + 2)°$ and $m\angle Z = (5x - 2)°$, find the value of x. **10**

APPLICATIONS

10. A carpenter uses a power saw to cut a piece of lumber at a 135° angle. What is the measure of the other angle formed by the cut? **45°**
11. Megan is making a quilt using the pattern shown at the right.
    a. What is $m\angle 1$? **120°**
    b. What is $m\angle 2$? **60°**
    c. What is $m\angle 3$? **120°**

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SKILL 11

TEACHER NOTES

Parallel Lines and Angle Relationships

OBJECTIVE: Recognize angle relationships formed by parallel lines. (Strand: Geometry)

USING THE TRANSPARENCY: Draw a pair of parallel lines cut by a transversal on the chalkboard. Point out to students the difference between interior angles and exterior angles.

USING THE STUDENT WORKBOOK: Have students draw a pair of parallel lines using the lines of notebook paper. Then have them draw a line through the parallel lines. Have students measure the resulting angles with a protractor.

EXTENSION: Have students find three or four real-world examples of angles formed by a transversal cutting parallel lines.

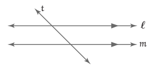
Transparency, Skill 11

SKILL 11 WARM UP

Parallel Lines and Angle Relationships

Two lines in a plane that never intersect are called **parallel lines**. Arrowheads on the lines indicate that they are parallel.

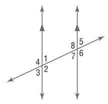
A line that intersects two or more parallel lines is called a **transversal**.



Lines ℓ and m are parallel. This can be written as $\ell \parallel m$. Line t is a transversal.

When two parallel lines are cut by a transversal, then the following are true.

- **Alternate interior angles** are congruent.
  $\angle 1 \cong \angle 7$ and $\angle 2 \cong \angle 8$
- **Alternate exterior angles** are congruent.
  $\angle 3 \cong \angle 5$ and $\angle 4 \cong \angle 6$
- **Corresponding angles** are congruent.
  $\angle 1 \cong \angle 5$, $\angle 2 \cong \angle 6$, $\angle 3 \cong \angle 7$, $\angle 4 \cong \angle 8$
- **Consecutive interior angles** are supplementary.
  $\angle 1$ and $\angle 8$ are supplementary.
  $\angle 2$ and $\angle 7$ are supplementary.



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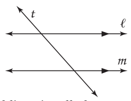
Student Workbook, p. 21

SKILL 11 Name ____________ Date ______

Parallel Lines and Angle Relationships

Two lines in a plane that never intersect or cross are called **parallel lines.** Arrowheads on the lines indicate that they are parallel.

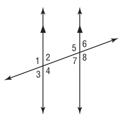


Lines ℓ and m are parallel. This can be written as $\ell \parallel m$. Line t is a transversal.

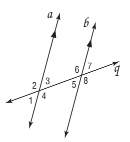
A line that intersects two or more parallel lines is called a **transversal.**

When two parallel lines are cut by a transversal, then the following are true.

- **Alternate interior angles,** those on opposite sides of the transversal and inside the other two lines are congruent. In the figure, $\angle 2 \cong \angle 7$ and $\angle 4 \cong \angle 5$.
- **Alternate exterior angles,** those on opposite sides of the transversal and outside the other two lines, are congruent. In the figure, $\angle 3 \cong \angle 6$ and $\angle 1 \cong \angle 8$.
- **Corresponding angles,** those in the same position on the two lines in relation to the transversal, are congruent. In the figure, $\angle 1 \cong \angle 5$, $\angle 2 \cong \angle 6$, $\angle 3 \cong \angle 7$, and $\angle 4 \cong \angle 8$.
- **Consecutive interior angles,** those on the same side of the transversal and inside the other two lines, are supplementary. In the figure, $\angle 2$ and $\angle 5$ are supplementary, and $\angle 4$ and $\angle 7$ are supplementary.



EXAMPLES *Find the measure of each angle.*



If $m\angle 4 = 115°$, $m\angle 6 =$ ______.
Since $\angle 4$ and $\angle 6$ are alternate interior angles, they are congruent. So, $m\angle 6 = 115°$

If $m\angle 7 = 50°$, $m\angle 1 =$ ______.
Since $\angle 7$ and $\angle 1$ are alternate exterior angles, they are congruent. So, $m\angle 1 = 50°$

If $m\angle 1 = 62°$, $m\angle 5 =$ ______.
Since $\angle 1$ and $\angle 5$ are corresponding angles, they are congruent. So, $m\angle 5 = 62°$

If $m\angle 3 = 34°$, $m\angle 6 =$ ______.
Since $\angle 3$ and $\angle 6$ are consecutive interior angles, they are supplementary.

$34 + m\angle 6 = 180$ *Definition of supplementary angles*
$m\angle 6 = 146$ *Subtract 34 from each side.*

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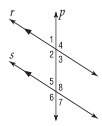
Student Workbook, p. 22

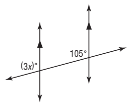
EXERCISES *Find the measure of each angle.*



1. $m\angle 1 = 42°$, $m\angle 7 =$ ______ **42°**
2. $m\angle 3 = 58°$, $m\angle 5 =$ ______ **58°**
3. $m\angle 2 = 110°$, $m\angle 5 =$ ______ **70°**
4. $m\angle 6 = 127°$, $m\angle 4 =$ ______ **127°**
5. $m\angle 8 = 150°$, $m\angle 2 =$ ______ **150°**
6. $m\angle 7 = 60°$, $m\angle 3 =$ ______ **60°**

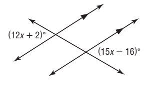
Find the value of x in each figure.

7.



35

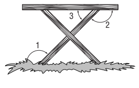
8.



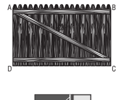
6

APPLICATIONS

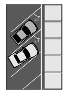
9. Brooke is building a bench to place in her yard. The top of the bench will be parallel to the ground. If $m\angle 1 = 135°$, find $m\angle 2$ and $m\angle 3$. **135°; 45°**



10. A section of fencing is reinforced with a diagonal brace as shown. What is $m\angle ACD$? **27°**



11. City planners angled the parking spaces at City Hall. All of the lines marking the parking spaces are parallel. If $m\angle 2 = 40°$, what is $m\angle 1$? Explain. **40°; The angles are consecutive interior angles, so they are congruent.**



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SKILL **12**

TEACHER NOTES

Percents as Fractions and Decimals

OBJECTIVE: Express percents as fractions and decimals. (Strand: Number and Operation)

USING THE TRANSPARENCY: Write the percent 75% on the chalkboard. Have students describe how they would write this percent as a fraction in simplest form and as a decimal.

USING THE STUDENT WORKBOOK: Have students work in pairs. Have one student write the fraction in simplest form and the other student write the decimal. Then have students reverse roles.

EXTENSION: Have students find examples of equivalent fractions and decimals in store flyers.

Transparency, Skill 12

SKILL 12 **WARM UP**

Percents as Fractions and Decimals

In a recent season in the NBA, the San Antonio Spurs won about 60% of their games. Write this percent as a fraction in simplest form and as a decimal.

To express a percent as a fraction, express the percent in the form $\frac{r}{100}$ and simplify.

$$60\% = \frac{60}{100}$$
$$= \frac{3}{5}$$

To express a percent as a decimal, express the percent in the form $\frac{r}{100}$ and then express the fraction as a decimal.

$$60\% = \frac{60}{100}$$
$$= 0.60 \text{ or } 0.6$$

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Student Workbook, p. 23

SKILL 12 Name ______________________ Date __________

Percents as Fractions and Decimals

A stereo is on sale for $33\frac{1}{3}$% off the original price.

EXAMPLE *Write this percent as a fraction in simplest form and as a decimal.*

To express a percent as a fraction in simplest form, express the percent in the form $\frac{r}{100}$ and simplify.

$$33\tfrac{1}{3}\% = \frac{33\frac{1}{3}}{100}$$

$= \frac{100}{3} \cdot \frac{1}{100}$ *Write $33\frac{1}{3}$ as $\frac{100}{3}$ and multiply by the reciprocal of 100.*

$= \frac{1}{3}$

To express a percent as a decimal, express the percent in the form $\frac{r}{100}$ and then express the fraction as a decimal.

$33\frac{1}{3}\% = \frac{1}{3}$ *You found this in the example above.*

≈ 0.33

EXERCISES *Write each percent as a fraction in simplest form and as a decimal.*

1. 40% **$\frac{2}{5}$; 0.4**
2. 8% **$\frac{2}{25}$; 0.08**
3. 29% **$\frac{29}{100}$; 0.29**
4. 55% **$\frac{11}{20}$; 0.55**
5. 25% **$\frac{1}{4}$; 0.25**
6. 81% **$\frac{81}{100}$; 0.81**

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Student Workbook, p. 24

7. $66\frac{2}{3}$% **$\frac{2}{3}$; 0.67**
8. 98% **$\frac{49}{50}$; 0.98**
9. 16.5% **$\frac{33}{200}$; 0.165**
10. 30% **$\frac{3}{10}$; 0.3**
11. 240% **$\frac{12}{5}$ or 2; 2.4 $\frac{2}{5}$**
12. 0.05% **$\frac{1}{2{,}000}$; 0.0005**

APPLICATIONS *Between 1980 and 1990, the population of New Hampshire increased by 20.5%. Use this information to answer Exercises 13–17.*

13. Write this percent as a fraction in simplest form.
$\frac{41}{200}$
14. Write this percent as a decimal.
0.205
15. When is it best to use the percent instead of the fraction or the decimal?
Answers will vary.
16. When is it best to use the fraction instead of the percent or the decimal?
Answers will vary.
17. When is it best to use the decimal instead of the percent or the fraction?
Answers will vary.
18. Between 1975 and 1985, the disposable personal income in the United States more than doubled. Does this mean the income has increased by more than 200%? Explain.
yes; When something doubles, it increases by a factor of 2 and 200% = $\frac{200}{100}$ = 2.

Glencoe/McGraw-Hill 24 Course 3 Intervention

SKILL 13 TEACHER NOTES

Percent of a Number

OBJECTIVE: Find the percent of a number. (Strand: Number and Operation)

USING THE TRANSPARENCY: Have students use a 10 × 10 grid to show various percents such as 50%, 30%, 45%, and so on.

USING THE STUDENT WORKBOOK: Ask students questions about percent such as “What is meant by 100% effort?” and “What is incorrect about claiming to give 110% effort?”

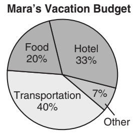
EXTENSION: Have students create a chart of how they spend the hours of their day. Convert the hours to a percent of the day.

Transparency, Skill 13

SKILL 13 WARM UP

Percent of a Number

Mara is budgeting for her upcoming vacation. She is hoping not to spend more than $1,500. The chart at the right shows her budget.



How much money has she budgeted for each of the four categories?

Method 1

Change the percent to a fraction.

Method 2

Change the percent to a decimal.

Transportation:

Method 1: $40\% = \frac{40}{100}$ or $\frac{2}{5}$; $\frac{2}{5} \times \$1,500 = \$600$

Method 2: $40\% = \frac{40}{100} = 0.40$; $0.40 \times \$1,500 = \$600$

Hotel:

Method 1: $33\% = \frac{33}{100}$; $\frac{33}{100} \times \$1,500 = \$495$

Method 2: $33\% = \frac{33}{100} = 0.33$; $0.33 \times \$1,500 = \$495$

Food:

Method 1: $20\% = \frac{20}{100}$ or $\frac{1}{5}$; $\frac{1}{5} \times \$1,500 = \$300$

Method 2: $20\% = \frac{20}{100} = 0.20$; $0.20 \times \$1,500 = \$300$

Other:

Method 1: $7\% = \frac{7}{100}$; $\frac{7}{100} \times \$1,500 = \$105$

Method 2: $7\% = \frac{7}{100} = 0.07$; $0.07 \times \$1,500 = \$105$

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Student Workbook, p. 25

SKILL 13 Name ____________ Date ______

Percent of a Number

To find the percent of a number, you can either change the percent to a fraction and then multiply, or change the percent to a decimal and then multiply.

EXAMPLE *In the Washington County championship basketball game, Lee made 55% of his 20 attempted field goals. How many field goals did he make?*

Find 55% of 20.

Method 1
Change the percent to a fraction.

$55\% = \frac{55}{100} = \frac{11}{20}$

$\frac{11}{20} \times 20 = 11$

Method 2
Change the percent to a decimal.

$55\% = \frac{55}{100}$ or 0.55

$0.55 \times 20 = 11$

Lee made 11 field goals.

EXERCISES *Find the percent of each number.*

1. 25% of 200 **50**
2. 30% of 55 **16.5**
3. 3% of 610 **18.3**
4. 5.5% of 25 **1.375**
5. 13% of 85 **11.05**
6. 97% of 12 **11.64**
7. 1% of 25 **0.25**
8. 140% of 125 **175**
9. 100% of 50 **50**
10. Which of the following does not belong? **d**
    a. 25% of 80
    b. 80% of 25
    c. 2.5% of 800
    d. 8% of 2,500
11. Hannah’s basketball team won 75% of their games this season. They played 28 games this year. How many games did they win? **21 games**

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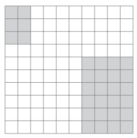
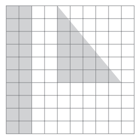
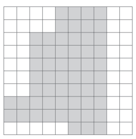
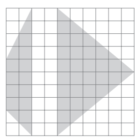
Student Workbook, p. 26

Write a percent to represent the shaded area.

12.  **30%**

13.  **35%**

14.  **57%**

15.  **44%**

APPLICATIONS

16. Kleema owns 40 music CD’s. Fifteen of her CD’s are recordings done by rap groups. What percent of her CD collection is rap music? **37.5%**
17. The Polletta’s went out to dinner, and the food bill was $35.00. The standard rate for tipping is 15%.
    a. What is the decimal value of this percent? **0.15**
    b. What should their tip be? **$5.25**
    c. What is their total food and tip bill? **$40.25**
18. Angie wants to put a winter coat in layaway at a store. To do so, she must pay the store 20% of the cost of the coat so they will hold it. If the coat costs $48.99, about how much of a deposit does Angie need to pay the store? **$10.00**
19. Mrs. Saunders made $600 last week, and she put 15% of that amount into her savings account. How much did she save? **$90**

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SKILL 14

TEACHER NOTES

Percent Proportion

OBJECTIVE: Solve problems using the percent proportion. (Strand: Number and Operation)

USING THE TRANSPARENCY: Sales people often work on commission. Have groups of students investigate the various commission percents that sales people earn and then write a problem using their commission percents.

USING THE STUDENT WORKBOOK: For Exercises 5–16, encourage students to estimate the answer first, then write the percent proportion. Finally, have them use a calculator to solve the problem.

EXTENSION: Give students sample scenerios. Have them decide in which scenerio they would earn more money. For example, mowing ten lawns a week at $5 per lawn, or delivering 100 newspapers a week for 50¢ with a 10% tip per paper.

Transparency, Skill 14

SKILL 14 WARM UP

Percent Proportion

Nicholas Rovin's father is an appliance sales associate. He is trying to decide whether or not to change jobs. In his current job, he earns 5% commission on his total sales. Last year he sold $550,000 worth of appliances. A different company has offered him a job where he would earn a base salary of $15,000, plus 2% commission on his total sales.

How much money did Mr. Rovin earn last year?

$\frac{P}{550{,}000} = \frac{5}{100}$

$(P)(100) = (550{,}000)(5)$ *Cross multiply.*

$100P = 2{,}750{,}000$

$P = 27{,}500$

He earned $27,500 last year.

How much money would Mr. Rovin have earned with the new company if his total sales were the same as last year?

$\frac{P}{550{,}000} = \frac{2}{100}$

$(P)(100) = (550{,}000)(2)$ *Cross multiply.*

$100P = 1{,}100{,}000$

$P = 11{,}000$

He would have earned $15,000 + $11,000 or $26,000 with the new company.

Based on last year's numbers, Mr. Rovin would have earned a higher salary in his current job.

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Student Workbook, p. 27

SKILL 14 Name ____________ Date ________

Percent Proportion

Use the percent proportion to solve problems dealing with percent.

$\frac{P}{B} = \frac{r}{100}$ P = percentage B = base $\frac{r}{100}$ = rate

EXAMPLES *37.2 is what percent of 186?* *What number is 15% of 280?*

37.2 is what percent of 186?	What number is 15% of 280?
$\frac{P}{B} = \frac{r}{100}$	$\frac{P}{B} = \frac{r}{100}$
$\frac{37.2}{186} = \frac{r}{100}$	$\frac{P}{280} = \frac{15}{100}$
$(37.2)(100) = (186)(r)$	$(P)(100) = (280)(15)$
$3{,}720 = 186r$	$100P = 4{,}200$
$20 = r$	$P = 42$
37.2 is 20% of 186.	42 is 15% of 280.

EXERCISES *Tell whether each number is the percentage, base, or rate.*

1. 12 is what percent of 30? **percentage: 12, base: 30**
2. 6.25% of 190 is what number? **base: 190, rate: 6.25%**
3. What percent of 49 is 7? **percentage: 7, base: 49**
4. 40% of what number is 82? **percentage: 82, rate: 40%**

Write a proportion for each problem. Then solve. Round answers to the nearest tenth.

5. What number is 10% of 230? **23**
6. 25% of what number is 38? **152**
7. Find 15% of 160. **24**
8. 24 is 20% of what number? **120**
9. 36 is 75% of what number? **48**
10. 36% of what number is 18? **50**

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Student Workbook, p. 28

11. What percent of 224 is 28? **12.5%**
12. What number is 40% of 250? **100**
13. 15% of 290 is what number? **43.5**
14. 50% of what number is 74? **148**
15. Use a proportion to find $55\frac{1}{2}$% of 66. Round to the nearest tenth. **36.6**
16. Use a proportion to find $19\frac{1}{4}$% of 45. Round to the nearest tenth. **8.7**

APPLICATIONS

17. In Juan's math class, there are 16 boys and 9 girls. What percent of Juan's class is girls? **36%**
18. To the nearest whole percent, 44% of the seventh-graders at King Middle School are girls. There are 425 seventh-graders. What is the number of girls in the seventh grade? **187 girls**
19. If 69% of the 247 students in the seventh grade ride the bus to school, about how many students do not ride the bus to school? **about 77 students**
20. There are 20 students running for student council at Pine Bluff High School. If the school will elect a president, vice president, treasurer, and secretary, what percent of the students running will win in the election? **20%**
21. There were 102,269 tickets available for a rock concert. If The Ticket Company sold 72.5% of the tickets available, about how many tickets did they sell for the concert? **about 74,145 tickets**

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SKILL 15

TEACHER NOTES

Percent of Change

OBJECTIVE: Find the percent of increase or decrease. (Strand: Number and Operation)

USING THE TRANSPARENCY: Write the phrases "an increase from \$45 to \$50" and "a decrease from \$50 to \$45" on the chalkboard. Have students describe how they would find the percent of increase or decrease.

USING THE STUDENT WORKBOOK: Have students work in pairs. Have one student write the percent proportion and the other student solve the proportion. Then have students reverse roles.

EXTENSION: Have students research and report on the Consumer Price Index.

Transparency, Skill 15

SKILL 15 WARM UP

Percent of Change

The Consumer Price Index (CPI) shows the relative costs of goods and services. The CPI in Year 1 was 136.2, and the CPI in Year 2 was 140.3. What was the percent of increase?

To find the percent of increase, first find the amount of increase. Next write the percent proportion, using the amount of increase as the percentage and the original amount as the base. Then solve the proportion.

amount of increase: $140.3 - 136.2 = 4.1$

$$\frac{4.1}{136.2} = \frac{r}{100}$$

$$4.1 \cdot 100 = 136.2 \cdot r \quad \textit{Cross multiply.}$$

$$410 = 136.2r$$

$$\frac{410}{136.2} = \frac{136.2r}{136.2} \quad \textit{Divide each side by 136.2.}$$

$$3 \approx r$$

The CPI increased by about 3%.

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Student Workbook, p. 29

SKILL 15 Name ______________________ Date __________

Percent of Change

The population of Iowa in 1980 was 2,913,808. The population in 1990 was 2,776,755.

EXAMPLE *Find the percent of decrease in the population.*

To find the percent of decrease, you can follow these steps.

1. Subtract to find the amount of decrease.

   $2{,}913{,}808 - 2{,}776{,}755 = 137{,}053$

2. Solve the percent proportion. Compare the amount of decrease to the original amount.

$$\frac{137{,}053}{2{,}913{,}808} = \frac{r}{100}$$

$$137{,}053 \cdot 100 = 2{,}913{,}808 \cdot r$$

$$13{,}705{,}300 = 2{,}913{,}808r$$

$$\frac{13{,}705{,}300}{2{,}913{,}808} = \frac{2{,}913{,}808r}{2{,}913{,}808}$$

$$5 \approx r$$

The population of Iowa decreased by about 5%.

EXERCISES *Find the percent of change. Round to the nearest whole percent.*

1. old: \$5
   new: \$7
   40% increase
2. old: 45 students
   new: 50 students
   11% increase
3. old: 32 dogs
   new: 30 dogs
   6% decrease
4. old: \$56
   new: \$52
   7% decrease

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Student Workbook, p. 30

5. old: 345 adults
   new: 450 adults
   30% increase
6. old: \$648
   new: \$635
   2% decrease
7. old: 150 pounds
   new: 138 pounds
   8% decrease
8. old: 9.5 hours
   new: 8 hours
   16% decrease

APPLICATIONS *Last year, the value of Paul's used car was \$19,990. Use this information to answer Exercises 9–11.*

9. This year, the value of his car is \$11,994. What was the percent change in the car's value?
   40% decrease
10. The year before last the value of his car was \$24,500. What was the percent change in the car's value? How does this change compare to the change from last year to this year?
    18% decrease; It is much less of a change.
11. What was the total percent change in the car's value over the two years? Can you find the answer to this question by simply adding the answers to Exercises 9 and 10? Why or why not?
    51% decrease; no; 40% + 18% = 58% − 51% which is the actual change.
12. A clothing store has a 65% markup on blazers. But, the blazers did not sell well at the listed price. So, the blazers were put on sale at 65% off the listed price. Did the store break even, make a profit, or lose money? Explain.
    The store lost money because 65% of the original list price is greater than 65% of the store's cost.

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SKILL **16**

TEACHER NOTES

Powers and Exponents

OBJECTIVE: Simplify expressions involving positive and negative exponents. (Strand: Number and Operation)

USING THE TRANSPARENCY: Have students work in small groups to examine the pattern developed in the power table. Share results with the class to establish the correct rule.

USING THE STUDENT WORKBOOK: Have students create a new power table using 4 as the base.

EXTENSION: Have students research where both positive and negative exponents are used in real life settings.

Transparency, Skill 16

SKILL 16 **WARM UP**

Powers and Exponents

An expression like $2 \times 2 \times 2 \times 2 \times 2 \times 2$ can be written as a **power**. A power has two parts, a **base** and an **exponent**. An exponent is a shorter way of writing repeated multiplication.

The expression $2 \times 2 \times 2 \times 2 \times 2 \times 2$ can be written as 2^6.

The base is the number that is multiplied. $\rightarrow 3^6 \leftarrow$ The exponent tells how many times the base is used as a factor.

Examine the table at the right to determine a pattern to assist you in developing a rule for computing with negative exponents.

$a^{-n} = \frac{1}{a^n}$, for $a \neq 0$ and any integer n

For example, $3^{-3} = \frac{1}{3^3}$ or $\frac{1}{27}$.

Power	Value
3^4	81
3^3	27
3^2	9
3^1	3
3^0	1
3^{-1}	$\frac{1}{3}$
3^{-2}	$\frac{1}{9}$

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Student Workbook, p. 31

SKILL 16 Name ______________ Date ________

Powers and Exponents

An expression like $3 \times 3 \times 3 \times 3 \times 3 \times 3$ can be written as a power. A power has two parts, a **base** and an **exponent**. The expression $3 \times 3 \times 3 \times 3 \times 3 \times 3$ can be written as 3^6.

EXAMPLE *Write the expression $m \cdot m \cdot m \cdot m \cdot m \cdot m$ using exponents.*

The base is m. It is a factor 6 times, so the exponent is 6.

$$m \cdot m \cdot m \cdot m \cdot m \cdot m = m^6$$

You can also use powers to name numbers that are less than one by using exponents that are negative integers. The definition of a negative exponent states that $a^{-n} = \frac{1}{a^n}$ for $a \neq 0$ and any integer n.

EXAMPLE *Write the expression 4^{-3} using a positive exponent.*

$$4^{-3} = \frac{1}{4^3}$$

EXERCISES *Write each expression using exponents.*

1. $2 \cdot 2 \cdot 2 \cdot 2$ $\mathbf{2^4}$
2. $(-3)(-3)(-3)(-3)(-3)$ $\mathbf{(-3)^5}$
3. 9 $\mathbf{9^1}$
4. $x \cdot x \cdot x$ $\mathbf{x^3}$
5. $c \cdot c \cdot d \cdot d \cdot d \cdot d \cdot d$ $\mathbf{c^2d^5}$
6. $8 \cdot a \cdot a \cdot a \cdot b$ $\mathbf{8a^3b}$
7. $(k-2)(k-2)$ $\mathbf{(k-2)^2}$
8. $4 \cdot 4 \cdot 4 \cdot 4 \cdot h \cdot h$ $\mathbf{4^4h^2}$
9. $(-w)(-w)(-w)(-w)(-w)$ $\mathbf{(-w)^5}$
10. $6 \cdot 6 \cdot 6 \cdot y \cdot y \cdot y \cdot y$ $\mathbf{6^3y^4}$

Evaluate each expression if $m = 3$, $n = 2$, and $p = -4$.

11. m^4 **81**
12. n^6 **64**
13. $3p^2$ **48**

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Student Workbook, p. 32

14. mn^2 **12**
15. $m^2 + p^3$ **−55**
16. $(p + 3)^5$ **−1**
17. $n^2 - 3n + 4$ **2**
18. $-2mp^2$ **96**
19. $5(n - 4)^3$ **−40**

Write each expression using a positive exponent.

20. 6^{-1} $\mathbf{\frac{1}{6^1}}$
21. 4^{-3} $\mathbf{\frac{1}{4^3}}$
22. $(-2)^{-4}$ $\mathbf{\frac{1}{(-2)^4}}$
23. d^{-7} $\mathbf{\frac{1}{d^7}}$
24. m^{-5} $\mathbf{\frac{1}{m^5}}$
25. $3b^{-6}$ $\mathbf{\frac{3}{b^6}}$
26. 10^{-2} $\mathbf{\frac{1}{10^2}}$
27. $\frac{1}{x^{-5}}$ $\mathbf{x^5}$
28. $\frac{7}{p^{-4}}$ $\mathbf{7p^4}$

Write each fraction as an expression using a negative exponent other than −1.

29. $\frac{1}{4^5}$ $\mathbf{4^{-5}}$
30. $\frac{1}{3^8}$ $\mathbf{3^{-8}}$
31. $\frac{1}{7^3}$ $\mathbf{7^{-3}}$
32. $\frac{1}{64}$ $\mathbf{2^{-6}}$
33. $\frac{1}{27}$ $\mathbf{3^{-3}}$
34. $\frac{1}{1{,}000}$ $\mathbf{10^{-3}}$

Evaluate each expression if $a = -2$ and $b = 3$.

35. 5^a $\mathbf{\frac{1}{25}}$
36. b^{-4} $\mathbf{\frac{1}{81}}$
37. a^{-3} $\mathbf{-\frac{1}{8}}$
38. $(-3)^{-b}$ $\mathbf{-\frac{1}{27}}$
39. ab^{-2} $\mathbf{-\frac{2}{9}}$
40. $(ab)^{-2}$ $\mathbf{\frac{1}{36}}$

APPLICATIONS

41. The area of a square is found by multiplying the length of a side by itself. If a square swimming pool has a side of length 45 feet, write an expression for the area of the swimming pool using exponents. $\mathbf{45^2}$ **square feet**
42. A molecule of a particular chemical compound weighs one millionth of a gram. Express this weight using a negative exponent. $\mathbf{10^{-6}}$ **gram**
43. A needle has a width measuring 2^{-5} inch. Express this measurement in standard form. $\mathbf{\frac{1}{32}}$ **inch**

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SKILL 17

TEACHER NOTES

Scientific Notation

OBJECTIVE: Translate numbers in scientific notation to standard form and numbers in standard form to scientific notation. (Strand: Number and Operation)

USING THE TRANSPARENCY: Have students guess at the proper ordering of the numbers before the numbers are converted to standard form. Use the size of the factor and the size of the exponent as a guide.

USING THE STUDENT WORKBOOK: Ask students to identify the differences between numbers written in scientific notation which involve positive and negative exponents.

EXTENSION: Have students work in pairs. One student writes a number in scientific notation and the other student converts it to standard form.

Transparency, Skill 17

SKILL 17 WARM UP

Scientific Notation

Juan plans to take a hike during a camping trip. Juan found a table that identifies the different hiking trails in the park and gives their lengths from start to finish. Help Juan order the trails from shortest to longest by expressing each of the distances in standard form.

Trail Name	Length
Sunshine Trail	2.35×10^4 feet
Lookout Point Trail	6.18×10^3 feet
Canyon Trail	4.6×10^4 feet

The lengths of the trails listed are shown in **scientific notation**. Scientific notation is used when dealing with very large or very small numbers where it can be difficult to keep track of the place value.

Scientific notation is written as the product of a factor and a power of 10. The factor must be greater than or equal to 1 and less than 10.

To write a number in scientific notation, place the decimal point after the first nonzero digit. Then find the power of 10.

Sunshine Trail: $2.35 \times 10^4 = 2.35 \times 10{,}000$ = 23,500 feet — *$10^4 = 10{,}000$ Move the decimal point 4 places to the right.*

Lookout Point Trail: $6.18 \times 10^3 = 6.18 \times 1{,}000$ = 6,180 feet — *$10^3 = 1{,}000$ Move the decimal point 3 places to the right.*

Canyon Trail: $4.6 \times 10^4 = 4.6 \times 10{,}000$ = 46,000 feet — *$10^4 = 10{,}000$ Move the decimal point 4 places to the right.*

From shortest to longest, the trails are Lookout Point Trail, Sunshine Trail, and Canyon Trail.

Student Workbook, p. 33

SKILL 17 Name ______________ Date ________

Scientific Notation

A number is expressed in scientific notation when it is written as the product of a factor and a power of ten. The factor must be greater than or equal to 1 and less than 10.

EXAMPLES *Express each number in standard form.*

$8.26 \times 10^5 = 8.26 \times 100{,}000$ — $10^5 = 100{,}000$

= 826,000 — *Move the decimal point 5 places to the right.*

$3.71 \times 10^{-4} = 3.71 \times 0.0001$ — $10^{-4} = 0.0001$

= 0.000371 — *Move the decimal point 4 places to the left.*

Express each number in scientific notation.

$68{,}000{,}000 = 6.8 \times 10{,}000{,}000$ — *The decimal point moves 7 places.*

$= 6.8 \times 10^7$ — *The exponent is positive.*

$0.000029 = 2.9 \times 0.00001$ — *The decimal point moves 5 places.*

$= 2.9 \times 10^{-5}$ — *The exponent is negative.*

EXERCISES *Express each number in standard form.*

1. 7.24×10^3 **7,240**
2. 1.09×10^{-5} **0.0000109**
3. 9.87×10^{-7} **0.000000987**
4. 5.8×10^6 **5,800,000**
5. 3.006×10^2 **300.6**
6. 4.999×10^{-4} **0.0004999**
7. 2.875×10^{-5} **0.00002875**
8. 6.3×10^4 **63,000**
9. 4.003×10^6 **4,003,000**
10. 1.28×10^{-2} **0.0128**

Student Workbook, p. 34

Express each number in scientific notation.

11. 7,500,000 **7.5×10^6**
12. 291,000 **2.91×10^5**
13. 0.00037 **3.7×10^{-4}**
14. 12,600 **1.26×10^4**
15. 0.0000002 **2.0×10^{-7}**
16. 0.004 **4.0×10^{-3}**
17. 60,000,000 **6.0×10^7**
18. 40,700,000 **4.07×10^7**
19. 0.00081 **8.1×10^{-4}**
20. 12,500 **1.25×10^4**

Choose the greater number in each pair.

21. 3.8×10^3, 1.7×10^5 **1.7×10^5**
22. 0.0015, 2.3×10^{-4} **0.0015**
23. 60,000,000, 6.0×10^6 **60,000,000**
24. 4.75×10^{-3}, 8.9×10^{-6} **4.75×10^{-3}**
25. 0.00145, 1.2×10^{-3} **0.00145**
26. 7.01×10^3, 7,000 **7.01×10^3**

APPLICATIONS

27. The distance from Earth to the Sun is 1.55×10^8 kilometers. Express this distance in standard form. **155,000,000 km**
28. In 2001, the population of Asia was approximately 3,641,000,000. Express this number in scientific notation. **3.641×10^9**
29. A large swimming pool under construction at the Greenview Heights Recreation Center will hold 240,000 gallons of water. Express this volume in scientific notation. **2.4×10^5**
30. A scientist is comparing two chemical compounds in her laboratory. Compound A has a mass of 6.1×10^{-7} gram, and compound B has a mass of 3.6×10^{-6} gram. Which of the two compounds is heavier? **Compound B**

SKILL 18

TEACHER NOTES

Exponential Growth and Decay

OBJECTIVE: Identify if the relationship described is exponential growth, decay, or neither. (Strand: Algebra)

USING THE TRANSPARENCY: Have students discuss what is different about the change in each round versus a change that is linear. Ensure that students understand there is not a constant change between each set of values.

USING THE STUDENT WORKBOOK: For the Application, have students create a table for notifying all the parents in your school of a cancellation.

EXTENSION: Have students set a savings goal for several years in the future. Examples could be saving for a car, saving for a graduation trip, or saving for college. Have them find the growth rate based on current interest rates, and analyze how much money they would need to save each month to reach their goal.

Transparency, Skill 18

SKILL 18 WARM UP

Exponential Growth and Decay

This year, there are 1,600 students compete in the National Spelling Bee Championship. In each round of the competition, half of the competitors are eliminated. The rest go on to compete in the next round. Is this a situation of exponential growth, exponential decay, or neither?

The number of competitors left after one round is $1{,}600 \cdot \frac{1}{2} = 800$.

Round (r)	Competitors remaining at the end of the round (c)
1	800
2	400
3	200
4	100
5	50

After r rounds, the number of competitors left is $c = 1{,}600 \cdot (0.5)^r$.

In this equation, c is the number of competitors left and r is the number of rounds that have been completed. 1,600 is the number of competitors at the beginning of the contest. The value 0.5 is the **decay factor.**

The number of competitors decreases with each round, and it decreases by a smaller amount each month. So, it is decaying exponentially.

When the growth factor is *greater than* 1, it represents exponential *growth*. If the growth factor is *less than* 1, it represents exponential *decay*.

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Student Workbook, p. 35

SKILL 18 Name ______________________ Date __________

Exponential Growth and Decay

In **exponential change** a quantity is repeatedly multiplied by the same factor.

If the quantity is increasing, the situation is called **exponential growth**. It happens when quantity is repeatedly multiplied by a number greater than 1.
If the quantity is decreasing, the situation is called **exponential decay**. It happens when quantity is repeatedly multiplied by a number between 0 and 1.
An exponential relationship between two variables is represented by an equation like this one:

$$y = b \cdot c^x$$

In this equation, b and c are constants. The variable b represents the amount you started with (when $x = o$, $y = b$). The variable c is the factor by which b is repeatedly multiplied. The variable x tells you how many times to multiply by b.

EXAMPLE Laurie deposited \$500 in a savings account at the bank. The money in her account earns 3% interest each month. Write an equation to represent the amount of money in Laurie's account after n months. Is this a situation of exponential growth, exponential decay, or neither?

The amount of money in the account after month one is the initial \$500 plus 3% of \$500, or 103% of \$500. To calculate the interest in the account after 1 month, find 103% of \$500.

$$1.03 \cdot 500 = 515$$

After two months, the amount of money in the account is \$515 plus 3% of \$515.

Months Since Opening the Account (n)	Money in the Account (d)
0	\$500
1	\$515
2	\$530.45
3	\$546.36
4	\$562.75

You can use a table to help you see how the amount of money in the account changes over time. The equation that represents this situation is $d = 500 \times 1.03^n$.

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Student Workbook, p. 36

In this equation, d is the amount of money in the account, n is the number of months that have passed since the account was opened. 500 is the amount of money in the account when it was opened. The value 1.03 is the **growth factor** or how much the amount of money increases or decreases each month.

EXERCISES *For each equation, state whether it represents an exponential relationship. If it does, tell whether that relationship involves growth or decay.*

1. 5×5^x **exponential growth**
2. 0.3×24^x **exponential growth**
3. $67 \times x^4$ **not exponential**
4. $8 \times (\frac{1}{3})^x$ **exponential decay**

For each table, state whether the relationship described could be exponential. If it could be, tell whether it would involve growth or decay. Explain your reasoning.

5.

x	y
1	10
2	20
3	40
4	80
5	160

Could be exponential; each y-value is 2 times the one before. It would be growth: y increases as x increases

6.

x	y
25	50
26	45
27	40
26	35
27	30

Could not be exponential; the y-values are not multiplied by a constant amount from one to the next

APPLICATIONS *Jasmine's school set up a phone tree to notify students and parents about snow days. Each parent was given the name of four other parents to call. If school is cancelled, the principal calls the first four parents on the list. Each of those parents calls four other parents, and so on.*

7. The principal makes the first round of phone calls, calling four parents. Those four parents make the second round of phone calls. How many parents receive a phone call in the second round? **16**
8. How many parents receive a phone call in the third round? **64**
9. At the end of the third round, how many parents have been notified, total? **4 + 16 + 64 = 84**
10. Write an equation to show how many parents are notified in a given round of phone calls. Use r to represent the number of rounds that have been completed, and p to represent the number of parents notified in the rth round of calls. $\boldsymbol{p = 4^r}$

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SKILL 19

TEACHER NOTES

Square Roots

OBJECTIVE: Find the square root of a number. (Strand: Algebra)

USING THE TRANSPARENCY: Write the numbers 4, 9, 16, 25, and 36 on the chalkboard. Have students discuss what these numbers all have in common. Then have them describe how they would find the square root of each number.

USING THE STUDENT WORKBOOK: Have students work in pairs. Have one student answer a row of exercises and mix up the answers. The other student matches each answer with the correct exercise.

EXTENSION: Have students order square roots on a number line.

Transparency, Skill 19

SKILL 19 WARM UP

Square Roots

Stella is opening a pizza shop. All of the pizzas she will sell will be circular. She decides to advertise her pizzas by giving their area. One size of pizza she offers has an area of 154 square inches. What is the diameter of this pizza?

Use the formula for the area of a circle, $A = \pi r^2$, to find the radius of the pizza.

$$A = \pi r^2$$

$$154 \approx 3.14 \cdot r^2$$

$$\frac{154}{3.14} \approx \frac{3.14 \cdot r^2}{3.14}$$

$$49 \approx r^2$$

$$\sqrt{49} \approx \sqrt{r^2}$$

$$7 \approx r$$

Multiply the radius by 2 to find the diameter.

$$d = 2r$$

$$d = 2(7) \text{ or } 14$$

The pizza has a diameter of 14 inches.

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Student Workbook, p. 37

SKILL 19 Name ____________ Date ______

Square Roots

If $a^2 = b$, then a is the **square root** of b.

EXAMPLE

Joanna wants to buy a house. The realtor told her that the family room in a certain house has a floor area of 144 square feet. What is the length of a side of the room if all four sides of the room are the same length?

If all four sides of the room are the same length, then the room is shaped like a square. The area of a square is given by the formula $A = s^2$. Use this formula to find the length of the sides of the room.

$$A = s^2$$

$$144 = s^2$$

$$\sqrt{144} = \sqrt{s^2}$$ *To solve this equation, find the square root of each side.*

$$12 = s$$ *The square root of 144 is 12.*

The length of a side of the room is 12 feet.

EXERCISES *Find each square root.*

1. $\sqrt{9}$ **3**
2. $\sqrt{25}$ **5**
3. $\sqrt{81}$ **9**
4. $\sqrt{169}$ **13**
5. $\sqrt{36}$ **6**
6. $\sqrt{16}$ **4**
7. $\sqrt{64}$ **8**
8. $\sqrt{121}$ **11**
9. $\sqrt{100}$ **10**
10. $\sqrt{400}$ **20**
11. $\sqrt{900}$ **30**
12. $\sqrt{10{,}000}$ **100**
13. $\sqrt{196}$ **14**
14. $\sqrt{0.09}$ **0.3**
15. $\sqrt{0.81}$ **0.9**
16. $\sqrt{1.44}$ **1.2**

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Student Workbook, p. 38

17. $\sqrt{0.49}$ **0.7**
18. $\sqrt{0.04}$ **0.2**
19. $\sqrt{2.25}$ **1.5**
20. $\sqrt{0.16}$ **0.4**
21. $\sqrt{\frac{4}{9}}$ $\boldsymbol{\sqrt{\frac{2}{3}}}$
22. $\sqrt{\frac{16}{25}}$ $\boldsymbol{\sqrt{\frac{4}{5}}}$
23. $\sqrt{\frac{49}{100}}$ $\boldsymbol{\sqrt{\frac{7}{10}}}$
24. $\sqrt{\frac{25}{36}}$ $\boldsymbol{\sqrt{\frac{5}{6}}}$

APPLICATIONS ***The area of a square picture is 64 square inches. Use this information to answer Exercises 25–27.***

25. What is the length of each side of the picture? **8 inches**
26. What is the length of each side of a picture frame for the picture if the area of the picture and the frame is 121 square inches? **11 inches**
27. Will a square mat with an area of 81 square inches be large enough on which to mount the picture? Why or why not? **Yes, the length of each side of the square mat is 9 inches, which is greater than the side of the picture.**
28. A square dog run with an area of 289 square feet is fenced in on all sides. What is the length of the fencing along one side? **17 feet**
29. What is the diameter of a pizza that has an area of 254 square inches? **about 18 inches**
30. The area of the bottom of a pizza box is 100 square inches. If a circular pizza fits in the box with the pizza touching the sides of the box at their midpoints, what is the diameter of the pizza? **10 inches**

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SKILL 20

TEACHER NOTES

n^{th} roots

OBJECTIVE: Identify if the relationship described by an equation, graph, or table is exponential growth or decay. (Strand: Algebra)

USING THE TRANSPARENCY: Have students discuss how roots are related to area and volume.

USING THE STUDENT WORKBOOK: Review with students factoring numbers and how they can combine factors to find the specified root.

EXTENSION: Create a set of index cards with various roots. Have pairs of students challenge each other to see who find the roots the fastest. The winner keeps that card. The player with the most cards wins.

Transparency, Skill 20

SKILL 20 WARM UP

n^{th} roots

Charlie would like to purchase a fish tank that is at least 5,000 cubic inches. The place where he wants to put the tank is limited to a length of no more than 20 inches for any side. Can Charlie get a fish tank that will fit in the location and meet his volume requirement?

If Charlie assumes that the fish tank can be a cube, he can find the cube root of 5,000, or $\sqrt[3]{5{,}000}$, to find the length of each side. To find a cube root, you find a number that when multiplied by itself 3 times gives you the original value.

$5{,}000 = x \cdot x \cdot x$

$5{,}000 = 100 \cdot 5 \cdot 10$

$= 20 \cdot 5 \cdot 5 \cdot 5 \cdot 2$

$= 5 \cdot 5 \cdot 4 \cdot 5 \cdot 5 \cdot 2$

$= 5 \cdot 5 \cdot 5 \cdot 5 \cdot 2 \cdot 2 \cdot 2$

$= 5 \cdot 10 \cdot 10 \cdot 10$

$= (1.7 \cdot 1.7 \cdot 1.7) \cdot 10 \cdot 10 \cdot 10$

$= 17 \cdot 17 \cdot 17$

$= 4{,}913$

So, rounding up, 17 inches for each side gives 4,913 cubic inches. This is below Charlie's volume requirement.

Going to 18 inches for each side gives 5,832 cubic inches. This is above Charlie's volume requirement.

Charlie can use a fish tank that holds more than 5,000 cubic inches with sides less than 20 inches each.

On a calculator, you can also use the $\sqrt[x]{y}$ command to find n^{th} roots of numbers.

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Student Workbook, p. 39

SKILL 20 Name ______________ Date ________

nth Roots

The nth root of a number is the number that, when raised to the nth power, equals the original number. For example, the fourth root of 100 is the number that equals 100 when it is multiplied by itself 4 times. The nth root is written as $\sqrt[n]{\ }$

When n is odd, there is only one possible $\sqrt[n]{\ }$ for each value of x. If x is positive, $\sqrt[n]{\ }$ is also positive. If x is negative, $\sqrt[n]{\ }$ is also negative.

When n is even, there are two possible nth roots of x for each value of x. The two nth roots have the same numerical value; one is negative and the other is positive.

The nth root of 0 is always 0.

EXAMPLE *Find the fourth roots of 256 without using a calculator.*

If you do not know where to begin, factoring 256 will help you figure out what the fourth roots could be.

$256 \div 2 = 128$

$128 \div 2 = 64$

At this point, you may recognize 64 as 8×8.

So, $256 = 2 \times 2 \times 8 \times 8$

$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 4 \times 4 \times 4 \times 4$

$= 4^4$

So, $\sqrt[4]{256} = 4$. The second fourth root of 256 is $-\sqrt[4]{256}$ or -4.

EXERCISES *Evaluate without using a calculator.*

1. $\sqrt[3]{27}$
   3
2. Find the fourth roots of 625.
   5, −5

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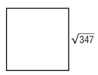
Student Workbook, p. 40

3. Find the square roots of 144.
   12, −12
4. $\sqrt[5]{243}$
   3
5. $-\sqrt[6]{64}$
   −2
6. Find the cube root of −1,000.
   −10
7. $\sqrt[4]{1296}$
   6
8. $\sqrt[3]{343}$
   −7
9. Find the fourth roots of 0.0016.
   0.2, −0.2
10. Find the cube root of $\frac{27}{125}$.
    $\mathbf{\frac{3}{5}}$
11. $\sqrt[3]{-1000000}$
    −100
12. Find the square roots of $\frac{121}{169}$.
    $\mathbf{\frac{11}{13}, -\frac{11}{13}}$
13. $\sqrt[5]{4^5}$
    4
14. $\sqrt[7]{12^7}$
    12

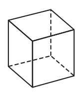
APPLICATIONS *Use the diagram and given information to find the missing information.*

15. The sides of this square are $\sqrt{347}$ cm long. What is the area of the square? **347 cm²**



$\sqrt{347}$

16. The volume of this cube is 8,000 cm³. What is the length of one side of the cube? **20 cm**



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SKILL 21

TEACHER NOTES

Order of Operations

OBJECTIVE: Evaluate expressions using the order of operations. (Strand: Number and Operation)

USING THE TRANSPARENCY: Write statements such as $5 \times 3 + 6$ and $5 \times (3 + 6)$ on the chalkboard. Have students discuss the difference between the two statements and the values they represent.

USING THE STUDENT WORKBOOK: Have students use three numbers, in the same order, to list as many expressions as possible; for example $4 \times 2 + 1$ and $4 - 2 \times 1$. Evaluate each expression. Repeat using expressions involving parentheses, for example, $4 \times (2 + 1)$.

EXTENSION: Give students an expression and the solution and have them place parentheses in the correct locations.

Transparency, Skill 21

SKILL 21 WARM UP

Order of Operations

Coach Taylor needs to buy 135 tennis balls, 25 sweatbands, and 5 rolls of athletic tape. She has also promised to buy 15 rolls of athletic tape for the team trainer. How much will these purchases cost?

To find the cost of the purchase, you must evaluate the following expression using the order of operations.

Number of Tennis Balls ↓ Number of Balls in Can ↓ Cost of Can of Balls ↓ Number of Sweatbands ↓ Cost of Sweatbands ↓ Tape for Coach ↓ Tape for Trainer ↓ Cost of Tape ↓

$(135 \div 3)\ 4 + 25 \times 2 + (5 + 15)3 =$		
$(45)4 + 25 \times 2 + (20)3$	=	*Do the operations within the grouping symbols.*
$180 + 50 + 60$	=	*Do the multiplication and division from left to right.*
290		*Do the addition and subtraction from left to right.*

The purchases will cost $290.

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Student Workbook, p. 41

SKILL 21 Name ______________________ Date ________

Order of Operations

When you evaluate an expression in mathematics, you must do the operations in a certain order. This order is called the **order of operations**.

EXAMPLE *Evaluate $56 \div (17 - 9) + 7 \times 3$.*

$56 \div (17 - 9) + 7 \times 3 =$	
$56 \div 8 + 7 \times 3 =$	*Do all the operations within the grouping symbols.*
$7 + 21 =$	*Do multiplication and division from left to right.*
28	*Do addition and subtraction from left to right.*

Therefore, $56 \div (17 - 9) + 7 \times 3 = 28$.

EXERCISES *Evaluate each expression.*

1. $2 \times 9 + 5 \times 3$ **33**
2. $(9 - 4) \div 5$ **1**
3. $10 - 4 + 1$ **7**
4. $15 - 18 \div 9 + 3$ **16**
5. $30 \div (12 - 6) + 4$ **9**
6. $(72 - 12) \div 2$ **30**
7. $2(16 - 9) - (5 + 1)$ **8**
8. $(43 - 23) - 2 \times 5$ **10**
9. $90 - 45 - 24 \div 2$ **33**
10. $81 \div (13 - 4)$ **9**
11. $7 \times 8 - 2 \times 8$ **40**
12. $71 + (34 - 34)$ **71**
13. $9 - 4 \div 2 + 16$ **23**
14. $(24 - 10) - 3 \times 3$ **5**

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15. $4(22 - 18) - 3 \times 5$ **1**
16. $12(5 - 5) + 3 \times 5$ **15**
17. $18(4 - 3) \div 3 + 3$ **9**
18. $(34 + 46) \div 20 + 20$ **24**
19. $92 - 66 - 12 \div 4$ **23**
20. $(16 - 8) \div 4 + 10$ **12**
21. $60 \div 12 \times (4 - 1)$ **15**
22. $(100 - 25) \times 2 + 25$ **175**
23. $3 \times 7 - 5 + 4$ **20**
24. $9 \times 4 \div 2 - 10$ **8**
25. $150 \div 10 - 3 \times 5$ **0**
26. $5(35 - 18) + 1$ **86**

APPLICATIONS *Use the price list at the right to answer Exercises 27–29.*

Sam's Sporting Supplies Price List	
Ping Pong Balls	5 for $2
Ping Pong Paddles	$8
Softballs	$5
Soccer Balls	$20

27. Alfred wants to buy 15 ping pong balls and 4 ping pong paddles. What is the cost of this purchase? **$38**
28. Ali plans to buy 6 softballs and 3 soccer balls for the teen club. If he has a coupon for $8 off his purchase, how much will he pay for the balls? **$82**
29. What is the cost of 20 ping pong balls, 2 ping pong paddles, 3 softballs, and 1 soccer ball? **$59**
30. Tickets for the play cost $12 for adults and $8 for children. How much would 3 adult tickets and 5 children tickets cost? **$76**
31. Use operation symbols, parentheses, and the numbers 1, 2, 3, and 4 to express the numbers from 1 to 15. For example, $2 + 3 - (4 \times 1) = 1$. **See students' work.**

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SKILL 22

TEACHER NOTES

Multiplication Properties

OBJECTIVE: Review multiplication properties. (Strand: Number and Operation)

USING THE TRANSPARENCY: Watch for students who confuse the commutative property with the associative property. Emphasize that the commutative property involves only the *order* of factors, while the associative property involves only the *grouping* of factors.

USING THE STUDENT WORKBOOK: Use base-ten blocks or counters to illustrate the Commutative, Associative, and Distributive Properties for whole-number expressions. For example, $5 \times 3 = 3 \times 5$, $3 \times (4 \times 5) = (3 \times 4) \times 5$, and $3 \times (4 + 5) = 3 \times 4 + 3 \times 5$.

EXTENSION: Have students work together to research the Reflexive, Symmetric, and Transitive Properties of Equality.

Transparency, Skill 22

SKILL 22 WARM UP

Multiplication Properties

The table below describes the properties for multiplication. The Examples column provides examples of each property using numbers.

Property	Examples
Commutative The product of two numbers is the same regardless of the order in which they are multiplied.	$9 \cdot 6 = 6 \cdot 9$ $54 = 54$
Associative The product of three or more numbers is the same regardless of the way in which they are grouped.	$2 \cdot (8 \cdot 7) = (2 \cdot 8) \cdot 7$ $2 \cdot 56 = 16 \cdot 7$ $112 = 112$
Identity The product of a number and 1 is the number.	$43 \cdot 1 = 43$
Inverse (Reciprocal) The product of a number and its reciprocal is 1.	$16 \cdot \frac{1}{16} = 1$
Distributive The sum of two addends multiplied by a number is equal to the sum of the products of each addend and the number.	$2(7 + 3) = (2 \cdot 7) + (2 \cdot 3)$ $2 \cdot 10 = 14 + 6$ $20 = 20$

Student Workbook, p. 43

SKILL 22 Name ______________________ Date __________

Multiplication Properties

The table shows the properties for multiplication.

Property	Examples
Commutative The product of two numbers is the same regardless of the order in which they are multiplied.	$21 \cdot 2 = 2 \cdot 21$ $42 = 42$
Associative The product of three or more numbers is the same regardless of the way in which they are grouped.	$5 \cdot (3 \cdot 6) = (5 \cdot 3) \cdot 6$ $5 \cdot 18 = 15 \cdot 6$ $90 = 90$
Identity The product of a number and 1 is the number.	$81 \times 1 = 81$
Inverse (Reciprocal) The product of a number and its reciprocal is 1.	$\frac{7}{8} \times \frac{8}{7} = 1$
Distributive The sum of two addends multiplied by a number is equal to the sum of the products of each addend and the number.	$2 \cdot (9 + 3) = (2 \cdot 9) + (2 \cdot 3)$ $2 \cdot 12 = 18 + 6$ $24 = 24$

EXERCISES *Name the multiplicative inverse, or reciprocal, of each number.*

1. $\frac{6}{11}$ $\mathbf{\frac{11}{6}}$ 2. $\frac{19}{3}$ $\mathbf{\frac{3}{19}}$ 3. $\frac{1}{8}$ **8** 4. 9 $\mathbf{\frac{1}{9}}$

Student Workbook, p. 44

Name the property shown by each statement.

5. $67 \cdot 89 = 89 \cdot 67$
commutative

6. $1 \cdot 45 = 45$
identity

7. $\frac{11}{12} \cdot 1 = \frac{11}{12}$
identity

8. $\left(\frac{1}{5} \cdot \frac{2}{3}\right) \cdot \frac{5}{9} = \frac{1}{5} \cdot \left(\frac{2}{3} \cdot \frac{5}{9}\right)$
associative

9. $\frac{3}{4} \cdot \frac{5}{6} = \frac{5}{6} \cdot \frac{3}{4}$
commutative

10. $\frac{3}{5}\left(\frac{1}{3} + \frac{5}{7}\right) = \left(\frac{3}{5} \cdot \frac{1}{3}\right) + \left(\frac{3}{5} \cdot \frac{5}{7}\right)$
distributive

11. $\frac{1}{4} \cdot 4 = 1$
inverse

12. $45(23 + 3) = (45 \cdot 23) + (45 \cdot 3)$
distributive

13. $\frac{9}{4} \cdot \frac{4}{9} = 1$
inverse

14. $\frac{4}{5} \cdot \frac{3}{4} = \frac{3}{4} \cdot \frac{4}{5}$
commutative

APPLICATIONS

15. Jill runs for $1\frac{3}{4}$ as long as Eva. Find Jill's running time if Eva runs for 48 minutes.
84 minutes

16. A chihuahua is 6 inches tall. The height of a German shepherd is $3\frac{2}{3}$ the height of the chihuahua. Find the height of the German shepherd.
22 inches

SKILL 23

TEACHER NOTES

Solve a Simpler Problem

OBJECTIVE: Solve problems by solving a simpler problem.
(Strand: Problem Solving)

USING THE TRANSPARENCY: Ask students to find the area of the floor of a room that is *not* rectangular. Students should make the measurements they need to find the area and do the calculations. Ask students to tell what simpler problems they solved to find the area.

USING THE STUDENT WORKBOOK: Show the class a photo of a large crowd of people. Ask students how they would use the solve-a-simpler-problem strategy to determine the number of people in the photo.

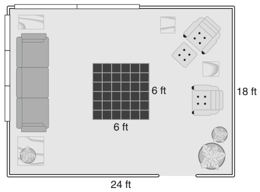
EXTENSION: Ask the students to find how many diagonals there are in a convex polygon with 50 sides by solving simpler problems.

Transparency, Skill 23

SKILL 23 WARM UP

Solve a Simpler Problem

Genaro wants to carpet his den. In the center of the room is a tile hearth for his stove. He does not want to carpet that area. How much carpet does he need?



You can solve this problem by solving two simpler problems. First find the total area of the den. Then find the area of the hearth. Subtract to find the area that will be carpeted.

Find the area of the den.

$24 \times 18 = 432$

The area of the den is 432 square feet.

Find the area of the hearth.

$6 \times 6 = 36$

The area of the hearth is 36 square feet.

Find the area that will be carpeted.

$432 - 36 = 396$

Genaro needs 396 square feet of carpet.

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Student Workbook, p. 45

SKILL 23 Name ______________ Date ________

Solve a Simpler Problem

EXAMPLE ***Find the sum of the whole numbers from 1 to 300.***

This would be a tedious problem to solve using a calculator or adding the numbers yourself. The problem is easier to solve if you solve simpler problems. First consider the partial sums indicated below.

1, 2, 3, 4, 5, . . . , 150, 151, . . . , 296, 297, 298, 299, 300

$150 + 151 = 301$
.
.
.
$5 + 296 = 301$
$4 + 297 = 301$
$3 + 298 = 301$
$2 + 299 = 301$
$1 + 300 = 301$

Notice that each sum is 301. There are 150 of these partial sums.

$301 \times 150 = 45{,}150$

The sum of the whole numbers from 1 to 300 is 45,150.

EXERCISES ***Solve by solving a simpler problem.***

1. Find the sum of the whole numbers from 1 to 150.

11,325

2. Find the sum of the whole numbers from 101 to 300.

40,100

3. Find the sum of the even numbers from 2 to 200.

10,100

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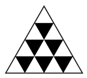
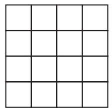
Student Workbook, p. 46

4. What is the total number of triangles of any size in the figure at the right?



26 triangles

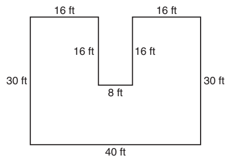
5. What is the total number of squares of any size in the figure at the right?



30 squares

APPLICATIONS

6. Shea is planning to carpet a large area in her basement as shown at the right. How much carpet will she need to carpet this area?



1,072 ft²

7. Cliff heard a funny joke on the radio on Sunday. On Monday (day 1), he told the joke to Sarah, Rich, and Claire. These people each told the joke to 3 more people on Tuesday (day 2), who told the joke to 3 more people on Wednesday (day 3). This pattern continued. How many people heard the joke on the sixth day?

729 people

8. How many days passed before at least 100 people had heard the joke in Exercise 7?

4 days

9. By the end of the day 6, how many people altogether had heard the joke in Exercise 7? (Remember to count Cliff!)

1,093 people

10. A summer camp has 7 buildings arranged in a circle. Paths must be constructed joining every building to every other building. How many paths are needed?

21 paths

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SKILL 24 TEACHER NOTES

Area of Rectangles

OBJECTIVE: Find the area of a rectangle. (Strand: Measurement)

USING THE TRANSPARENCY: Have students draw a rectangle on graph paper and label its dimensions. Have them use the formula $A = \ell w$ to find the area. Then have them check their answers by counting the squares.

USING THE STUDENT WORKBOOK: Have students work in pairs to measure three rectangular objects in the classroom. Have them record the names of the objects and their dimensions. Then have them use the formula $A = \ell w$ to find the area of each object.

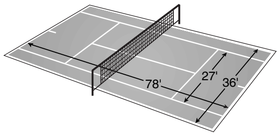
EXTENSION: Tell students to imagine that they have 28 feet of fencing. Ask them to give the whole-number dimensions of a rectangular garden with the greatest area that could be formed with the fencing.

Transparency, Skill 24

SKILL 24 **WARM UP**

Area of Rectangles

A diagram of a lawn tennis court is shown at the right. What is the difference between the area of a singles court and the area of a doubles court?



The area of a rectangle is the product of its length (ℓ) and its width (w).

$$A = \ell w$$

The length of a singles court is 78 feet, and the width is 27 feet.

$$A = \ell w$$
$$A = 78 \times 27$$
$$A = 2{,}106$$

The area of a singles court is 2,106 square feet.

The length of a doubles court is 78 feet, and the width is 36 feet.

$$A = \ell w$$
$$A = 78 \times 36$$
$$A = 2{,}808$$

The area of a doubles court is 2,808 square feet.

The area of a doubles court is 2,808 − 2,106, or 702 square feet more than the area of a singles court.

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Student Workbook, p. 47

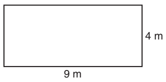
SKILL 24 Name ________________ Date ________

Area of Rectangles

Area is the number of square units needed to cover a surface. The area of a rectangle is the product of its length (ℓ) and its width (w).

$$A = \ell w$$

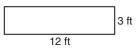
EXAMPLE *Find the area of the rectangle at the right.*



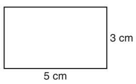
$A = \ell w$
$A = 9 \times 4$
$A = 36$

The area of the rectangle is 36 square meters.

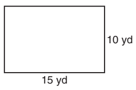
EXERCISES *Find the area of each rectangle.*

1. 

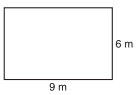
36 ft²

2. 

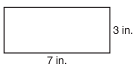
15 cm²

3. 

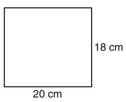
150 yd²

4. 

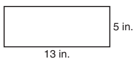
54 m²

5. 

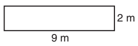
21 in²

6. 

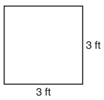
360 cm²

7. 

65 in²

8. 

18 m²

9. 

9 ft²

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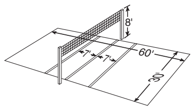
Student Workbook, p. 48

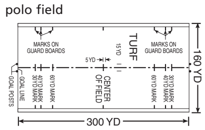
APPLICATIONS *Find the area of each playing field.*

10. volleyball court



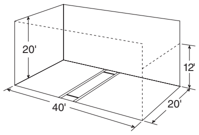
1,800 ft²

11. polo field



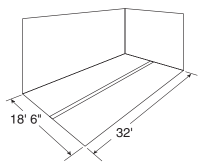
48,000 yd²

12. four-wall handball court



800 ft²

13. squash court



592 ft²

The maximum and minimum sizes of a soccer field are given at the right. Use this information to answer Exercises 14–16.

Soccer Field Size	
Maximum	225 ft by 360 ft
Minimum	195 ft by 330 ft

14. What is the maximum area of a soccer field?
81,000 ft²

15. What is the minimum area of a soccer field?
64,350 ft²

16. What is the difference between the maximum area of a soccer field and the minimum area of a soccer field?
16,650 ft²

17. Henry wants to carpet a rectangular room that is 6 yards by 5 yards. If the carpet costs $29.50 a square yard, how much will it cost to carpet the room?
$885.00

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SKILL 25

TEACHER NOTES

Adding and Subtracting Decimals

OBJECTIVE: Add and subtract decimals. (Strand: Number and Operation)

USING THE TRANSPARENCY: Play "Starting Line-Up." Give groups of three students an addition or subtraction problem. Have one player line up the decimal points and another find the sum or difference. The third player checks the answer on a calculator. The group with the first correct answer makes up the next problem.

USING THE STUDENT WORKBOOK: Have pairs of students create addition and subtraction problems from take-out menus or store flyers.

EXTENSION: Tell students that the perimeter of a rectangle is 15 centimeters and the length is 5.25 centimeters. Ask them to find the width of the rectangle.

Transparency, Skill 25

SKILL 25 WARM UP

Adding and Subtracting Decimals

The results of the popular vote for the 1860 election are listed at the left. What percent of the voters voted for the two Democrat candidates?

1860 Presidential Election

Party	Candidate	Percent of Popular Vote
Republican	Abraham Lincoln	39.82
Democrat	Stephen Douglas	29.46
Democrat	John Breckinridge	18.1
Constitutional Union	John Bell	12.61
Other		0.01

To find the percent of the voters who voted for Stephen Douglas or John Breckinridge, add 29.46 and 18.1. To add decimals, line up the decimal points. Then add the same way you add whole numbers.

$$\begin{array}{r} 29.46 \\ +\ \underline{18.10} \\ 47.56 \end{array} \quad \textit{Annex a zero.}$$

In 1860, Stephen Douglas and John Breckinridge received 47.56% of the popular vote.

How many more percentage points did Abraham Lincoln get than Stephen Douglas?

To find the difference between the percent who voted for Abraham Lincoln and the percent who voted for Stephen Douglas, subtract 29.46 from 39.82. To subtract decimals, line up the decimal points. Then subtract the same way you subtract whole numbers.

$$\begin{array}{r} 39.82 \\ -\ \underline{29.46} \\ 10.36 \end{array}$$

The difference between the percent who voted for Lincoln and the percent who voted for Douglas is 10.36.

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Student Workbook, p. 49

SKILL 25 Name ____________ Date ______

Adding and Subtracting Decimals

To add decimals, line up the decimal points. Then add the same way you add whole numbers.

EXAMPLE *4.76 + 3.62* *12.8 + 3.467 + 8.56*

$$\begin{array}{r} 4.76 \\ +\ \underline{3.62} \\ 8.38 \end{array} \qquad \begin{array}{r} 12.800 \\ 3.467 \\ +\ \underline{8.560} \\ 24.827 \end{array} \quad \textit{Annex zeros.}$$

The sum is 8.38. The sum is 24.827.

To subtract decimals, line up the decimal points. Then subtract the same way you subtract whole numbers.

EXAMPLE *15.05 − 4.86* *35 − 13.631*

$$\begin{array}{r} 15.05 \\ -\ \underline{4.86} \\ 10.19 \end{array} \qquad \begin{array}{r} 35.000 \\ -\ \underline{13.631} \\ 21.369 \end{array} \quad \textit{Annex zeros.}$$

The difference is 10.19. The difference is 21.369.

EXERCISES *Add or subtract.*

1. 45.9 + 12.7 **58.6**
2. 6.83 − 3.77 **3.06**
3. 43.89 + 56.32 **100.21**
4. 205.7 − 98.8 **106.9**
5. 6.7 + 3.56 **10.26**
6. 18.75 − 7.2 **11.55**
7. 17.93 + 33.5 **51.43**
8. 77 − 12.66 **64.34**
9. 6.5 + 7.547 **14.047**

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10. 4.7 − 0.89 **3.81**
11. 15.6 + 7.89 **23.49**
12. 25 − 4.76 **20.24**
13. 6.43 + 7.8 + 13 **27.23**
14. 9.857 − 4.5 **5.357**
15. 65.8 + 15.75 + 7.854 **89.404**
16. 408.7 − 56.78 **351.92**
17. 7.9 + 1.22 + 6.1 + 11 **26.22**
18. 73.56 − 29 **44.56**
19. 11.444 + 5.9 + 13.93 **31.274**

APPLICATIONS ***The results of the 1948 presidential election is given at the right. Use this information to answer Exercises 20–22.***

Candidate	Percent of Popular Vote
Truman	49.5
Dewey	45.12
Thurmond	2.4
Wallace	2.38
Other	0.6

20. What percent of the vote was cast for Truman or Dewey? **94.62%**
21. How many more percentage points did Truman receive than Dewey? **4.38 percentage points**
22. What percent of the vote was not cast for Truman or Dewey? **5.38%**
23. Albert had $284.73 in his checking account. He wrote checks for $55.86 and $25.00. He deposited a check for $113.76. What is his new balance in his checking account? **$317.63**
24. For lunch, Connie buys a sandwich for $2.35 and a small lemonade for $0.79. If she gives the cashier a five-dollar bill, how much change should she receive? **$1.86**
25. Tony drove 12.7 kilometers to the computer store. Then he drove 5.2 kilometers to the library, and finally 6.7 kilometers to his house. What was the total distance Tony drove? **24.6 km**

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SKILL 26

TEACHER NOTES

Multiplying and Dividing Decimals

OBJECTIVE: Multiply and divide decimals. (Strand: Number and Operation)

USING THE TRANSPARENCY: Ask the students what they should do if the product has less digits than the number of decimal places it needs. Ask students what they should do if the dividend does *not* have enough decimal places to move the decimal point the same number of places moved in the divisor.

USING THE STUDENT WORKBOOK: Show students several meat labels. Read the weight of the meat and the price per pound. Ask the students how they would determine the cost of the package of meat.

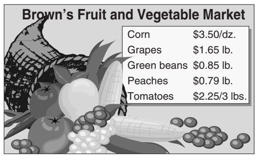
EXTENSION: Have pairs of students use the financial page of a newspaper to make up problems about changing one currency to another.

Transparency, Skill 26

SKILL 26 WARM UP

Multiplying and Dividing Decimals

Brown's Fruit and Vegetable Market sells fresh fruit and vegetables. What is the cost of 3.4 pounds of grapes?



To find the cost of the grapes, multiply 1.65 and 3.4.

$$\begin{array}{r} 1.65 \\ \times\ 3.4 \\ \hline 660 \\ +\ 4\,95 \\ \hline 5.610 \end{array}$$

1.65 ← *two decimal places*
× 3.4 ← *one decimal place*
5.610 ← *three decimal places*

The cost of the grapes is $5.61.

What is the cost of one pound of tomatoes?

To find the cost of one pound of tomatoes, divide 2.25 by 3.

$$\begin{array}{r} .75 \\ 3\overline{)\,2.25} \\ -\ 2\,1 \\ \hline 15 \\ -\ 15 \\ \hline 0 \end{array}$$

The cost of one pound of tomatoes is $0.75.

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Student Workbook, p. 51

SKILL 26 Name ______ Date ______

Multiplying and Dividing Decimals

EXAMPLE *Multiply 1.45 by 0.68.*

$$\begin{array}{r} 1.45 \\ \times\ 0.68 \\ \hline 1160 \\ +\ 870 \\ \hline 0.9860 \end{array}$$

1.45 ← *2 decimal places*
× 0.68 ← *2 decimal places*
0.9860 ← *4 decimal places*

The sum of the decimal places in the factors is 4, so the product has 4 decimal places.

The product is 0.9860.

EXAMPLE *Divide 38.22 by 2.6.*

$$\begin{array}{r} 14.7 \\ 2.6.\overline{)\,38.2.2} \\ -\ 26 \\ \hline 12\,2 \\ -\ 10\,4 \\ \hline 1\,8\,2 \\ -\ 1\,8\,2 \\ \hline 0 \end{array}$$

Change 2.6 to 26 by moving the decimal point one place to the right.

Move the decimal point in the dividend one place to the right.

Divide as with whole numbers, placing the decimal point above the new point in the dividend.

The quotient is 14.7.

EXERCISES *Multiply.*

1. 4.9 × 35 = **171.5**
2. 53 × 3.7 = **196.1**
3. 2.8 × 3.5 = **9.80**
4. 18.9 × 3.7 = **69.93**
5. 0.014 × 0.65 = **0.0091**
6. 53.98 × 71.2 = **3,843.376**

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Student Workbook, p. 52

7. 4.55 × 41.8 = **190.19**
8. 0.133 × 4.2 = **0.5586**
9. 3.91 × 8.5 = **33.235**

Divide.

10. 6)8.52 **1.42**
11. 23)64.4 **2.8**
12. 53)19.61 **0.37**
13. 1.6)134.4 **84**
14. 0.52)37.96 **73**
15. 0.23)36.8 **160**
16. 1.7)0.0374 **0.022**
17. 0.112)72.8 **650**
18. 7.4)37.962 **5.13**

APPLICATIONS ***The prices at Martha's Meat Market are given at the right. Use this information to answer Exercises 19–21.***

Martha's Meat Market	
Specials of the Week	
Ground Beef	$1.90/lb
Chicken	$1.15/lb
Turkey Breast	$1.75/lb

19. What is the cost of a chicken that weighs 3.4 pounds?
$3.91
20. Willy buys a package of ground beef for $6.84. How many pounds of ground beef did he buy?
3.6 lb
21. A turkey breast costs $8.05. How much does the turkey breast weigh?
4.6 lb
22. One centimeter on a map represents 56 kilometers. If a distance between two towns on the map is 3.2 centimeters, what is the actual distance between the towns?
179.2 km

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SKILL 27

TEACHER NOTES

Adding and Subtracting Fractions

OBJECTIVE: Add and subtract fractions. (Strand: Number and Operation)

USING THE TRANSPARENCY: On the chalkboard or overhead, draw an oversized ruler marked in eighth-inch increments. Draw arrows to model $\frac{1}{8} + \frac{1}{4}$.

USING THE STUDENT WORKBOOK: Explain that there are many common denominators for any set of fractions, but only one least common denominator. Other common denominators may be used to add or subtract the fractions, but the answer will need to be simplified.

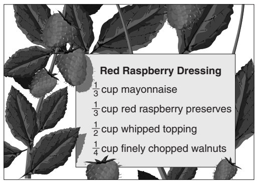
EXTENSION: A unit fraction is a fraction with the numerator of 1. Ask students to find two or more unit fractions that add up to $\frac{21}{30}$.

Transparency, Skill 27

SKILL 27 WARM UP

Adding and Subtracting Fractions

What is the total amount of the ingredients that are combined to make the dressing at the right?



Add $\frac{1}{3}, \frac{1}{3}, \frac{1}{2}$, and $\frac{1}{4}$.

To add or subtract fractions with unlike denominators, rename the fractions so that they have a common denominator.

$$\begin{aligned} \tfrac{1}{3} &= \tfrac{4}{12} \\ \tfrac{1}{3} &= \tfrac{4}{12} \\ \tfrac{1}{2} &= \tfrac{6}{12} \\ +\tfrac{1}{4} &= +\tfrac{3}{12} \\ \hline & \tfrac{17}{12} = 1\tfrac{5}{12} \end{aligned}$$

Find the LCM of 2, 3, and 4.
The LCM of 2, 3, and 4 is 12.
Rename $\frac{1}{3}$ as $\frac{4}{12}$, $\frac{1}{2}$ as $\frac{6}{12}$ and $\frac{1}{4}$ as $\frac{3}{12}$.

The total amount of the ingredients is $1\frac{5}{12}$ cups.

Carlos has just $\frac{3}{4}$ cup of mayonnaise. If he makes red raspberry dressing, how much mayonnaise will he have left?
Subtract $\frac{1}{3}$ from $\frac{3}{4}$.

$$\begin{aligned} \tfrac{3}{4} &= \tfrac{9}{12} \\ -\tfrac{1}{3} &= -\tfrac{4}{12} \\ \hline & \tfrac{5}{12} \end{aligned}$$

The LCM of 3 and 4 is 12.
Rename $\frac{3}{4}$ as $\frac{9}{12}$ and $\frac{1}{3}$ as $\frac{4}{12}$.

Carlos will have $\frac{5}{12}$ cup of mayonnaise left.

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SKILL 27 Name ______________________ Date ________

Adding and Subtracting Fractions

To add fractions, you must have a common denominator.

EXAMPLE *Find each sum.*

a. $\frac{2}{7} + \frac{3}{7}$

$$\begin{aligned} &\tfrac{2}{7} \\ +&\tfrac{3}{7} \\ \hline &\tfrac{5}{7} \end{aligned}$$

The sum $\frac{5}{7}$.

b. $\frac{1}{4} + \frac{5}{6}$

$$\begin{aligned} \tfrac{1}{4} &= \tfrac{3}{12} \\ +\tfrac{5}{6} &= +\tfrac{10}{12} \\ \hline & \tfrac{13}{12} = 1\tfrac{1}{12} \end{aligned}$$

The sum is $1\frac{1}{12}$.

To subtract fractions, you must have a common denominator.

EXAMPLE *Find each difference.*

a. $\frac{11}{12} - \frac{2}{12}$

$$\begin{aligned} &\tfrac{11}{12} \\ -&\tfrac{2}{12} \\ \hline &\tfrac{9}{12} = \tfrac{3}{4} \end{aligned}$$

The difference is $\frac{3}{4}$.

b. $\frac{5}{8} - \frac{1}{2}$

$$\begin{aligned} \tfrac{5}{8} &= \tfrac{5}{8} \\ -\tfrac{1}{2} &= -\tfrac{4}{8} \\ \hline & \tfrac{1}{8} \end{aligned}$$

The difference is $\frac{1}{8}$.

EXERCISES *Add or subtract. Write each answer in simplest form.*

1. $\frac{7}{9} - \frac{4}{9} = $ **$\frac{1}{3}$**
2. $\frac{3}{8} + \frac{1}{8} = $ **$\frac{1}{2}$**
3. $\frac{5}{6} - \frac{1}{6} = $ **$\frac{2}{3}$**

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4. $\frac{4}{5} - \frac{1}{2} = $ **$\frac{3}{10}$**
5. $\frac{6}{7} + \frac{1}{3} = $ **$\frac{4}{21}$**
6. $\frac{3}{4} - \frac{1}{6} = $ **$\frac{7}{12}$**
7. $\frac{3}{4} - \frac{5}{12} = $ **$\frac{1}{3}$**
8. $\frac{1}{7} + \frac{4}{5} = $ **$\frac{33}{35}$**
9. $\frac{13}{15} - \frac{2}{3} = $ **$\frac{1}{5}$**
10. $\frac{1}{2} + \frac{3}{5} + \frac{2}{5} = $ **$\frac{1}{2}$**
11. $\frac{1}{8} + \frac{3}{4} + \frac{1}{2} = $ **$\frac{3}{8}$**
12. $\frac{3}{5} + \frac{7}{10} + \frac{1}{4} = $ **$\frac{11}{20}$**

APPLICATIONS

13. Reginald planted $\frac{2}{5}$ of his garden with tomatoes and $\frac{1}{4}$ of his garden with green beans. How much of his garden is planted with either tomatoes or green beans? How much of his garden is planted with other crops?
$\frac{13}{20}$ of the garden; $\frac{7}{20}$ of the garden

14. Tina rode her bicycle $\frac{2}{3}$ mile to the park and then $\frac{1}{2}$ mile to the library. Finally she rode her bicycle $\frac{3}{5}$ mile to her home. How far did Tina ride her bike?
$\frac{53}{30}$ or 1 mi $\frac{23}{30}$

15. In a survey, $\frac{2}{7}$ of the people said they preferred Brand A, and $\frac{1}{5}$ of the people said they preferred Brand B. What is the difference between the fraction of people who prefer Brand A and the fraction of people who prefer Brand B?
$\frac{3}{35}$

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SKILL 28

TEACHER NOTES

Multiplying and Dividing Fractions

OBJECTIVE: Multiply and divide fractions. (Strand: Number and Operation)

USING THE TRANSPARENCY: Draw rectangles to illustrate multiplication. Illustrate $\frac{4}{9} \times \frac{1}{2}$ by drawing a rectangle and shading $\frac{4}{9}$ of it. Use darker shading for $\frac{1}{2}$ of the shaded part.

USING THE STUDENT WORKBOOK: Have students work in small groups using measuring cups and water to determine the number of $\frac{1}{2}$ cups of water in 3 cups of water. Ask them how many $\frac{1}{4}$ cups of water are in $\frac{7}{8}$ cup of water.

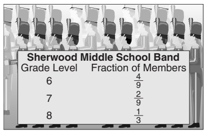
EXTENSION: Ask students to explain how they would multiply $1\frac{1}{3}$ and $\frac{1}{4}$.

Transparency, Skill 28

SKILL 28 WARM UP

Multiplying and Dividing Fractions

The Sherwood Middle School Band has members from the sixth, seventh, and eighth grades. The fraction of the band members that are in each of the grade levels is indicated at the right.



If half of the band members in the sixth grade are girls, what fraction of all of the band members are girls in the sixth grade?

Multiply $\frac{4}{9}$ by $\frac{1}{2}$. To multiply fractions, multiply the numerators and multiply the denominators.

$$\frac{4}{9} \times \frac{1}{2} = \frac{4 \times 1}{9 \times 2} = \frac{4}{8} \text{ or } \frac{2}{9}$$

Two-ninths of all of the band members are girls in the sixth grade.

If $\frac{3}{15}$ of the band members are boys in the eighth grade, what fraction of all of the band members in the eighth grade are boys?

Divide $\frac{3}{15}$ by $\frac{1}{3}$. To divide by a fraction, multiply by its reciprocal.

$$\frac{3}{15} \div \frac{1}{3} = \frac{3}{15} \times \frac{3}{1}$$

Multiply by the reciprocal of $\frac{1}{3}$.

$$= \frac{3 \times 3}{15 \times 1} = \frac{9}{15} \text{ or } \frac{3}{5}$$

Three-fifths of all of the band members in the eighth grade are boys.

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SKILL 28 Name ______ Date ______

Multiplying and Dividing Fractions

To multiply fractions, multiply the numerators and multiply the denominators.

EXAMPLE *What is the product $\frac{3}{8}$ of and $\frac{2}{3}$?*

$$\frac{3}{8} \times \frac{2}{3} = \frac{3 \times 2}{8 \times 3}$$

Multiply the numerators.
Multiply the denominators.

$$= \frac{6}{24} \text{ or } \frac{1}{4}$$

Simplify.

The product is $\frac{1}{4}$.

To divide by a fraction, multiply by its reciprocal.

EXAMPLE *What is the quotient of $\frac{3}{5}$ and $\frac{1}{2}$?*

$$\frac{3}{5} \div \frac{1}{2} = \frac{3}{5} \times \frac{2}{1}$$

Multiply by the reciprocal of $\frac{1}{2}$.

$$= \frac{3 \times 2}{5 \times 1}$$

Multiply the numerators.
Multiply the denominators.

$$= \frac{6}{5} \text{ or } 1\frac{1}{5}$$

Simplify.

The quotient is $\frac{6}{5}$ or $1\frac{1}{5}$.

EXERCISES *Multiply or divide. Write each answer in simplest form.*

1. $\frac{1}{2} \times \frac{2}{3}$ **$\frac{1}{3}$**
2. $\frac{1}{2} \div \frac{2}{3}$ **$\frac{3}{4}$**
3. $\frac{4}{5} \times \frac{1}{6}$ **$\frac{2}{15}$**
4. $\frac{5}{7} \div \frac{5}{6}$ **$\frac{6}{7}$**
5. $\frac{4}{5} \times \frac{3}{4}$ **$\frac{3}{5}$**
6. $\frac{3}{5} \div \frac{1}{3}$ **$\frac{9}{5}$ OR $1\frac{4}{5}$**
7. $\frac{4}{7} \times \frac{2}{3}$ **$\frac{8}{21}$**
8. $\frac{5}{6} \div \frac{2}{3}$ **$\frac{5}{4}$ OR $1\frac{1}{4}$**
9. $\frac{3}{4} \times \frac{5}{6}$ **$\frac{5}{8}$**

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10. $\frac{1}{7} \div \frac{2}{3}$ **$\frac{3}{14}$**
11. $\frac{5}{6} \times \frac{1}{3}$ **$\frac{5}{18}$**
12. $\frac{7}{8} \div \frac{1}{6}$ **$\frac{21}{4}$ or $5\frac{1}{4}$**
13. $\frac{2}{5} \times \frac{3}{4}$ **$\frac{3}{10}$**
14. $\frac{1}{6} \div \frac{1}{9}$ **$\frac{3}{2}$ or $1\frac{1}{2}$**
15. $\frac{4}{5} \times \frac{1}{2}$ **$\frac{2}{5}$**
16. $\frac{7}{9} \div \frac{2}{3}$ **$\frac{7}{6}$ or $1\frac{1}{6}$**
17. $\frac{3}{8} \times \frac{4}{5}$ **$\frac{3}{10}$**
18. $\frac{8}{9} \div \frac{2}{3}$ **$\frac{4}{3}$ or $1\frac{1}{3}$**
19. $\frac{6}{7} \times \frac{2}{3}$ **$\frac{4}{7}$**
20. $\frac{3}{7} \div \frac{2}{3}$ **$\frac{9}{14}$**
21. $\frac{1}{8} \times \frac{6}{7}$ **$\frac{3}{28}$**

APPLICATIONS

22. Of the 48 NBA World Championship Series from 1947 to 1994, the Boston Celtics won $\frac{5}{16}$ of the championships. Two thirds of the Celtics' championships occurred before 1970. What fraction represents the championships that were won by the Celtics before 1970? **$\frac{5}{24}$**
23. About $\frac{1}{11}$ of the land in the continental United States is in Texas. About $\frac{5}{9}$ of the land in Texas is used as rural pastureland. What fraction of the land in the continental United States is Texas pastureland? **$\frac{5}{99}$**
24. Helen planted vegetables and flowers in her garden. Three fourths of her garden is planted in flowers. If $\frac{1}{10}$ of the total garden is planted in roses, what fraction of the flower garden is planted in roses? **$\frac{2}{15}$**
25. One third of the videos at Vinnie's Video Store are appropriate for young children. If $\frac{2}{5}$ of the children's videos are cartoons, what fraction of the videos in the store are children's cartoons? **$\frac{2}{15}$**

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SKILL 29

TEACHER NOTES

Line Symmetry

OBJECTIVE: Investigate line symmetry. (Strand: Geometry)

USING THE TRANSPARENCY: Bring to class some samples of wallpaper or wrapping paper. Have the students cut out figures or patterns and fold them to determine if they are symmetrical.

USING THE STUDENT WORKBOOK: Have students draw triangles, rectangles, and circles using graph paper, a compass, and a straightedge. Have them cut out the figures and try to fold each to create two matching halves.

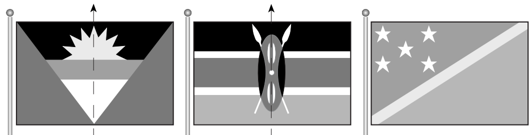
EXTENSION: Have students draw a triangle with exactly one line of symmetry, a triangle with exactly three lines of symmetry, and a triangle with no lines of symmetry.

Transparency, Skill 29

SKILL 29 **WARM UP**

Line Symmetry

If a figure can be folded so that the two halves match exactly, the figure has a line of symmetry. Some nations have flags with designs that have one or more lines of symmetry.



Antigua and Barbuda — Kenya — Solomon Islands

The flag of Antigua and Barbuda has one line of symmetry, the flag of Kenya has one line of symmetry, and the flag of the Solomon Islands has no lines of symmetry.

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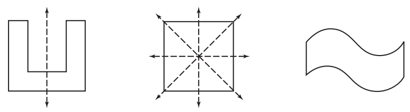
SKILL 29 Name ______________ Date ________

Line Symmetry

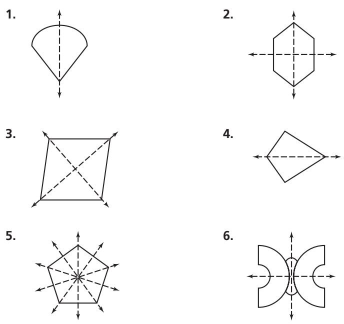
If a figure can be folded in half so that the two halves match exactly, the figure has a line of symmetry.

EXAMPLE *Draw all lines of symmetry for each figure.*



one line of symmetry — four lines of symmetry — no lines of symmetry

EXERCISES *Draw all lines of symmetry for each figure.*



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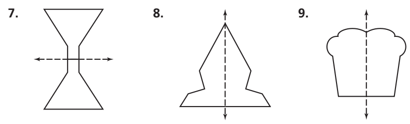
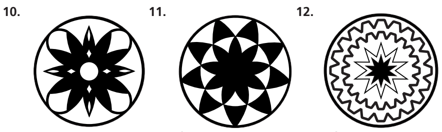
Complete each figure so that the dashed line is a line of symmetry.



APPLICATIONS *The following are designs from Navaho baskets. Determine the number of lines of symmetry for each of the designs.*



4 **9** **10**

Printers use many fonts or styles of type. For Exercises 13–16, consider block capital letters.

13. List the letters that have a vertical line of symmetry.
A, H, I, M, O, T, U, V, W, X, Y

14. List the letters that have a horizontal line of symmetry.
B, C, D, E, H, I, K, O, X

15. List the letters that have no line of symmetry.
F, G, J, L, N, P, Q, R, S, Z

16. List the letters that have more than one line of symmetry.
H, I, O, X

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SKILL 30

TEACHER NOTES

Reflections

OBJECTIVE: Investigate reflections. (Strand: Geometry)

USING THE TRANSPARENCY: Ask students to look in a mirror and describe what they see. How is their reflection similar to them? How is it different?

USING THE STUDENT WORKBOOK: Show the class some of the sketches made by M. C. Escher. Ask students to find reflections in some of his work. Ask students to find other examples of reflections in their surroundings.

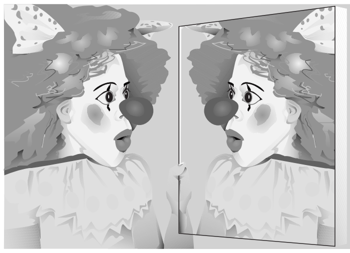
EXTENSION: Have students find samples of reflections in tile patterns, wall paper, or other designs.

Transparency, Skill 30

SKILL 30 WARM UP

Reflections

A clown looks in the mirror to make sure her make-up is on correctly. How does her reflection compare with her face?



The reflection of the face in the mirror appears to be the same distance from the surface of the mirror as the actual face, but it is the opposite direction. The reflection of the face is the same size as the real face. The nose is between the two ears for both the real face and the reflection. Both the clown and her reflection have the same eyes, the same hair, and the same mouth.

In mathematics, a reflection is a mirror image of a figure across a line.

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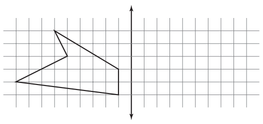
SKILL 30 Name ______________________ Date __________

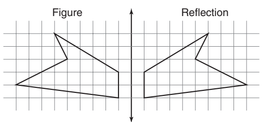
Reflections

In a **transformation**, every point in an image corresponds to exactly one point on the figure. **Reflections** are one type of transformation.

EXAMPLE *Use the grid to reflect, or flip, the figure over the given line.*

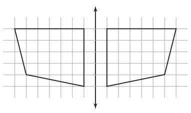


For each vertex on the figure, find the point that is exactly the same distance from the line of reflection, but on the other side of the line. Draw the completed image.

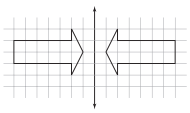


EXERCISES *Reflect each figure over the given line.*

1.



2.



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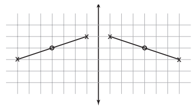
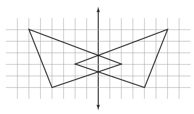
3.



4.



Use your reflections to answer Exercises 5–8.

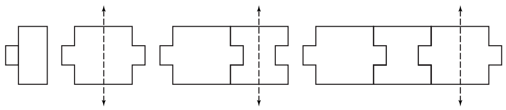
5. Are the reflections in Exercises 1–4 smaller, larger, or the same size as the original figures? **the same**

6. In Exercise 2, are the arrows pointing in the same direction? Do you think that direction is the same for a figure and its reflection? **no; no**

7. In Exercise 3, the x's and the dot are in a straight line. In the reflection, are the x's and the dot in a straight line? **yes**

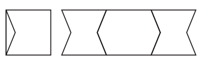
8. In Exercise 3, the dot is between the two x's. In the reflection, is the dot between the two x's? **yes**

APPLICATIONS *M. C. Escher used transformations such as reflections to create interesting art. A simple example of his type of art starts with a square. A simple change is made and this change is reflected over the dashed line. Other reflections are made over other dashed lines as shown.*

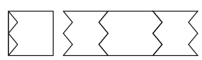


Make a drawing using reflections, squares, and the changes indicated.

9.



10.



11. Make your own design using reflections. **See students' work.**

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SKILL 31

TEACHER NOTES

Dilations and Rotations

OBJECTIVE: Investigate dilations and rotations. (Strand: Geometry)

USING THE TRANSPARENCY: Use a photocopier to make a copy and an enlargement of a picture. Show the class the picture and the enlargement. Ask students to compare the two pictures. Then show the class the picture and the copy. Rotate the copy on its side and ask the students to compare the pictures.

USING THE STUDENT WORKBOOK: Have students cut out a triangle and rotate it around the origin of a coordinate plane.

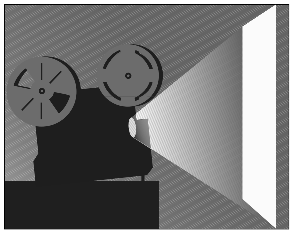
EXTENSION: Have students use a geoboard to create dilations and rotations.

Transparency, Skill 31

SKILL 31 WARM UP

Dilations and Rotations

In college, Rachel is studying how to produce films. She hopes to make an award-winning movie some day.



When you go to the movie theater, light passing through the 35-millimeter film projects a much larger picture onto the screen. In mathematics, a **dilation** is the process of enlarging or reducing a figure. The picture on the screen is a dilation of the picture on the film.

For a special effect, Rachel decides to rotate the image so that people appear to be walking on the walls. In a **rotation**, a figure is turned less than 360° around a point of rotation. In the case of Rachel's special effect, the picture is rotated 90°.

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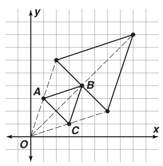
SKILL 31 Name ______________ Date ________

Dilations and Rotations

In mathematics, there are several ways that a figure may be moved or changed. Two of these ways are **dilations** and **rotations**.

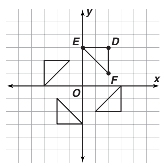
EXAMPLES ***Draw the image of the triangle ABC for a dilation with a scale factor of 2.***

Draw a dashed line from the origin of the coordinate plane to point *A*. Extend the dashed line so that its length is twice as long as the distance from the origin to point *A*. This is one vertex of the dilated triangle. Repeat the procedure for the other two vertices and draw the dilated triangle.



Draw three rotated images of triangle DEF. Rotate the image around the origin of the coordinate plane using 90° as the angle for each successive rotation.

Visualize point *E* rotating around the origin clockwise 90°. Remember that the image point must be the same distance from the origin as the original point. In this case the image of (0, 3) is (3, 0). Find the image points for the other two vertices and draw the rotated triangle. Rotate the image two more times.



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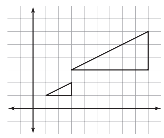
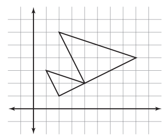
EXERCISES ***Draw a dilation for the given scale drawing.***

1. Scale factor: 3

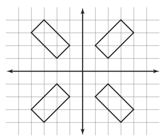


2. Scale factor: $\frac{1}{2}$

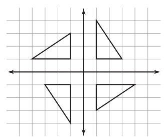


Draw three images using 90° rotations around the origin.

3.



4.



Answer each of the following.

5. Does a dilation form similar or congruent figures? **similar**
6. Does a rotation form similar or congruent figures? **congruent**

APPLICATIONS

7. Does the movement of a Ferris wheel represent a dilation or a rotation? **rotation**
8. Does an enlargement of a photograph represent a dilation or a rotation? **dilation**
9. Make a design using rotations. **See students' work.**
10. Make a design using dilations. **See students' work.**

Glencoe/McGraw-Hill 62 Course 3 Intervention

SKILL 32

TEACHER NOTES

Translations

OBJECTIVE: Investigate translations. (Strand: Geometry)

USING THE TRANSPARENCY: Ask students to describe translations from their desk to your desk or the desk of another student.

USING THE STUDENT WORKBOOK: Have students work with partners. Each student draws a triangle and his or her partner translates the triangle 8 units to the right and 5 units up. Students should check each other's translations.

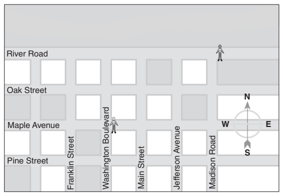
EXTENSION: Give students a starting location of a figure on the coordinate plane and the ending location. Have students write the steps of the translation.

Transparency, Skill 32

SKILL 32 WARM UP

Translations

Bob lives in Middletown. The map at the right shows some of the streets in Middletown. Bob is on the corner of Washington Boulevard and Maple Avenue and wants to meet his friend Paul at the corner of Madison Road and River Road. What route could he take to meet his friend?



There are many routes that Bob can take. A few are listed below.

- Walk 2 blocks north on Washington Boulevard and then turn right and walk 3 blocks east on River Road.
- Walk 1 block east on Maple Avenue, turn left and walk 2 blocks north on Main Street, and then turn right and walk 2 blocks east on River Road.
- Walk 1 block north on Washington Boulevard, turn right and walk 3 blocks east on Oak Street, and then turn left and walk 1 block north on Madison Road.
- Walk 1 block south on Washington Boulevard, turn left and walk 3 blocks east on Pine Street, and then turn left and walk 3 blocks north on Madison Road.

In each case, Bob has moved from one place to another place that is 3 blocks east and 2 blocks north. In mathematics, this type of move is called a **translation**.

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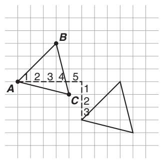
Translations

A **translation** is a slide or movement of a figure from one place to another.

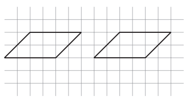
EXAMPLE *Translate triangle ABC 5 units to the right and 3 units down.*



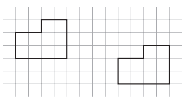
Move point *A* 5 units to the right and 3 units down. Move point *B* 5 units to the right and 3 units down. Finally, move point *C* 5 units to the right and 3 units down and draw the new triangle.

EXERCISES *Translate each figure as indicated.*

1. 7 units to the left



2. 8 units to the right and 2 units down



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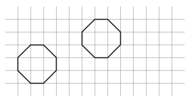
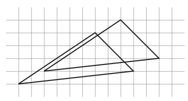
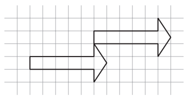
3. 5 units to the right and 2 units up



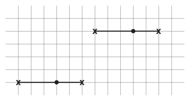
4. 2 units to the left and 1 unit down



5. 5 units to the left and 2 units down



6. 6 units to the right and 4 units up

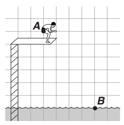


Answer each question.

7. Are the translated figures congruent or similar to the original figures? **congruent**
8. In Exercise 5, are the arrows pointing in the same direction? Is direction the same for a figure and its translation? **yes; yes**
9. In Exercise 6, the x's and the dot are in a straight line. In the translation, are the x's and the dot in a straight line? **yes**
10. In Exercise 6, the dot is between the two x's. In the translation, is the dot between the two x's? **yes**

APPLICATIONS

11. Describe the dive from *A* to *B* in terms of a translation. **4 units to the right and 6 units down**
12. Describe a translation from your house to a friend's house. **See students' work.**



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SKILL 33 TEACHER NOTES

Scale Drawings

OBJECTIVE: Find the actual length from a scale drawing. (Strand: Algebra)

USING THE TRANSPARENCY: Have students find the scale on various maps. Discuss the meaning of the scale. Ask students to list some examples of scale drawings.

USING THE STUDENT WORKBOOK: Tell the students that the wingspan of a model of a Boeing 747–400 is 3 inches. The scale is 1 inch equals 71 feet. Ask the students to describe how to find the actual length of the wingspan.

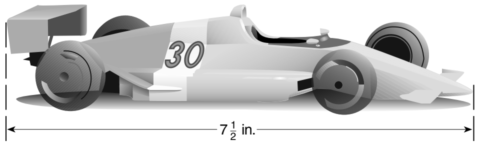
EXTENSION: Have students create a scale drawing of a favorite car, building, or statue.

Transparency, Skill 33

SKILL 33 WARM UP

Scale Drawings

At a gift shop at the Indianapolis Motor Speedway and Museum, Miwa bought a model of a race car. The scale of the model is $\frac{1}{2}$ inch equals 1 foot. If the length of the model is $7\frac{1}{2}$ inches, what is the actual length of the car?



Think of $\frac{1}{2}$ inch as 0.5 inch and $7\frac{1}{2}$ inches as 7.5 inches.

Write a proportion to find the actual length.

$$\frac{\text{model}}{\text{actual car}} \rightarrow \frac{0.5}{1} = \frac{7.5}{x} \leftarrow \frac{\text{model}}{\text{actual car}}$$

$0.5x = 7.5$ *Cross multiply.*

$\frac{0.5x}{0.5} = \frac{7.5}{0.5}$ *Divide each side by 0.5.*

$x = 15$

The length of the actual car is 15 feet.

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SKILL 33 Name ______________________ Date __________

Scale Drawings

Chuck has a scale drawing of Detroit's Tiger Stadium. The scale of the drawing is $\frac{1}{4}$ inch equals 25 feet. On the drawing, the home-run distance from home plate to right field is $3\frac{1}{4}$ inches.

EXAMPLE *What is the actual home-run distance from home plate to right field?*

Think of $\frac{1}{4}$ inch as 0.25 inch and $3\frac{1}{4}$ inches as 3.25 inches. Use the scale 0.25 inch equals 25 feet and write a proportion to find the actual distance.

$$\frac{\text{drawing}}{\text{actual distance}} \rightarrow \frac{0.25}{25} = \frac{3.25}{x} \leftarrow \frac{\text{drawing}}{\text{actual distance}}$$

$0.25x = 25 \times 3.25$ *Cross multiply.*

$0.25x = 81.25$

$\frac{0.25x}{0.25} = \frac{81.25}{0.25}$ *Divide each side by 0.25.*

$x = 325$

The actual distance is 325 feet.

EXERCISES *On a map, the scale is 1 inch equals 150 miles. For each map distance, find the actual distance.*

1. 3 inches **450 miles**
2. 8 inches **1,200 miles**
3. $\frac{1}{2}$ inch **75 miles**
4. 5 inches **750 miles**
5. $1\frac{1}{2}$ inches **225 miles**
6. $4\frac{1}{2}$ inches **675 miles**

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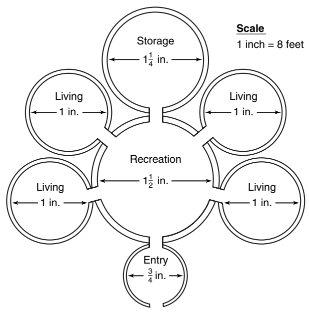
On a scale drawing of a floor plan for a new building, the scale is $\frac{1}{4}$ inch equals 1 foot. Find the actual dimensions of the rooms if the measurements from the drawing are given.

7. 5 inches by 3 inches **20 ft by 12 ft**
8. 2 inches by 4 inches **8 ft by 16 ft**
9. 2 inches by $3\frac{1}{2}$ inches **8 ft by 14 ft**
10. $4\frac{1}{2}$ inches by $4\frac{1}{2}$ inches **18 ft by 18 ft**
11. $3\frac{1}{4}$ inches by $2\frac{1}{2}$ inches **13 ft by 10 ft**
12. $3\frac{3}{4}$ inches by $4\frac{1}{4}$ inches **15 ft by 17 ft**

APPLICATIONS *An igloo is a domed structure built of snow blocks traditionally used by the Inuit people of Canada. Sometimes several families built a cluster of igloos connected by passageways. Use the scale drawing of such a cluster to answer Exercises 13–17.*



13. What is the actual diameter of the living chambers? **8 ft**
14. What is the actual diameter of the entry chamber? **6 ft**
15. What is the actual diameter of the recreation area? **12 ft**
16. What is the actual diameter of the storage area? **10 ft**
17. Estimate the actual distance from the entry chamber to the back of the storage chamber. **about 28 ft**

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SKILL 34

TEACHER NOTES

Use an Equation

OBJECTIVE: Solve problems by using an equation. (Strand: Algebra)

USING THE TRANSPARENCY: Separate students into groups and have them play "Color Logic." Ask them to choose two colors and assign a point value to each one. Have each player make up problems such as the following. *I have a red one and enough green ones to make 8 points. How many green ones do I have?*

USING THE STUDENT WORKBOOK: Make sure students understand that the variable always represents the unknown number. Encourage them to choose appropriate variables, such as s for the number of stickers.

EXTENSION: Write several two-step equations on the chalkboard. Have students state a possible word problem for these equations.

Transparency, Skill 34

SKILL 34 WARM UP

Use an Equation

There are 435 members in the U.S. House of Representatives. There are 156 representatives from states that are west of the Mississippi River and 264 representatives from states that are east of the Mississippi River. Minnesota and Louisiana have the Mississippi flowing through their borders. How many representatives do these two states share?

Write an equation to solve this problem. Let x represent the number of representatives for Minnesota and Louisiana.

$156 + 264 + x = 435$

$420 + x = 435$ — *Add 156 and 264.*

$420 - 420 + x = 435 - 420$ — *Subtract 420 from each side.*

$x = 15$

There are 15 representatives from Minnesota and Louisiana.

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SKILL 34 Name ______________________ Date __________

Use an Equation

Lucy bought some stickers that cost \$0.25 each and a sticker book for \$3.50. She spent \$6.00.

EXAMPLE *How many stickers did Lucy buy?*

Let s equal the number of stickers. Write and solve an equation.

s stickers at \$0.25 each plus a \$3.50 book cost \$6.00.

$s \times \$0.25 + \$3.50 = \$6.00$

$0.25s + 3.50 = 6.00$

$0.25s + 3.50 - 3.50 = 6.00 - 3.50$ — *Subtract 3.50 from each side.*

$0.25s = 2.50$

$0.25s \div 0.25 = 2.50 \div 0.25$ — *Divide each side by 0.25.*

$s = 10$

Lucy bought 10 stickers.

EXERCISES *Solve by using an equation.*

1. A number increased by 14 is 27. Find the number.
   13
2. The product of a number and 5 is 80. Find the number.
   16
3. A number is divided by 7. Then 6 is added to the result. The result is 26. What is the number?
   140
4. Three times a number minus 17 is equal to 28. What is the number?
   15

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5. A number is multiplied by 12. Then 3 is added to the result. If the answer is 51, what is the original number?
   4
6. Twelve less than 16 times a number is 2 less than the product of 10 and 15. What is the number?
   10

APPLICATIONS

7. Ruiz earned \$117. If his pay is \$6.50 per hour, how many hours did he work?
   18 hr
8. There are 425 students at Dayville Elementary School. If 198 of the students are girls, how many students are boys?
   227 boys
9. Jason is driving to his grandmother's house 635 miles away. He drives 230 miles the first day and 294 miles the second day. How many miles must he drive the third day to reach his grandmother's house?
   111 miles
10. Pachee bought some baseballs for \$4 each and a batting glove for \$10. She spent \$26. How many baseballs did she buy?
    4 baseballs
11. Fred has saved \$490 toward the purchase of an \$825 clarinet. His aunt gave him \$75 to be used toward the purchase. How much more money must he save?
    \$260
12. Cindy went to the hobby shop and bought 2 model sports cars at \$8.95 each and some paints. If she spent \$23.65, what was the cost of the paints?
    \$5.75
13. Arlen drove for 3 hours at 52 miles per hour. How fast must he drive during the next 2 hours in order to have traveled a total of 254 miles?
    49 mph
14. Postage costs \$0.29 for the first ounce and \$0.23 for each additional ounce. Peter spent \$1.44 to send a package. How much did it weigh?
    6 oz

SKILL 35

TEACHER NOTES

Work Backward

OBJECTIVE: Solve problems by working backward. (Strand: Problem Solving)

USING THE TRANSPARENCY: Discuss inverse operations and their role in the work-backward strategy.

USING THE STUDENT WORKBOOK: Separate the class into small groups. Read the following problem. *If I add 3 to my number, then divide by 6, the answer is 2. Guess my number.* Ask one student in each group to state a problem involving two operations similar to the example. The student who correctly guesses the number scores one point.

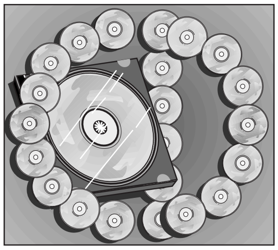
EXTENSION: Ask students to suggest situations for which the working-backward strategy is a reasonable strategy.

Transparency, Skill 35

SKILL 35 WARM UP

Work Backward

Lisa took some of her CD's to Amy's house for the purpose of trading them. Lisa gave Amy half of the CD's she brought in exchange for 5 different CD's. Then Lisa gave Amy's brother 2 CD's. If Lisa left Amy's house with 18 CD's, how many CD's did she bring to Amy's house?



Work backward to answer this question. Undo each step.

Start with 18 CD's.	18
Since Lisa gave 2 CD's to Amy's brother, add 2 to the 18 CD's.	$18 + 2 = 20$
Since Amy gave Lisa 5 CD's, subtract 5 from the 20 CD's.	$20 - 5 = 15$
Since Lisa gave Amy half of her CD's, multiply 15 by 2.	$15 \times 2 = 30$

Lisa started with 30 CD's.

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SKILL 35 Name ______________ Date ________

Work Backward

Rupesh earned some money mowing lawns one month. He put half of his money into savings. With the rest, he spent \$15 on a new CD, \$6 to see a movie, and \$3 on food. He still had \$24 left in his pocket.

EXAMPLE ***How much money did Rupesh earn mowing lawns?***

Work backward to answer this question. Undo each step.

Start with \$24.	\$24
Add the \$3 spent on food.	\$24 + \$3 = \$27
Add the \$6 spent to see the movie.	\$27 + \$6 = \$33
Add the \$15 spent on the CD.	\$33 + \$15 = \$48
Since Rupesh saved half of the money, multiply by 2.	\$48 × 2 = \$96

Rupesh made \$96 mowing lawns.

EXERCISES ***Solve by working backward.***

1. A number is added to 8, and the result is multiplied by 10. The final answer is 140. Find the number.
6

2. A number is divided by 8, and the result is added to 12. The final answer is 75. Find the number.
504

3. A number is decreased by 12. The result is multiplied by 5, and 30 is added to the new result. The final result is 200. What is the number?
46

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4. Twenty five is added to a number. The sum is multiplied by 4, and 35 is subtracted from the product. The result is 121. What is the number?
14

5. Take a number, divide it by 3, add 14, multiply by 7, and double the answer. The result is 252. What is the number?
12

APPLICATIONS

6. Dwayne's weight is twice Beth's weight minus 24 pounds. Dwayne weighs 120 pounds. How much does Beth weigh?
72 lb

7. Kara wants to buy a certain leather jacket, but she did not have enough money. The leather jacket went on sale and was reduced by \$15.00, then by \$13.50 more, and finally by an additional \$12.15. Kara bought the jacket at the final sale price of \$109.35. What was the original price?
\$150.00

8. James arrived for piano practice at 4:45 P.M. On the way from school, he stopped at the video store for 15 minutes and also made a call from the phone booth for 10 minutes. It usually takes 25 minutes to get from the school to the piano teacher's house. What time did James leave school?
3:55 P.M.

9. Dave has 12 baseball cards left after trading cards. This is one third as many as he had yesterday, which is 8 less than the day before. How many cards did Dave have on the day before yesterday?
44 cards

10. A fence is put around a dog run 10 feet wide and 20 feet long. Enough fencing is left over to also fence a square garden with an area of 25 square feet. If there is 3 feet left after the fencing is completed, how much fencing was available at the beginning?
83 ft

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SKILL 36

TEACHER NOTES

Solve Equations Involving Addition and Subtraction

OBJECTIVE: Solve equations involving addition and subtraction. (Strand: Algebra)

USING THE TRANSPARENCY: Have students model addition and subtraction equations with cups and counters. Ask students why the goal is to get the cup by itself on one side of the mat.

USING THE STUDENT WORKBOOK: Have each student in a group write an equation and read it to the group. Each member must write a word problem than can be solved by solving each of the equations.

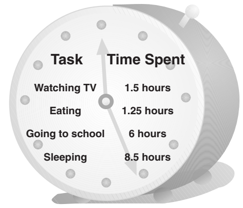
EXTENSION: Create a set of index cards for students to use in creating equations to solve.

Transparency, Skill 36

SKILL 36 WARM UP

Solve Equations Involving Addition and Subtraction

Joe kept track of how much time he spent doing certain tasks in a 24-hour period. The list of these tasks and the time he spent doing them on Monday are found at the right.



How much time did Joe spend in the 24-hour period doing other tasks?

Use the equation $x + 1.5 + 1.25 + 6 + 8.5 = 24$ to find x, the amount of time Joe spent doing other tasks.

$x + 1.5 + 1.25 + 6 + 8.5 = 24$	*$1.5 + 1.25 + 6 + 8.5 = 17.25$ hours*
$x + 17.25 = 24$	*Substitute 17.25 for the sum of the numbers.*
$x + 17.25 - 17.25 = 24 - 17.25$	*Subtract 17.25 from each side.*
$x = 6.75$	

Check:

$x + 1.5 + 1.25 + 6 + 8.5 = 24$

$6.75 + 1.5 + 1.25 + 6 + 8.5 \stackrel{?}{=} 24$ *Replace x with 6.75.*

$24 = 24$ ✔

Joe spent 6.75 hours doing other tasks.

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SKILL 36 Name ______________________ Date __________

Solve Equations Involving Addition and Subtraction

Addition Property of Equality: If you add the same number to each side of an equation, the two sides remain equal.

EXAMPLE ***Solve $t - 57 = 46$.***

	$t - 57 = 46$	
	$t - 57 + 57 = 46 + 57$	*Add 57 to each side.*
	$t = 103$	
Check:	$t - 57 = 46$	
	$103 - 57 \stackrel{?}{=} 46$	*Replace t with 103.*
	$46 = 46$ ✓	

The solution is 103.

Subtraction Property of Equality: If you subtract the same number from each side of an equation, the two sides remain equal.

EXAMPLE ***Solve $t + 24.4 = 25.1$.***

	$t + 24.4 = 25.1$	
	$t + 24.4 - 24.4 = 25.1 - 24.4$	*Subtract 24.4 from each side*
	$t = 0.7$	*of the equation.*
Check:	$t + 24.4 = 25.1$	
	$0.7 + 24.4 \stackrel{?}{=} 25.1$	*Replace t with 0.7.*
	$25.1 = 25.1$ ✓	

The solution is 0.7.

EXERCISES ***Complete each statement.***

1. $y + 18 = 39$
   $y + 18 - 18 = 39 -$ **18**

2. $m - 23 = 17$
   $m - 23 +$ **23** $=$ **17** $+$ **23**

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Solve each equation. Check your solution.

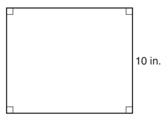
3. $w + 6 = 19$ **13**	4. $n - 4.7 = 8.4$ **13.1**	5. $m + 18 = 78$ **60**
6. $18.42 + t = 63$ **44.58**	7. $e - 0.9 = 17.4$ **18.3**	8. $b - 43 = 18$ **61**
9. $h - 32\frac{3}{5} = 44$ **76**	10. $947 = p - 43$ **990**	11. $7.36 + w = 8.94$ **1.58**
12. $g - 6.3 = 9.5$ **15.8**	13. $r - 18 = 36$ **54**	14. $2.17 + k = 4.19$ **2.02**

APPLICATIONS ***Each of Exercises 15–18 can be modeled by one of these equations:***
$n + 2 = 10$ $n - 2 = 10$
Choose the correct equation. Then solve the problem.

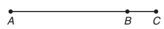
15. Jameel loaned two tapes to a friend. He has ten tapes left. How many tapes did Jameel originally have? **$n - 2 = 10$; 12 tapes**

16. Ana needs \$2 more to buy a \$10 scarf. How much money does she already have? **$n + 2 = 10$; \$8**

17. The width of the rectangle shown at the right is 2 inches less than the length. What is the length? **$n - 2 = 10$; 12 inches**



18. In the figure at the right, the length of $\overline{AC}$ is 10 centimeters. The length of $\overline{BC}$ is 2 centimeters. What is the length of $\overline{AB}$? **$n + 2 = 10$; 8 cm**



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SKILL 37

TEACHER NOTES

Solve Equations Involving Multiplication and Division

OBJECTIVE: Solve equations involving multiplication and division. (Strand: Algebra)

USING THE TRANSPARENCY: Give students copies of grocery ads. Have groups of students set up equations to compare various prices to find the best unit prices. Have them solve and discuss their results.

USING THE STUDENT WORKBOOK: Have students summarize the lesson by writing two equations—one that can be solved by solving a multiplication equation and one that can be solved by solving a division equation. Then have students exchange papers and have them write a word problem that would go with the equations.

EXTENSION: Have students create two-step equations to solve.

Transparency, Skill 37

SKILL 37 **WARM UP**

Solve Equations Involving Multiplication and Division

John went to the grocery store to buy some laundry detergent for his mom. He couldn't decide what to buy since there were different sizes and different prices. He narrowed it down to two. Brand A was 44 ounces for \$5.90, and Brand B was 32 ounces for \$4.80. Write two equations that will help to determine which is a better price.

Let a = price per ounce for the Brand A package.

Let b = price per ounce for the Brand B package.

$$44a = 5.90 \qquad 32b = 4.80$$
$$\frac{44a}{44} = \frac{5.90}{44} \qquad \frac{32b}{32} = \frac{4.80}{32}$$
$$a \approx 0.134 \qquad b = 0.15$$

The best price is Brand A for \$5.90.

If the price per ounce for Brand C is 12¢ and there are 40 ounces in the package, write an equation to determine how much Brand C costs. Then solve.

$$40 = \frac{c}{0.12}$$
$$40(0.12) = \frac{c}{0.12}(0.12) \qquad \textit{Multiply each side by 0.12.}$$
$$4.8 = c$$

The 40-ounce package of brand C costs \$4.80.

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SKILL 37 Name ______________________ Date __________

Solve Equations Involving Multiplication and Division

Division Property of Equality: If you divide each side of an equation by the same nonzero number, the two sides remain equal.

EXAMPLE *Solve 156 = 4r.*

$156 = 4r$

$\frac{156}{4} = \frac{4r}{4}$ *Divide each side by 4.*

$39 = r$

Check: $156 = 4r$

$156 \stackrel{?}{=} 4 \times 39$ *Replace r with 39.*

$156 = 156$ ✓ The solution is 39.

Multiplication Property of Equality: If you multiply each side of an equation by the same number, the two sides remain equal.

EXAMPLE *Solve* $\frac{w}{21} = 4.2$.

$\frac{w}{21} = 4.2$

$\frac{w}{21} \times 21 = 4.2 \times 21$ *Multiply each side by 21.*

$w = 88.2$

Check: $\frac{w}{21} = 4.2$

$\frac{88.2}{21} \stackrel{?}{=} 4.2$ *Replace w with 88.2.*

$4.2 = 4.2$ ✓ The solution is 88.2.

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Student Workbook, p. 74

EXERCISES *Complete the solution of each equation.*

1. $12h = 48$

   $\frac{12h}{12} = \frac{48}{\mathbf{12}}$

   $h = \mathbf{4}$

2. $34 = \frac{r}{3}$

   $34 \times \mathbf{3} = \frac{r}{3} \times \mathbf{3}$

   $\mathbf{102} = r$

Solve each equation. Check your solution.

3. $3.6t = 11.52$ **3.2**
4. $\frac{n}{4} = 15$ **60**
5. $\frac{1}{2}w = \frac{3}{8}$ $\mathbf{\frac{3}{4}}$
6. $1.4j = 0.7$ **0.5**
7. $4.1m = 13.12$ **3.2**
8. $\frac{c}{5} = 16$ **80**
9. $1.3z = 3.9$ **3**
10. $\frac{7}{8} = \frac{1}{2}f$ $\mathbf{\frac{7}{4}}$
11. $\frac{d}{3.5} = 0.6$ **2.1**
12. $h \div 12 = 4.8$ **57.6**
13. $4.8g = 15.36$ **3.2**
14. $c \div \frac{1}{4} = \frac{1}{2}$ $\mathbf{\frac{1}{8}}$

APPLICATIONS ***Each of Exercises 15–17 can be modeled by one of these equations:***

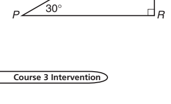
$2n = 10 \qquad \frac{n}{2} = 10$

Choose the correct equation. Then solve the problem.

15. Chad earned \$10 for working two hours. How much did he earn per hour? **$2n = 10$; \$5**

16. Kathy and her brother won a contest and shared the prize equally. Each received \$10. What was the amount of the prize? **$\frac{n}{2} = 10$; \$20**

17. In the triangle at the right, the length of $\overline{PQ}$ is twice the length of $\overline{QR}$. What is the length of $\overline{QR}$? **$2n = 10$; 5 cm**



Glencoe/McGraw-Hill 74 Course 3 Intervention

SKILL 38

TEACHER NOTES

Solve Inequalities

OBJECTIVE: Solve and graph inequalities. (Strand: Algebra)

USING THE TRANSPARENCY: Have students write an inequality for the following problem: *five more than twice a number is at least 15.*

USING THE STUDENT WORKBOOK: Have students discuss the meaning of *at least* and *at most*. Have them give several examples of both types of inequalities using these phrases.

EXTENSION: Have students graph the solutions of inequalities on a coordinate plane.

Transparency, Skill 38

SKILL 38 WARM UP

Solve Inequalities

Mr. Bauman sells new cars. He earns $400 for each car he sells plus a salary of $20,000 per year. How many cars does Mr. Bauman need to sell in order to earn at least $66,000 this year?

Write an inequality to represent this problem.
Let *c* represent the number of cars Mr. Bauman sells in a year.

$20{,}000 + 400c \geq 66{,}000$

$20{,}000 + 400c - 20{,}000 \geq 66{,}000 - 20{,}000$ *Subtract 20,000 from each side.*

$400c \geq 46{,}000$

$\frac{400c}{400} \geq \frac{46{,}00}{400}$ *Divide each side by 400.*

$c \geq 115$

Mr. Bauman will need to sell 115 cars to earn at least $66,000 in a year.

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Student Workbook, p. 75

SKILL 38 Name ______________________ Date __________

Solve Inequalities

Inequalities are sentences that compare two quantities that are not necessarily equal. The symbols below are used in inequalities.

Symbol	Words
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to

EXAMPLES *Solve each inequality. Show the solution on a number line.*

$2n + 1 > 5$

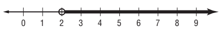
$2n + 1 - 1 > 5 - 1$ *Subtract 1 from each side.*

$2n > 4$

$\frac{2n}{2} > \frac{4}{2}$ *Divide each side by 2.*

$n > 2$

To graph the solution on a number line, draw an open circle at 2. Then draw an arrow to show all numbers greater than 2.



$2p - 3 \leq 15$

$2p - 3 + 3 \leq 15 + 3$ *Add 3 to each side.*

$2p \leq 18$

$\frac{2p}{2} \leq \frac{18}{2}$ *Divide each side by 2.*

$n \leq 9$

To graph the solution on a number line, draw a closed circle at 9. Then draw an arrow to show all numbers less than 9.

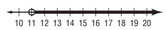
Glencoe/McGraw-Hill 75 Course 3 Intervention

Student Workbook, p. 76

EXERCISES *Solve each inequality. Graph the solution on a number line.*

1. $a + 7 < 12$ $\mathbf{a < 5}$

2. $b - 3 > 8$ $\mathbf{b > 11}$

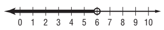


3. $2c - 7 \geq 9$ $\mathbf{c \geq 8}$

4. $5d + 7 \leq 32$ $\mathbf{d \leq 5}$

5. $e + 2 > 16$ $\mathbf{e > 14}$

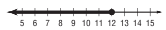
6. $f + 12 < 18$ $\mathbf{f < 6}$



7. $\frac{g}{2} \geq 3$ $\mathbf{g \geq 6}$

8. $\frac{h}{2} + 6 < 8$ $\mathbf{h < 4}$

9. $\frac{j}{3} + 6 \leq 10$ $\mathbf{j \leq 12}$



10. $\frac{k}{4} + 2 > 3$ $\mathbf{k > 4}$

APPLICATIONS

19. Madison wants to earn at least $75 to spend at the mall this weekend. Her father said he would pay her $15 to mow the lawn and $5 an hour to work on the landscaping. If Madison mows the lawn, how many hours must she work on the landscaping to earn at least $75? **12 hours**

20. A rental car agency rents cars for $32 per day. They also charge $0.15 per mile driven. If you are taking a 5-day trip and have budgeted $250 for the rental car, what is the maximum number of miles you can drive and stay within your budget? **600 miles**

21. Mr. Stamos needs 1,037 valid signatures on a petition to become a candidate for the school board election. An official at the board of elections told him to expect that 15% of the signatures he collects will be invalid. What is the minimum number of signatures he should get to help ensure that he qualifies for the ballot? **1,220 signatures**

Glencoe/McGraw-Hill 76 Course 3 Intervention

SKILL **39**

TEACHER NOTES

Graph Inequalities

OBJECTIVE: Graph inequalities on the coordinate plane. (Strand: Algebra)

USING THE TRANSPARENCY: Engage students in a discussion of situations where an inequality applies. Have students come up with an inequality that includes the line and one that does not.

USING THE STUDENT WORKBOOK: Have students discuss when the line for the equation will be solid or dotted. Give students practice with selecting multiple points to see where the solution set is.

EXTENSION: Extend the lesson by having students graph two inequalities on the same graph and reason where the solution set would be.

Transparency, Skill 39

SKILL 39 WARM UP

Graph Inequalities

Sarah wants to purchase fresh peaches for a dessert. She is only willing to pay up to \$1.99 per pound for peaches. How much will the purchase of peaches cost her?

First write the equation that represents the situation.

$$y \le \$1.99x$$

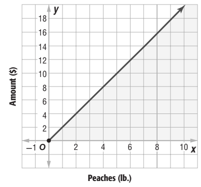
Change the inequality to an equation and graph it.

$$y = \$1.99x$$

To determine which side of the graph to shade, pick a point and see if it is a solution for the inequality.

Shade the part of the graph that is a solution for the inequality.

Determine if the line should be dotted or solid.



The shaded region, including the line, shows what Sarah will pay for different weights of peaches.

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Student Workbook, p. 77

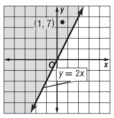
SKILL 39 Name ______________________ Date ________

Graphing Inequalities

EXAMPLE *Graph the inequality $y > 2x$ on a coordinate plane.*

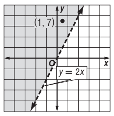
Find the equation that corresponds to the inequality. $y = 2x$

Graph the equation.



The inequality represents a range of possible points, all those whose y coordinate is more than 2 times their x coordinate.

Locate a point that satisfies the inequality. Try (1, 7).



Since $7 > 2$, this point satisfies the inequality. Therefore, it must be in the area of points that satisfy the inequality. All of the points on the same side of the $y = 2x$ line as this point are possible solutions.

Shade the area of the graph that includes the possible solutions.

What about points on the line $y = 2x$ itself? Are they solutions to $y > 2x$? No value for y can be equal to $2x$ and also larger than $2x$. Use a dotted line to indicate that the line $y = 2x$ is the boundary of the solution area, but that it is not included in the area.

If you were graphing $y \ge 2x$, the line would be included in the solution area, because the solutions to the equation are also solutions to the inequality. You would indicate by drawing a solid line instead of a dotted one.

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Student Workbook, p. 78

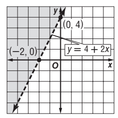
EXERCISES *For Exercises 1 and 2 use the inequality $y \ge 5x + 3$.*

1. If you graphed this inequality, would you use a solid line or a dotted line for the edge of the solution area? Explain your answer. **Sample answer: A solid line. The value of y needs to be equal to or greater than $5x + 3$, so the points on the line $y = 5x + 3$ are solutions to the inequality.**

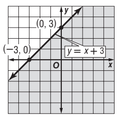
2. What part of the graph would you shade? Explain your answer. **Sample answer: All the points above the line $y = 5x + 3$ are solutions, because those are the ones where y is larger than $5x + 3$. So, everything above the line would be shaded.**

Convert each inequality into linear form and then graph.

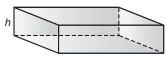
3. $y - 2x > 4$



4. $2y + 3x \ge 4x + y + 3$



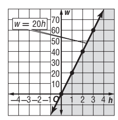
APPLICATIONS *The volume of a box with a rectangular bottom varies depending on the height of the box.*



5. The area of the bottom of the box is 20 cm². Write an expression to represent the volume of the box, using h to represent the box's height. **$20h$ cm³**

6. Use your expression from Exercise 5 to write an inequality representing the amount of water that could be in the box. Use w to represent the amount of water. **$w \le 20h$**

7. Graph the inequality from Exercise 6.



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SKILL 40

TEACHER NOTES

Graphing Equations

OBJECTIVE: Graph equations with two variables. (Strand: Algebra)

USING THE TRANSPARENCY: Have students write an equation with two variables. Then have them make a function table with at least four solutions to their equation and graph the equation on a coordinate plane.

USING THE STUDENT WORKBOOK: Have students name all the steps involved in graphing an equation with two variables.

EXTENSION: Have students use a graphing calculator to graph equations.

Transparency, Skill 40

SKILL 40 WARM UP

Graphing Equations

To determine how much profit a business makes, the owner must consider the relationship between sales and expenses. A graph can be a useful tool to show this relationship.

Maria's Dress Shop marks up each dress $25.00. The shop's daily operating expenses are $200.00. Write an equation that relates the profit to the number of dresses sold. Then graph the relationship.

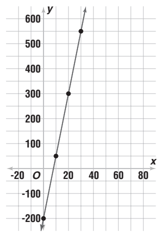
Let x represent the number of dresses sold in a day and y represent the profit.

$$y = 25x - 200$$

To graph this equation, make a function table for the equation and graph the ordered pairs from the table.

$y = 25x - 200$

x	$25x - 200$	y	(x, y)
0	25(0) − 200	−200	(0, −200)
10	25(10) − 200	50	(10, 50)
20	25(20) − 200	300	(20, 300)
30	25(30) − 200	550	(30, 550)



Notice that the points are in a straight line. Draw the line. This line represents the equation $y = 25x - 200$.

Student Workbook, p. 79

SKILL 40 Name ________________________ Date __________

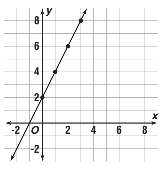
Graphing Equations

EXAMPLE *Graph the equation $y = 2x + 2$.*

Make a function table for $y = 2x + 2$. Then graph each ordered pair and complete the graph.

$y = 2x + 2$

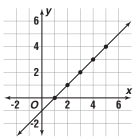
x	$2x + 2$	y	(x, y)
0	2(0) + 2	2	(0, 2)
1	2(1) + 2	4	(1, 4)
2	2(2) + 2	6	(2, 6)
3	2(3) + 2	8	(3, 8)



EXERCISES *Complete each function table. Then graph the equation.*

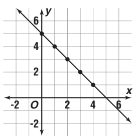
1. $y = x - 1$

x	$x - 1$	y	(x, y)
1	**1 − 1**	**0**	**(1, 0)**
2	**2 − 1**	**1**	**(2, 1)**
3	**3 − 1**	**2**	**(3, 2)**
4	**4 − 1**	**3**	**(4, 3)**
5	**5 − 1**	**4**	**(5, 4)**



2. $y = 5 - x$

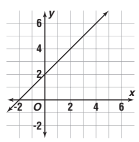
x	$5 - x$	y	(x, y)
0	**5 − 0**	**5**	**(0, 5)**
1	**5 − 1**	**4**	**(1, 4)**
2	**5 − 2**	**3**	**(2, 3)**
3	**5 − 3**	**2**	**(3, 2)**
4	**5 − 4**	**1**	**(4, 1)**



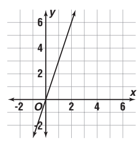
Student Workbook, p. 80

Graph each equation.

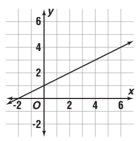
3. $y = x + 2$



4. $y = 3x$

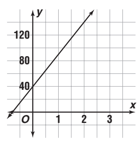


5. $y = \frac{1}{2}x + 1$

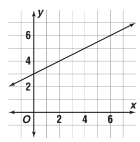


APPLICATIONS

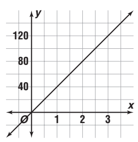
6. An electrician charges an initial fee of $40, plus $50 for every hour she works. Let x represent the number of hours she works and y represent the total fee. Write an equation to represent the total fee. Graph the equation.
   $y = 50x + 40$



7. A blizzard at the Slippery Ski Area deposited $\frac{1}{2}$ foot of snow per hour atop a 3-foot snow base. Let x represent the number of hours and y represent the total amount of snow. Write an equation to represent the total amount of snow. Graph the equation.
   $y = x + 3$



8. Yukari averages 40 miles per hour when she drives from Los Angles to San Francisco. Let x represent the number of hours and y represent the distance traveled. Write an equation to represent the distance traveled. Graph the equation.
   $y = 40x$



SKILL 41

TEACHER NOTES

Solve Equations With Two Variables

OBJECTIVE: Solve equations with two variables. (Strand: Algebra)

USING THE TRANSPARENCY: Have students use the example on the transparency for other numbers of rides. Then have them write a new equation for children under 8—with an admission price of \$2 and rides being free.

USING THE STUDENT WORKBOOK: Watch for students who confuse *x*- and *y*-variables. Prevent this by emphasizing the use of a table to list ordered pairs of *x*- and *y*-values.

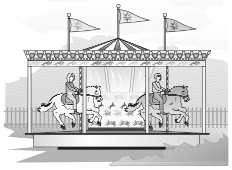
EXTENSION: Have students write an equation with two variables given the following ordered pairs.

(–4, –10)   (2, 5)   (6, 15)

Transparency, Skill 41

SKILL 41 WARM UP

Solve Equations With Two Variables



The town of Circleville is holding a carnival as a fundraiser. It costs \$3 for admission plus \$0.50 for each ride. Write an equation for the cost of rides and admission.

Let r = number of rides that a student rides.

Let c = total cost for a student.

Therefore, the equation is $c = 0.50r + 3$.

How much did it cost each of the following students for rides and admission to the carnival?

Terry went to the carnival and rode 5 rides.
Laura went to the carnival and rode 2 rides.
Wesley went to the carnival and rode 7 rides.
Barrett went to the carnival and rode 4 rides.
You could make a chart.

Student	r	$0.50r + 3$	c
Terry	5	0.50(5) + 3	\$5.50
Laura	2	0.50(2) + 3	\$4.00
Wesley	7	0.50(7) + 3	\$6.50
Barrett	4	0.50(4) + 3	\$5.00

It cost Terry \$5.50, Laura \$4.00, Wesley \$6.50, and Barrett \$5.00 for rides and admission to the carnival.

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SKILL 41 Name ______________________ Date __________

Solve Equations With Two Variables

An ordered pair that makes an equation true is a solution for the equation.

EXAMPLE *Find four solutions for the equation $y = 5x - 1$.*

Choose values for x.	Calculate y values.	Write ordered pairs.
Let $x = -4$.	$y = 5(-4) - 1 = -21$	(–4, –21)
Let $x = -2$.	$y = 5(-2) - 1 = -11$	(–2, –11)
Let $x = 0$.	$y = 5(0) - 1 = -1$	(0, –1)
Let $x = 2$.	$y = 5(2) - 1 = 9$	(2, 9)

Four solutions are (–4, –21), (–2, –11), (0, –1), and (2, 9).

EXERCISES *Complete the table for each equation. Then use the results to write four solutions for each equation. Write the solutions as ordered pairs.*

1. $y = 3x + 2$

x	$3x + 2$	y
1	3(1) + 2	**5**
2	3(2) + 2	**8**
3	3(3) + 2	**11**
4	3(4) + 2	**14**

(1, 5), (2, 8), (3, 11), (4, 14)

2. $y = 4x$

x	$4x$	y
–1	4(–1)	**–4**
0	4(0)	**0**
1	4(1)	**4**
2	4(2)	**8**

(–1, –4), (0, 0), (1, 4), (2, 8)

3. $y = -3x - 4$

x	$-3x - 4$	y
–1	–3(–1) – 4	**–1**
0	–3(0) – 4	**–4**
1	–3(1) – 4	**–7**
2	–3(2) – 4	**–10**

(–1, –1), (0, –4), (1, –7), (2, –10)

Find four solutions for each equation. Write your solutions as ordered pairs. **Answers will vary. Samples are given.**

4. $y = x - 4$
(0, –4), (1, –3), (2, –2), (3, –1)

5. $y = 3x + 1$
(–1, –2), (0, 1), (1, 4), (2, 7)

6. $y = -3$
(0, –3), (1, –3), (2, –3), (3, –3)

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7. $y = -2x - 2$
(–2, 2), (–1, 0), (0, –2), (2, –6)

8. $y = 2.5x$
(–2, –5), (–1, –2.5), (0, 0), (1, 2.5)

9. $y = -2x + 4$
(0, 4), (1, 2), (2, 0), (3, –2)

10. $y = -\frac{1}{2}x - 4$
(–2, –3), (0, –4), (2, –5), (4, –6)

11. $y = \frac{1}{3}x + 1$
(0, 1), (3, 2), (6, 3), (9, 4)

12. $y = \frac{1}{2}x + 3$
(–2, 2), (0, 3), (2, 4), (4, 5)

APPLICATIONS

13. One number is three more than half another number. Determine which ordered pairs in the set {(0, 3), (–2, 2), (4, –1), (1, $3\frac{1}{2}$)} are solutions for the two numbers.
(0, 3), (–2, 2), (1, 3)

14. An organization donates one third of all the money it raises for housing the homeless. How much will it donate if it raises \$6,000?
$y = x$; \$2,000

15. You can show the distance in feet it takes a car to stop when traveling at a certain speed on a dry, concrete surface by using the formula $d = 0.042\,s^2 + 1.1s$. Complete the table to find the distance for each speed. Round the distances to the nearest foot.

speed in mph (s)	30	35	40	45	50	55	60	65	70	75
distance in feet (d)	**71**	**90**	**111**	**135**	**160**	**188**	**217**	**249**	**283**	**319**

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SKILL 42

TEACHER NOTES

Function Tables

OBJECTIVE: Complete function tables. (Strand: Algebra)

USING THE TRANSPARENCY: Write the numbers 2, 8, 12, and 16 on the chalkboard. Have students describe the pattern they see in the data. Then have them give the next four numbers in the pattern.

USING THE STUDENT WORKBOOK: Have students work in pairs. Have one student make a function table and have the other student complete it. Then have students reverse roles.

EXTENSION: Have students write descriptions of data that can be used to make a function table on 3″ × 5″ cards. Have students exchange cards and make the tables.

Transparency, Skill 42

SKILL 42 WARM UP

Function Tables

The table at the right shows the 2001 U.S. Postal Service rates for first-class mail. Complete the table.

U.S. Postal Rates, 1993	
Maximum Weight (ounces)	**Rate (dollars)**
1	0.34
2	0.57
3	0.80
4	1.03
5	1.26
6	1.49
7	1.72
8	
9	
10	
11	

To complete the table, first look for a pattern in the data that is already given. Each entry in the rate column is 0.23 greater than the previous entry. So, the rate for 8 ounces is 1.72 + 0.23 or 1.95. Find the remaining entries in the same way. The entries for the last 4 rows are given below.

Weight	Rate
8	1.95
9	2.18
10	2.41
11	2.64

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SKILL 42 Name ______________________ Date __________

Function Tables

The data at the right shows the shipping and handling charged by a catalog company.

Maximum Purchase (dollars)	Shipping and Handling (dollars)
50	6.95
100	9.95
150	12.95
200	15.95
250	
300	
350	

EXAMPLE *Complete the table.*

First look for a pattern in the data that is already given. Each entry in the shipping and handling column is $3 greater than the previous entry. So, to complete the table, add $3 to each entry in the second column to get the next entry. The entries for the last 3 rows of the table are given below.

Maximum Purchase	Shipping and Handling
250	18.95
300	21.95
350	24.95

EXERCISES *Complete each table.*

1.

Principal (dollars)	Interest (dollars)
1,000	10
1,500	15
2,000	20
2,500	25
3,000	**30**
3,500	**35**
4,000	**40**
4,500	**45**

2.

Distance (feet)	Time (seconds)
5	7.5
10	15
15	22.5
20	30
25	37.5
30	**45**
35	**52.5**
40	**60**

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3.

Purchase (dollars)	Tax (dollars)
10	0.60
20	1.20
30	1.80
40	2.40
50	**3.00**
60	**3.60**
70	**4.20**
80	**4.80**

4.

Length of call (minutes)	Cost (dollars)
1	1.00
2	1.35
3	1.70
4	2.05
5	**2.40**
6	**2.75**
7	**3.10**
8	**3.45**

APPLICATIONS *The table at the right shows the amount of Federal individual income tax for 1993 for different amounts of adjusted gross income between $22,100 and $53,500 for single taxpayers. Use the data to answer Exercises 5–7.*

Adjusted Gross Income (dollars)	Income Tax (dollars)
25,000	7,000
30,000	8,400
35,000	9,800
40,000	**11,200**
45,000	**12,600**
50,000	**14,000**

5. Complete the table. **See table above for answer.**
6. Make a new table that includes 27,500, 32,500, 37,500, 42,500, 47,500, and 52,500 in the adjusted gross income column. Explain how you found the income tax for these amounts. **The new entries in the second column would be 7,700, 9,100, 10,500, 11,900, 13,300, and 14,700.**
7. Do you think it would be useful to have a table that contains more data? Why or why not? How can you add more data to the table? **Answers will vary.**
8. The rate for single taxpayers with an adjusted gross income between $53,500 and $115,000 is 31%. Make a table using adjusted gross incomes of $55,000, $60,000, $65,000, $70,000, $75,000, $80,000, $85,000, and $90,000. **The entries in the second column would be 17,050, 18,600, 20,150, 21,700, 23,250, 24,800, 26,350, and 27,900.**
9. Extend the table you made in Exercise 8 to include any additional data you think would be useful. Explain why you included the data you did. **Answers will vary.**

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SKILL 43

TEACHER NOTES

Graphing Exponential Equations

OBJECTIVE: Use the graphing calculator to graph exponential equations. (Strand: Algebra)

USING THE TRANSPARENCY: Write the equation $y = 2^x$ on the chalkboard. Have students describe how they would use a graphing calculator to graph the equation.

USING THE STUDENT WORKBOOK: Point out that the keystrokes used are for a TI-82 graphing calculator. Have students refer to their owners manual if using other models.

EXTENSION: Give small groups of students an exponential equation such as $y = 0.5^x$ and ask them to use a graphing calculator to do an experiment about how changing the base affects the graph of the equation. Ask each group to report their findings to the class.

Transparency, Skill 43

SKILL 43 WARM UP

Graphing Exponential Equations

The value of an automobile with an initial value of \$12,500 depreciates at a rate of 30% a year. The value, V, of the automobile after n years is given by the equation $V = 12{,}500(1 - 0.30)^n$. Use a graphing calculator to graph this equation.

Before you graph the equation on a graphing calculator, rewrite the equation using Y for V and X for n to get $Y = 12{,}500(1 - 0.30)^X$.

- First, press the [Y=] key.
- To enter the equation, press 12500 [(] 1 [−] [.] 3 [)] [^] [X,T,θ].
- Then set the size of the viewing window. To display the current boundaries of the viewing window, press [WINDOW]. For this graph, set the boundaries at Xmin = 0, Xmax = 10, Xscl = 1, Ymin = 0, Ymax = 12500, and Yscl = 1000.
- To draw the graph, press [GRAPH]. The graph is shown below.

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SKILL 43 Name ______________________ Date __________

Graphing Exponential Equations

Jamie conducted an experiment that began with 400 bacteria. He found that the number of bacteria, y, after x hours was given by the equation $y = 400(2^x)$.

EXAMPLE *Use a graphing calculator to graph this equation.*

Follow the steps below to graph the equation.

1. Press the [Y=] key. Then enter the equation by pressing 400 [×] 2 [^] [X,T,θ] .
2. Press [WINDOW] to view the current boundaries of the viewing window of the calculator. Set the boundaries at Xmin = 0, Xmax = 10, Xscl = 1, Ymin = 0, Ymax = 500000, and Yscl = 50000.
3. Press [GRAPH] to draw the graph shown below.

EXERCISES *Use a graphing calculator to graph each equation. Make a sketch of each screen.*

See students' work. Graphs will vary.

1. $y = 5^x$
2. $y = 0.8^x$

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Student Workbook, p. 86

3. $y = \left(\frac{1}{8}\right)^x$
4. $y = 2^{2x}$
5. $y = 30(0.5^x)$
6. $y = 500(0.25^x)$

APPLICATIONS *Carbon-14 has a half-life of 5,730 years. Manford has a sample that contains 200 g of carbon-14. The equation for the grams of carbon-14 in the sample, y, after x 5,730-year intervals is given by the equation $y = 200(0.5^x)$.*

7. Use a graphing calculator to graph this equation.
   See students' work. Graphs will vary.
8. How would you use the information shown on this graph?
   See students' work. Answers will vary.
9. Do you think this graph is the best way to display this information? Why or why not?
   See students' work. Answers will vary.
10. Jaunita conducted an experiment that began with 200 bacteria. She found that the number of bacteria, y, after x hours was given by the equation $y = 200(3^x)$. Use a graphing calculator to graph this equation. How would you use the information shown on this graph?
    See students' work. Answers will vary.

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SKILL 44

TEACHER NOTES

Quadratic Equations and Graphs

OBJECTIVE: Graph inequalities on the coordinate plane. (Strand: Algebra)

USING THE TRANSPARENCY: Give students an opportunity to use graphing calculators or graphing software on a computer to explore the affects of changing the coefficients *a, b*, and *c*.

USING THE STUDENT WORKBOOK: Have students explain how to graph points from a table and to determine an appropriate scale for a graph.

EXTENSION: Create sets of cards, half with equations and half with their matching graphs. Have students play a memory game to match the graphs with their equations.

Transparency, Skill 44

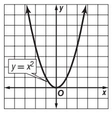
SKILL 44 WARM UP

Quadratic Equations and Graphs

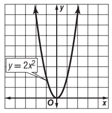
Equations in the form $ax^2 + bx + c = 0$ are quadratic equations. The coefficients *a*, *b*, and *c* determine the shape of the graph as well as the location of the graph on the coordinate plane.

Examine the following equations and corresponding graphs.

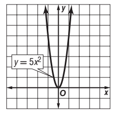
$y = x^2$



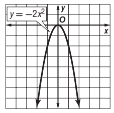
$y = 2x^2$



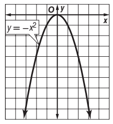
$y = 5x^2$



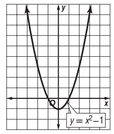
$y = -2\,x^2$



$y = -x^2$



$y = x^2 - 1$



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SKILL 44 Name ______________________ Date __________

Quadratic Equations and Graphs

EXAMPLE *Graph the equation $y = \frac{x^2}{4}$.*

Because there is a quadratic term in the equation, you should expect the shape of the graph to be a parabola (U-shape).

Find some points that satisfy the equation.

Choose a value for *x*.	$x = 0$
Substitute the *x*-value into the equation.	$y = \frac{0^2}{4}$
Determine the corresponding value of *y*.	$y = 0$

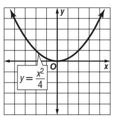
The point (0, 0) is on the graph.

An input-output table can help you keep track of the points you find and can also help you see patterns in the *x*- and *y*-values.

x	0	1	−1	2	−2	4	−4
y	0	$\frac{1}{4}$	$-\frac{1}{4}$	1	1	4	4

Try to pick points that will be easy to graph and give you useful information about the shape of the graph. For example, it is a good idea to try 0 for *x*, and to figure out (if possible) what values of *x* correspond to a *y*-value of 0. In this example, knowing that you will have to divide x^2 by 4, it makes sense to try even *x* values, so that you will be able to simplify the resulting fraction.

Graph each point. When you have enough points to get a sense of the shape of the graph, connect all your points with a smooth curve.



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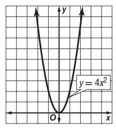
EXERCISES *In each exercise, find some points that satisfy the equation. Record the points in the input-output table. Graph the points and connect them with a smooth curve.*

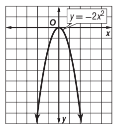
1. $y = 4x^2$

x	**1**	**−1**	**1**	**2**	**−2**	$\mathbf{\frac{1}{2}}$	**−1**
y	**0**	**4**	**4**	**16**	**16**	**1**	**4**



2. $y = -2x^2$

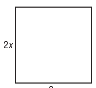
x	**0**	**1**	**−1**	**2**	**−2**	$\mathbf{\frac{1}{2}}$	$\mathbf{-\frac{1}{2}}$
y	**0**	**−2**	**−2**	**−8**	**−8**	$\mathbf{-\frac{1}{2}}$	$\mathbf{-\frac{1}{2}}$



APPLICATIONS *The sides of this square are the same length as the longer side of the rectangle.*

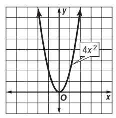
3. Write an equation to calculate the area of this square.
A = $(2x)^2 = 4x^2$

2*x*



2*x*

4. Make a graph showing how the area of the square changes as the value of *x* changes.



SKILL 45

TEACHER NOTES

Inverse Relationships

OBJECTIVE: Create equations, graphs, and tables for inverse relationships. (Strand: Algebra)

USING THE TRANSPARENCY: Have students discuss relationships that are inversely related.

USING THE STUDENT WORKBOOK: In small groups, have students take one of the families of functions, and graph different values for the constants to see the shape of these functions on a graph.

EXTENSION: Have students explore the three families of inverse relationships on a graphing calculator and determine the impact of changing the constants *a*, *b*, and *c.*

Transparency, Skill 45

SKILL 45 WARM UP

Inverse Relationships

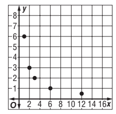
Darius is riding his bike to soccer practice. He wants to see how long it will take him to get to practice based on the speed he rides. Darius finds that he can ride the 6 miles to practice in $\frac{1}{2}$ hour if he rides at a speed of 12 miles per hour. If he rides half as fast, 6 miles per hour, it takes him one hour.

The relationship between the rate Darius rides and the time it takes him to go a specific distance, is **inversely proportional**. This means as one variable increases, the other variable decreases. As the rate increases, the time decreases.

Look at a table to see the pattern.

Rate (x)	12 mph	6 mph	3 mph	2 mph	1 mph
Time (y)	0.5 hour	1 hour	2 hours	3 hours	6 hours

Plot the data to see the relationship.



Write an equation for the inverse relationship.

$$y = \frac{6}{x}$$

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SKILL 45 Name ______________________ Date __________

Inverse Relationships

The variables x and y are **inversely proportional** when the product of x and y is always the same. This relationship is also called a **reciprocal relationship**.

EXAMPLE *There are different families of equations that express inverse relationships. In the equations below, x and y are variables, a, b, and c are constants.*

Family A

$xy = a$ or $y = \frac{a}{x}$

In equations like this, x and y are inversely proportional.

Family B

$(x + b)y = 1$ or $y = \frac{1}{(x + b)}$

In this family of equations, y is not inversely proportional to x. Instead, y is inversely proportional to $(x + b)$.

Family C

$x(y - c) = 1$ or $y = \frac{1}{x + c}$

In this family of equations, x is inversely proportional to $(y - c)$

EXERCISES *For each exercise, decide if the equation represents an inverse relationship. If it does not, tell what kind of relationship the equation does represent.*

1. $y = \frac{2}{x}$ **yes**
2. $x + 3 = y$ **No. Linear.**
3. $5xy = 7$ **Yes**
4. $y + 1 = \frac{1}{x}$ **Yes**
5. $y = x^2 + 2$ **No. Quadratic.**
6. $y = \frac{1}{(x + 5)}$ **Yes**
7. $y = \frac{1}{x - 15}$ **Yes**
8. $\frac{1}{y} = 2x$ **Yes**
9. $xy = x + 3$ **Yes**

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APPLICATIONS *For each exercise, do parts a – c.*

a. Write an equation that belongs to the given family.

b. Complete the input-output table with points that fit the equation.

c. Graph the points on a pair of axes. **Sample answers given for Exercises 10 – 12.**

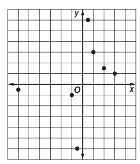
10. Family A

a. $z = \frac{3}{m}$

b.

m	1	2	3	−1	−6	$\frac{1}{2}$	$-\frac{1}{2}$
z	3	$\frac{3}{2}$	1	−3	$-\frac{1}{2}$	6	−6

c.



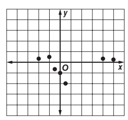
11. Family B

a. $t = \frac{1}{(s - 1)}$

b.

s	−2	−1	0	4	5	$\frac{1}{2}$	$-\frac{1}{2}$
t	$-\frac{1}{3}$	$-\frac{1}{2}$	−1	$\frac{1}{3}$	$\frac{1}{4}$	−2	$-\frac{2}{3}$

c.



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SKILL 46

TEACHER NOTES

Prime Factorization

OBJECTIVE: Find the prime factorization of a composite number. (Strand: Number and Operation)

USING THE TRANSPARENCY: Write 2, 15, 21, 29, and 36 on the chalkboard. Have students identify the prime and composite numbers. Discuss their differences.

USING THE STUDENT WORKBOOK: Have students work in small groups. Have one student begin a factor tree for an exercise by writing the number and the first row. Have each successive student add a row.

EXTENSION: Have students write a complex number on an index card. Exchange index cards with a partner. Have the partner find the prime factorization of the number.

Transparency, Skill 46

SKILL 46 WARM UP

Prime Factorization

Jackie is setting up tables for her party. There are 29 people coming to her party. She wants to set up the same number of tables in each of two rooms with the same number of people at each table. How many tables will she need to set up in each room? How many people will be sitting at each table?

Since Jackie will need a place to sit too, she needs to set up 30 chairs. To solve this problem, find the **prime factorization** of 30.

$$30 = 2 \cdot 15$$
$$= 2 \cdot 3 \cdot 5$$

Since 2, 3, and 5 are all prime numbers, $2 \cdot 3 \cdot 5$ is the prime factorization of 30.

Jackie will need to have either 3 tables in each room with 5 people seated at a table or 5 tables in each room with 3 people seated at a table.

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SKILL 46 Name ____________ Date ________

Prime Factorization

Evelyn has 105 books. She is trying to decide how to put them on the shelves of 3 separate bookcases.

EXAMPLE *How can she arrange the books if she wants to have the same number of books on each shelf?*

To solve this problem, find the **prime factorization** of 105.

$$105 = 3 \cdot 35$$
$$= 3 \cdot 5 \cdot 7$$

She can put 5 books on each of 7 shelves or 7 books on each of 5 shelves.

EXERCISES *Find the prime factorization of each number.*

1. 75	2. 36	3. 49	4. 72
3 · 5 · 5	**2 · 2 · 3 · 3**	**7 · 7**	**2 · 2 · 2 · 3 · 3**
5. 90	6. 42	7. 100	8. 121
2 · 3 · 3 · 5	**2 · 3 · 7**	**2 · 2 · 5 · 5**	**11 · 11**
9. 275	10. 385	11. 210	12. 147
5 · 5 · 11	**5 · 7 · 11**	**2 · 3 · 5 · 7**	**3 · 7 · 7**
13. 525	14. 66	15. 196	16. 500
3 · 5 · 5 · 7	**2 · 3 · 11**	**2 · 2 · 7 · 7**	**2 · 2 · 5 · 5 · 5**

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17. 136	18. 495	19. 231	20. 1,001
2 · 2 · 2 · 17	**3 · 3 · 5 · 11**	**3 · 7 · 11**	**7 · 11 · 13**
21. 234	22. 84	23. 255	24. 252
2 · 3 · 3 · 13	**2 · 2 · 3 · 7**	**3 · 5 · 17**	**2 · 2 · 3 · 3 · 7**

APPLICATIONS *Monty's yard has dimensions of 35 feet by 35 feet. He wants to construct a rectangular garden in his yard. Use this information to answer Exercises 25–27.*

25. Monty decides that the garden should have an area of 95 square feet. What are the whole number dimensions that are possible for this garden? **19 ft and 5 ft**

26. Monty changes his mind and decides that the garden should have an area of 100 square feet. What are the whole number dimensions that are possible for this garden? **25 ft by 4 ft, 10 ft by 10 ft, 20 ft by 5 ft**

27. Monty's neighbor asks Monty if he wants to construct a garden that they could share. One-half of the garden would be in Monty's yard and one-half would be in his neighbor's yard. His neighbor's yard has dimensions 40 feet by 35 feet. They decide to construct a rectangular garden with an area of 250 feet. What are the whole number dimensions that are possible for this garden? **50 ft by 5 ft, 25 ft by 10 ft**

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SKILL 47

TEACHER NOTES

Greatest Common Factor (GCF)

OBJECTIVE: Find the greatest common factor of two or more numbers. (Strand: Number and Operation)

USING THE TRANSPARENCY: Write the numbers 24 and 42 on the chalkboard. Have students state how they would find the greatest common factor of these two numbers. Discuss different strategies.

USING THE STUDENT WORKBOOK: Have students work in pairs. Have one student find the common factors of a set of numbers and the other student find the greatest common factor. Then have students reverse roles.

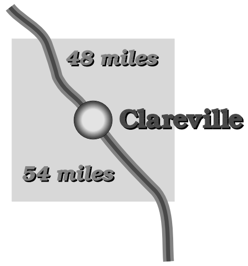
EXTENSION: Write four or five numbers on the chalkboard. Have students find the GCF of all five numbers.

Transparency, Skill 47

SKILL 47 WARM UP

Greatest Common Factor (GCF)

The Clareville City Council decides to install emergency phones along two stretches of highway on either side of their city. The stretch on one side of Clareville is 48 miles long, and the stretch on the other side is 54 miles long. They decide to install the phones at equal distances along both stretches of highway. If the distances between phones are as great as possible, how far apart should the phones be?



To find how far apart the phones should be, find the common factors.

factors of 48: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48

factors of 54: 1, 2, 3, 6, 9, 18, 27, 54

The common factors of 48 and 54 are 1, 2, 3, and 6. The **greatest common factor (GCF)** of the two numbers is 6. So, the phones should be 6 miles apart.

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SKILL 47 Name ______________________ Date __________

Greatest Common Factor (GCF)

Carlos is 20 years old and his brother Thomas is 24 years old. The **greatest common factor (GCF)** of their ages is the same as their niece Cristina's age.

EXAMPLE *How old is Cristina?*

To find Cristina's age, find the GCF of 20 and 24. One way to find the GCF is to find the prime factorization of each number.

$20 = 2 \cdot 10$ $24 = 2 \cdot 12$

$= 2 \cdot 2 \cdot 5$ $= 2 \cdot 4 \cdot 3$

$= 2 \cdot 2 \cdot 2 \cdot 3$

Then find the common prime factors.

$20 = 2 \cdot 2 \cdot 5$

$24 = 2 \cdot 2 \cdot 2 \cdot 3$

The common prime factors are 2 and 2. So, the greatest common factor of 20 and 24 is $2 \cdot 2$, or 4. So Cristina is 4 years old.

EXERCISES *Find the GCF for each set of numbers.*

1. 16, 24 **8**
2. 15, 18 **3**
3. 18, 36 **18**
4. 32, 48 **16**
5. 28, 70 **14**
6. 72, 96 **24**
7. 81, 48 **3**
8. 48, 36 **12**
9. 40, 56 **8**
10. 14, 28 **14**
11. 30, 18 **6**
12. 84, 154 **14**

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13. 24, 64 **8**
14. 35, 25 **5**
15. 100, 80 **20**
16. 75, 120 **15**
17. 2, 4, 8 **2**
18. 8, 12, 16 **4**
19. 18, 30, 36 **6**
20. 15, 25, 30 **5**
21. 18, 12, 24 **6**
22. 24, 36, 48 **12**
23. 8, 16, 40 **8**
24. 12, 18, 72 **6**

APPLICATIONS *Nita is making a baby quilt. She is using strips of material that are cut from pieces of material that are 36 inches wide and 48 inches wide. Use this information to answer Exercises 25 and 26.*

25. All of the strips are to be the same width and as wide as possible. How wide should the strips be? How many strips will Nita be able to cut from each piece of material? **12 in. wide; 3 pieces from the 36-in. wide piece and 4 pieces from the 48-in. wide piece**

26. Nita found another piece of material that she decided to use for the quilt. The piece of material is 54 inches wide. If all of the strips from the three pieces of material are to be the same width and as wide as possible, how wide should the strips be? How many strips will Nita be able to cut from each of the three pieces of material? **6 in. wide; 6 pieces from the 36-in. wide piece, 8 pieces from the 48-in. wide piece, and 9 pieces from the 54-in. wide piece**

SKILL 48 TEACHER NOTES

Perimeter and Area

OBJECTIVE: Find the relationship between perimeter and area. (Strand: Measurement)

USING THE TRANSPARENCY: Have students work the same problem using different lengths of fence such as 18 feet, 36 feet, and 50 feet. Then ask students what they notice about the dimensions of the garden when the area is the greatest.

USING THE STUDENT WORKBOOK: Have students use grid paper to cut out rectangular shapes given a fixed perimeter. Ask how the dimensions of a rectangle affect the area.

EXTENSION: Have students answer the following question: *What is the total area of the six rectangles needed to make a cereal box 10 inches high, 8 inches long, and 2 inches wide?*

Transparency, Skill 48

SKILL 48 WARM UP

Perimeter and Area

Matt McNeal wants to build a retangular garden with the greatest area that can be formed with 28 feet of fencing. What would be the whole number dimensions of the garden?

Perimeter and area are used in this problem. In order to organize the data, you can create a chart.

width	length	perimeter $P = 2\ell + 2w$	area $A = \ell w$
1	13	28	13
2	12	28	24
3	11	28	33
4	10	28	40
5	9	28	45
6	8	28	48
7	7	28	49
8	6	28	48

Notice that you have already used 8 and 6, so you have used all whole number dimensions.

Looking down through the chart, the greatest area is 49 square feet. Therefore, the whole number dimensions for our rectangular garden should be 7 feet by 7 feet.

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Student Workbook, p. 95

SKILL 48 Name ____________________ Date ________

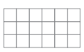
Perimeter and Area

EXAMPLE *Tova Albert wants to make a garden with a perimeter of 54 feet because that is the amount of fence that she has. She wants the least area possible because she doesn't have that much space in her yard. What should be the dimensions of her garden?*

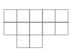
Dimensions	Perimeter	Area
1×26	54	26
2×25	54	50
3×24	54	72
4×23	54	92

Notice that the perimeter stays 54 feet but the area continues to increase. Therefore, the least area with a perimeter of 54 feet is a garden with dimensions 1 foot by 26 feet.

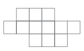
EXERCISES *Find the perimeter and area of each figure.*

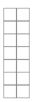
1. 
P = 18 units
A = 18 units²

2. 
P = 16 units
A = 16 units²

3. 
P = 16 units
A = 12 units²

4. 
P = 20 units
A = 24 units²

5. 
P = 18 units
A = 12 units²

6. 
P = 18 units
A = 14 units²

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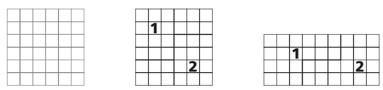
APPLICATIONS

7. A cardboard tube has a circumference of 7 inches and a length of 15 inches. When it is cut straight down its length, it becomes a rectangle. How much cardboard is used to make this tube? **105 in²**

8. Ryan Allaire wants to build a deck onto the back of his house. He wants the area to be at least 240 square feet. There is space for the length to be up to 20 feet, but the width cannot be more than 15 feet.
   a. Will he have room to build the size deck that he wants? **yes**
   b. What is the largest deck that he can build? **300 ft²**
   c. If he wants the deck to be exactly 240 square feet, what are the whole number dimensions that are possible for him? **15 ft × 16 ft; 20 ft × 12 ft**

9. Using the large square below, show how to cut it into two pieces (cuts must be made along the grid lines) that can be rearranged to form a rectangle with a perimeter of 26 centimeters. **Sample answer:**



10. Bovinet Candy Company needs to have a box designed so that the bottom has an area of 96 square inches but has the least perimeter possible. What would be the whole number dimensions of the bottom of the box? **8 in. × 12 in.**

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SKILL 49

TEACHER NOTES

Volume of Rectangular Prisms

OBJECTIVE: Find the volume of rectangular prisms. (Strand: Measurement)

USING THE TRANSPARENCY: Watch for students who confuse surface area and volume. You can help to prevent this by teaching the mnemonic, "Surface skin, volume in."

USING THE STUDENT WORKBOOK: Separate the class into small groups. Give each group cubes and ask them to build a prism with given dimensions. Have students find the volume by counting the cubes. Now give students the volume of a prism and have them build it. Are all the models the same?

EXTENSION: Have students work in small groups. Give the students a net made out of graph paper. Have the students form the figure from the net, then calculate its volume.

Transparency, Skill 49

SKILL 49 WARM UP

Volume of Rectangular Prisms

Jake has a two-year-old brother. For his brother's birthday, Jake made him a sandbox that measured 36 inches by 48 inches by 12 inches. He then went to the store to buy the sand for the sandbox. The sand was sold in bags measuring 12 inches by 16 inches by 9 inches. How many bags of sand does Jake need to buy to fill the sandbox?

You must find the volume or amount of space inside the sandbox. You must also know the volume or amount of sand inside each bag of sand. You can then divide the sandbox volume by the bag of sand volume to determine the number of bags needed to fill the box.

Volume of sandbox $= \ell \times w \times h$
$V = 36 \times 48 \times 12$
$V = 20{,}736$
Volume of sandbox = 20,736 cubic inches

Volume of bag of sand $= \ell \times w \times h$
$V = 12 \times 16 \times 9$
$V = 1{,}728$
Volume of bag of sand = 1,728 cubic inches

$\frac{20{,}736}{1{,}728} = 12$ Therefore, Jake must buy 12 bags of sand to fill the sandbox.

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Student Workbook, p. 97

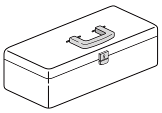
SKILL 49 Name ______________ Date ________

Volume of Rectangular Prisms

The **volume** (V) of a rectangular prism is found by multiplying the length (ℓ), the width (w), and the height (h).

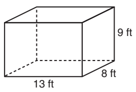
$$V = \ell wh$$

EXAMPLE *Nicholas has been working with his dad in the evenings and on weekends in his dad's repair shop. For Nicholas' birthday, his dad bought him a new toolbox and some of the starting tools he would need. What is the volume of Nicholas' toolbox if it is 18 inches long, 8 inches tall, and 7.5 inches deep?*

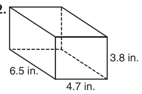


$V = \ell wh$
$V = 18 \times 7.5 \times 8$
$V = 1{,}080$ The volume of the toolbox is 1,080 cubic inches.

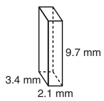
EXERCISES *Find the volume of each rectangular prism shown or described below. Round decimal answers to the nearest tenth.*

1. 

936 ft³

2. 

116.1 in³

3. 

69.3 mm³

4. length, 14 meters
width, 23 meters
height, 18 meters
5,796 m³

5. length, $4\frac{1}{3}$ feet
width, $3\frac{3}{4}$ feet
height, 5 feet
81 ft³

6. cube:
side, 9.2 cm
778.7 cm³

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Student Workbook, p. 98

7. Draw and label a rectangular prism whose length is 6 centimeters, width is 4 centimeters, and height is 10 centimeters. Find its volume. **See students' work.; 240 cm³**

8. How many different rectangular prisms can be formed with 18 cubes? **4**

9. The surface area of a cube is 486 square inches. What is the volume of the cube? **729 in³**

10. A cube has a volume of 1,000 cubic inches. What is the surface area of the cube? **600 in²**

11. What is the height of a rectangular prism if the volume is 2,112 cubic yards, the length is 48 feet, and the width is 36 feet? **33 ft or 11 yd**

12. A rectangular prism has a volume of 36 cubic centimeters. Make a list showing all the possible whole-number dimensions of the prism. **1×1×36; 1×2×18; 1×3×12; 1×4×9; 1×6×6; 2×2×9; 2×3×6; 3×3×4**

APPLICATIONS

13. A bar of soap has the dimensions $2 \times 4 \times 1.5$ inches. A bathtub has the inside dimensions of $21 \times 50 \times 15$ inches. How many bars of soap would it take to fill the bathtub? **1,312.5 bars**

14. An aquarium is 3 feet long and $1\frac{1}{2}$ feet wide. It is filled with water to a height of 1 foot. How many gallons of water are in the aquarium? (Hint: 1 cubic foot ≈ 7.5 gallons.) **about 33.75 gal**

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SKILL 50

TEACHER NOTES

Make a List

OBJECTIVE: Solve problems by making a list. (Strand: Data Analysis and Probability)

USING THE TRANSPARENCY: Place three different objects in a row on a desk. Have the students arrange the objects in different orders while you record each different arrangement on the chalkboard.

USING THE STUDENT WORKBOOK: Give small groups of students a take-out pizza menu. Have them list all the possible two-topping pizzas available. Then have them pick their favorite option.

EXTENSION: Have the students describe a problem that could be solved by making a list.

Transparency, Skill 50

SKILL 50 WARM UP

Make a List

Mrs. Nitobe bought four rose bushes. Their flowers are red, yellow, white, and pink. She wants to plant the bushes in a row in front of her house. In how many different ways can she arrange the bushes in a row if she does not want to plant the red bush next to the pink bush?

You can solve this problem by making a list of all the possible ways that the rose bushes can be arranged. Let R = red, Y = yellow, W = white, and P = pink.

RYWP	YRWP	WRYP	PRYW
RYPW	YRPW	WRPY	PRWY
RPYW	YPRW	WPRY	PWRY
RPWY	YPWR	WPYR	PWYR
RWPY	YWPR	WYRP	PYRW
RWYP	YWRP	WYPR	PYWR

Cross out all arrangements where the red bush is next to the pink bush. Mrs. Nitobe could arrange the rose bushes in 12 different ways.

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Student Workbook, p. 99

SKILL 50 Name ______________________ Date __________

Make a List

Pat's Pizza offers 7 different toppings: pepperoni, sausage, bacon, green peppers, onions, mushrooms, and anchovies. The Davis family wants to order a 3-topping pizza. Tommy Davis does not like anchovies.

EXAMPLE ***How many different pizzas can the Davis family order if they want to satisfy all members of the family?***

Let P = pepperoni, S = sausage, B = bacon, G = green peppers, O = onions, M = mushrooms, and A = anchovies. List the possible combinations that do not include anchovies.

PSB	PSG	PSO	PSM
PBO	PBM	PGO	PGM
SBG	SBO	SBM	SGO
SOM	BGO	BGM	BOM
PBG	POM	SGM	GOM

There are 20 different pizzas the Davis family can order.

EXERCISES *Solve by making a list.*

1. How many different ways can a triangle, a square, and a circle be arranged in a row? **6 ways**
2. How many different four-digit numbers can be formed from the numbers 4, 5, 6, and 7 if all the digits must be different? **24 numbers**
3. How many different three-digit numbers can be formed from the numbers 4, 5, 6, and 7 if all the digits must be different? **24 numbers**

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4. How many different two-digit numbers can be formed from the numbers 4, 5, 6, and 7 if both the digits must be different? **12 numbers**
5. How many numbers between 77 and 103 are divisible by 3? **9 numbers**

APPLICATIONS

6. A vendor at a rock concert sells T-shirts in three colors: red, blue, and yellow. The T-shirts come in 4 sizes: small, medium, large, and extra large. How many different T-shirts are available to the customers? **12 T-shirts**
7. Four chairs are placed in a row on the stage. The three candidates for class president, Adrian, Toni, and Miwa, are seated on the stage. How many different ways can the candidates seat themselves? **24 ways**
8. Leslie wants to take a picture of her four dogs. She has a beagle, a terrier, a collie, and a poodle. How many ways can she arrange her dogs in a row if the beagle and terrier must be next to each other? **12 ways**
9. Using only dimes and nickels, how many different ways can a clerk make change for a dollar? **11 ways**
10. Earl attends a convention every three years. The year 1992 was a leap year, and Earl attended a convention. What is the next leap year that Earl will be attending a convention? **2004**

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SKILL 51

TEACHER NOTES

Probability of Independent Events

OBJECTIVE: Find the probability of independent events. (Strand: Data Analysis and Probability)

USING THE TRANSPARENCY: The probability an event will happen is a number between 0 and 1 inclusive. An event with a probability of 0 is impossible. An event with a probability of 1 is certain to happen.

USING THE STUDENT WORKBOOK: Have pairs of students toss two coins thirty times and record the result of each toss. Combine the results of the pairs of students.

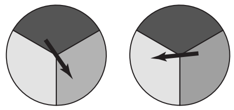
EXTENSION: Have students brainstorm situations of independent events that happen in their daily lives.

Transparency, Skill 51

SKILL 51 WARM UP

Probability of Independent Events

Two spinners are shown at the right. Suppose you spin both of these spinners. What is the probability that the spinners will stop on the same color?



Since the results of one spinner does *not* affect the results of the other spinner, these events are **independent events**. Make a tree diagram to show all the possible outcomes of these events.

First Spinner	Second Spinner
Red	Red
	Yellow
	Green
Yellow	Red
	Yellow
	Green
Blue	Red
	Yellow
	Green

The **probability** of an event is the ratio of the number of ways an event can occur to the number of possible outcomes.

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{number of possible outcomes}}$$

In this case, there are 2 outcomes that show the same color and 9 possible outcomes.

$$\text{probability spinners stop on the same color} = \frac{2}{9}$$

The probability that the spinners show the same color is $\frac{2}{9}$.

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Student Workbook, p. 101

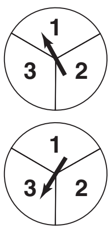
SKILL 51 Name ______________________ Date __________

Probability of Independent Events

The **probability** of an event is the ratio of the number of ways an event can occur to the number of possible outcomes.

$$\text{Probability of an event} = \frac{\text{number of ways the event can occur}}{\text{number of possible outcomes}}$$

EXAMPLE *Suppose you spin the two spinners. What is the probability that the sum of the numbers showing on the two spinners will be 4?*



Make a tree diagram to show all possible outcomes of these events.

First Spinner	Second Spinner	Sum
1	1	2
	2	3
	3	4
2	1	3
	2	4
	3	5
3	1	4
	2	5
	3	6

There are 3 outcomes that have a sum of 4 and there are 9 possible outcomes.

Probability of sum of 4 $= \frac{3}{9}$ or $\frac{1}{3}$

The probability that the sum will be 4 is $\frac{1}{3}$.

EXERCISES *Use the spinners in the Example above to answer Exercises 1–4.*

1. What is the probability that the sum of the numbers showing on the two spinners is 3? $\frac{2}{9}$

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2. What is the probability that the sum of the numbers showing on the two spinners is greater than 3? $\frac{2}{3}$
3. What is the probability that the sum of the numbers showing on the two spinners is an even number? $\frac{5}{9}$
4. What is the probability that the sum of the numbers showing on the two spinners is *not* a 5? $\frac{7}{9}$
5. Make a tree diagram showing the possible outcomes of tossing a penny and a dime.

Penny	Dime
heads	heads
	tails
tails	heads
	tails

6. What is the probability that a tossed penny and a tossed dime will both show heads? $\frac{1}{4}$
7. What is the probability that a tossed penny and a tossed dime will both show one head and one tail? $\frac{1}{2}$
8. What is the probability that a tossed penny and a tossed dime will show at least one tail? $\frac{3}{4}$

APPLICATIONS *Beau, Jiang, and Marci are playing a game that requires each player to toss two number cubes. Use this information to answer Exercises 9–12.*

9. Beau needs a sum of 4 on the number cubes to win. What is the probability that Beau will toss a 4? $\frac{1}{12}$
10. Jiang needs a sum of 9 on the number cubes to win. What is the probability that Jiang will toss a 9? $\frac{1}{9}$
11. Marci needs a sum of 7 on the number cubes to win. What is the probability that Marci will toss a 7? $\frac{1}{6}$
12. Who is most likely to win the game? **Marci**

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SKILL 52

TEACHER NOTES

Expected Value of an Outcome

OBJECTIVE: Find the expected value of an outcome. (Strand: Data Analysis and Probability)

USING THE TRANSPARENCY: Tell students that you have 3 hats and each day you pick one at random. Ask students how many times you would expect to pick a certain hat during a six-day period.

USING THE STUDENT WORKBOOK: Have students answer the questions and then choose several problems to act out.

EXTENSION: Have students design and carry out a simulation to solve the following problem: *An equipment manager for the high school team mixed up the hats of 6 players, and then handed them out to the players at random. Find the probability that at least one player gets her own hat.*

Transparency, Skill 52

SKILL 52 WARM UP

Expected Value of an Outcome

Dee's class is selling boxes of raisins to raise money to buy some equipment for the school. They are putting a prize in every tenth box. If they sell a total of 1,000 boxes, how often would you expect to win a prize if you bought 10 boxes? 20 boxes? 30 boxes?

Since they are putting a prize in every tenth box, there will be 100 prizes.

probability of winning a prize $= \frac{100}{1,000}$ or $\frac{1}{10}$

If you buy 10 boxes, you could expect to win one prize.

If you buy 20 boxes, you could expect to win two prizes.

If you buy 30 boxes, you could expect to win three prizes.

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SKILL 52 Name ________________ Date ________

Expected Value of an Outcome

EXAMPLE ***Mr. Eugene has four different colored markers in a cup on his desk. Each day he pulls a marker out of the cup at random. How often could he expect to use a given marker in 8 days? in 16 days? in 40 days?***

The probability of choosing any one of the four different colored markers is $\frac{1}{4}$.

In 8 days, he could expect to use the given marker twice.

In 16 days, he could expect to use the given marker 4 times.

In 40 days, he could expect to use the given marker 10 times.

EXERCISES ***A number cube is rolled 12 times. How often would you expect to get each of the following outcomes?***

1. a 6
twice
2. a 7
never
3. a prime number
6 times
4. an even number
6 times
5. a number greater than 2
8 times
6. a number less than 1
never
7. a multiple of 1
12 times
8. a multiple of 4
twice

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Student Workbook, p. 104

A coin is tossed 20 times. How often would you expect to get each of the following outcomes?

9. a head
10 times
10. a tail
10 times
11. a head or a tail
20 times
12. neither a head nor a tail
never

APPLICATIONS ***LeRoy has 15 different ties. He chooses a tie at random every day.***

13. How many times could he expect to wear a given tie in 45 days?
3 times
14. How many times could he expect to wear a given tie in 180 days?
12 times
15. How many times could he expect to wear a given tie in a year that is not a leap year?
about 24 times
16. Suppose LeRoy buys 5 more ties to add to his collection. How many times could he now expect to wear a given tie in 45 days? in 180 days? in a year that is not a leap year?
about 2 times; 9 times; about 18 times
17. How many ties would LeRoy need to own in order to expect to wear each tie just 5 times in a year that is not a leap year?
73 ties

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SKILL 53

TEACHER NOTES

Make a Model

OBJECTIVE: Solve problems by making a model. (Strand: Problem Solving)

USING THE TRANSPARENCY: Have students work in groups to list real-world applications of making models to solve problems.

USING THE STUDENT WORKBOOK: Give each pair of students 20 cubes. Ask them to use all 20 cubes to make many different shapes. Ask them which of their shapes are rectangular prisms. Encourage them to make all four of the possible rectangular prisms with the cubes.

EXTENSION: Interior designers often make models of rooms to show various ways of arranging furniture. Have students pick a room and use a model to plan at least two different room arrangements.

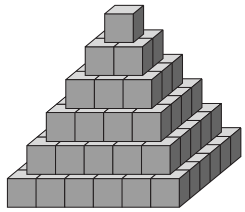
Transparency, Skill 53

SKILL 53 WARM UP

Make a Model

Roberto wants to make a pyramid-shaped display of basketballs for his sports shop. Each basketball comes in a ten-inch cubic box. Roberto starts with a base that is six boxes wide and six boxes long. He decreases each dimension by one box for each layer. How many basketballs will he need for his display?

To solve this problem, make a model using cubes and count the number of cubes. The model should look like the picture below.



If you made the pyramid correctly, there should be 91 cubes. Roberto will need 91 boxes.

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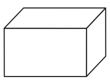
SKILL 53

Name ______________________ Date __________

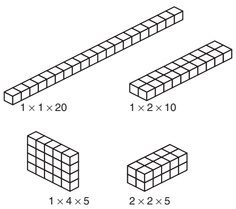
Make a Model

A box like the one at the right is a **rectangular prism**. It has six sides and each one is the shape of a rectangle.



EXAMPLE ***How many different shapes of rectangular prisms can be formed using exactly 20 cubes?***

Use 20 cubes to model this problem. Make as many different shapes of rectangular prisms as you can.



There are four different shapes of rectangular prisms that can be made.

EXERCISES ***Solve by making a model.***

1. How many different shapes of rectangular prisms can be formed using exactly 12 cubes? **4 shapes**

2. How many different shapes of rectangular prisms can be formed using exactly 24 cubes? **6 shapes**

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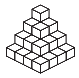
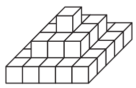
Student Workbook, p. 106

3. How many cubes are needed to make the display shown at the right?
30 cubes



4. How many cubes are needed to make the display shown at the right?
35 cubes



APPLICATIONS

5. Ronnie used blocks to build a "fort". The blocks were cubes and were stacked five high. The top, front, and side views were all squares. How many blocks did Ronnie need to build his fort?
80 blocks

6. Twelve one-inch-tall square snack cakes are packed in a box. No two cakes are stacked on top of one another. What are the possible dimensions of the box if the top view of each cake is a two-inch by two-inch square?
24 in. by 2 in. by 1 in., 12 in. by 4 in. by 1 in., 8 in. by 6 in. by 1 in.

7. The town playground is to have a hedge around it. The playground is in the shape of a pentagon with two sides of 40 feet, two sides of 60 feet, and one side of 70 feet. The bushes will be planted every 5 feet. How many bushes will be needed?
54 bushes

8. Rita collects miniature lamps. She is building a shelf around the rectangular family room to display them. If the family room is 15 feet wide and 18 feet long, how many feet of shelving will she need?
66 feet

9. A carton is 8 inches by 4 inches by 12 inches. How many four-inch cubes can Brian pack in the carton?
6 cubes

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SKILL 54

TEACHER NOTES

Classify Information

OBJECTIVE: Solve problems by classifying information. (Strand: Problem Solving)

USING THE TRANSPARENCY: Have small groups of students collect newspaper and magazine articles. From these articles, have each group formulate a question based on the information. Have them read the story and the question to the class. Then have the other students determine what information is needed to answer the question and what is not.

USING THE STUDENT WORKBOOK: Help students understand that sometimes there is *not* enough information to answer a question.

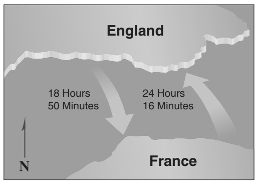
EXTENSION: Have students write two problems, one with *not* enough information, the other with extra information.

Transparency, Skill 54

SKILL 54 WARM UP

Classify Information

In 1961, Antonio Abertondo swam from England to France in 18 hours 50 minutes, rested 4 minutes, and swam back to England in 24 hours 16 minutes. He completed the first double crossing of the English Channel in 43 hours 10 minutes. How much less time did it take him to swim from England to France than from France to England?



Study this problem. What is the question?

How much less time did Antonio take to swim from England to France than from France to England?

What information is needed?

The swimming time from England to France, 18 hours 50 minutes, and the swimming time from France to England, 24 hours 16 minutes, are needed.

What information is *not* needed?

The time of the rest, 4 minutes, and the total time for the double crossing, 43 hours 10 minutes, are *not* needed.

Solve the problem.

24 hours 16 minutes	23 hours 76 minutes	*Rename.*
− 18 hours 50 minutes	− 18 hours 50 minutes	
	5 hours 26 minutes	

Antonio Abertondo took 5 hours 26 minutes longer to swim from France to England than from England to France.

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Student Workbook, p. 107

SKILL 54 Name ______ Date ______

Classify Information

In 1980, the United States film industry took in $2,748,500,000 in box office receipts. The average admission charge was $2.69. In 1990, the box office receipts were $5,021,800,000, and the average admission charge was $4.75.

EXAMPLE *How much more were the box office receipts in 1990 than in 1980?*

What is the question?
How much more were the receipts in 1990 than 1980?
What information is needed?
The total receipts in 1980 and 1990 are needed.
What information is *not* needed?
The average admission charges in 1980 and 1990 are *not* needed.
Solve the problem.

$$\begin{array}{r} 5{,}021{,}800{,}000 \\ -\ 2{,}748{,}500{,}000 \\ \hline 2{,}273{,}300{,}000 \end{array}$$

In 1990, the receipts were $2,273,300,000 more than in 1980.

EXERCISES *Classify information in each problem by writing* "not enough information" *or* "too much information." *Then solve, if possible.*

1. The sum of three numbers is 78. If one of the numbers is 14, what are the other two numbers?
not enough information

2. If the product of 56 and 77 is 4,312, what is the sum of the numbers?
too much information; 133

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Student Workbook, p. 108

3. If the sum of 18 and a number is 54 and their product is 648, what is their difference?
too much information; 36

4. If the product of two numbers is 100, what is the difference of the numbers?
not enough information

APPLICATIONS *Classify information in each problem by writing* "not enough information" *or* "too much information." *Then solve, if possible.*

5. Phien bought 3 address books that cost $4.98 each. She gave the cashier a $20 bill. What was the total cost of the books?
too much information; $14.94

6. Jimmy grew 3 inches last year and 2 inches so far this year. How tall is Jimmy now?
not enough information

7. Carla, a carpenter, has two tape measures. The steel tape is 8 feet long. The cloth tape is marked in metric measure at one-centimeter intervals. How much longer is the steel tape than the cloth tape?
not enough information

8. Jonathan bought 10 computer disks for $1.39 each. The disks usually sell for $1.99 each, or ten for $18. How much did he pay for the disks?
too much information; $13.90

9. The Sheng family drove 1,287 miles on their vacation. About how many miles did they drive per day?
not enough information

10. Gerda pays a delivery service $18 for priority delivery, $15 for standard delivery, and $21 for Saturday delivery. How much will she save by sending a package by standard delivery instead of Saturday delivery?
too much information; $6

11. Alan ran the same number of miles for 6 days. How far did he run?
not enough information

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SKILL 55

TEACHER NOTES

Box-and-Whisker Plots

OBJECTIVE: Construct a box-and-whisker plot from a given set of data. (Strand: Data Analysis and Probability)

USING THE TRANSPARENCY: Review with students the process for finding the median, lower quartile, and upper quartile.

USING THE STUDENT WORKBOOK: Remind students that even though the four parts of the box-and-whisker plot may differ in length, each part contains 25% of the data.

EXTENSION: Conduct a survey in the classroom and use the data to construct a box-and-whisker plot.

Transparency, Skill 55

SKILL 55 WARM UP

Box-and-Whisker Plots

Ms. Bogart is tracking the number of customers that visit her bookstore on a daily basis. The table below shows the number of customers for a period of fifteen days. Display the data in a box-and-whisker plot.

Bookstore Customers				
56	72	45	63	50
38	84	70	64	44
58	89	74	65	68

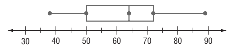
Step 1 Find the least and greatest numbers. Then draw a number line that covers the range of the data.

The least number is 38 and the greatest is 89.

Step 2 Find the median, the extremes, and the upper and lower quartiles. Mark these points above the number line.

The median is 64, the extremes are 38 and 89, the UQ is 72, and the LQ is 50.

Step 3 Draw a box and the whiskers.

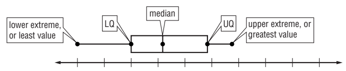


Student Workbook, p. 109

SKILL 55 Name ________________ Date ________

Box-and-Whisker Plots

A **box-and-whisker plot** separates a set of data into four parts using the median and quartiles. A **box** is drawn around the quartile values, and **whiskers** extend from each quartile to the extreme data points.



EXAMPLE *Draw a box-and-whisker plot for the set of test scores given below.*

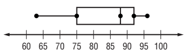
83 92 75 96 89 70 62 85 94 88 92

Step 1 Find the least and greatest numbers. Then draw a number line that covers the range of the data.
The lowest data value is 62 and the highest is 96. Draw a number line ranging from 60 to 100 with increments of 5.

Step 2 Find the median, the extremes, and the upper and lower quartiles. Mark these points above the number line.

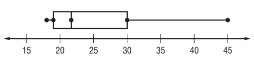
The median for the data is 88. The extremes are 62 and 96. The upper quartile is 92 and the lower quartile is 75.

Step 3 Draw a box and the whiskers.

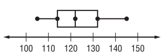


EXERCISES *Draw a box-and-whisker plot for each set of data.*

1. 18, 24, 21, 19, 32, 22, 45, 21, 18, 28, 30



2. 132, 118, 145, 107, 125, 130, 105, 114, 122, 138, 117



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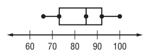
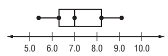
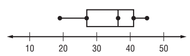
3. 75, 88, 100, 92, 68, 73, 95, 84, 70, 85, 90, 66, 78, 89, 95



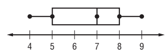
4. 6.8, 7.7, 8.3, 5.4, 6.9, 7.0, 9.1, 8.2, 7.1, 6.3, 5.5



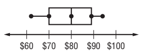
5. 38, 42, 27, 19, 35, 40, 31, 24, 45, 37, 41



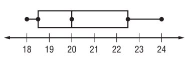
6. 5, 9, 7, 6, 5, 8, 4, 9, 7, 7, 6, 5, 8, 9, 6



7. $89, $74, $62, $83, $94, $66, $80, $73, $88, $91, $70



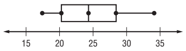
8. 18, 21, 19, 18, 20, 22, 19, 24, 23



APPLICATIONS

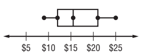
9. The following data gives the total amount of snowfall (in inches) for a community in Ohio, over the past nine winters. Draw a box-and-whisker plot for the data.

24.3, 18.6, 21.9, 34.1, 17.4, 25.5, 31.3, 22.7, 24.6



10. David is in charge of counting the money collected at his school each day for the annual fund-raiser. The data below shows the amounts collected each day during the past two weeks. Draw a box-and-whisker plot for the data.

$12, $23, $18, $15, $9, $25, $14, $11, $21, $16



SKILL 56 TEACHER NOTES

Constructing and Interpreting Graphs

OBJECTIVE: Construct and interpret graphs that involve distance and time. (Strand: Data Analysis and Probability)

USING THE TRANSPARENCY: Draw several graphs on the chalkboard. Have students suggest data that the graphs might show.

USING THE STUDENT WORKBOOK: Have students work in small groups. Have them study their graphs and describe events that could result in the data shown by the graphs.

EXTENSION: Have students find graphs on the Internet and explain what the graph tells about the data.

Transparency, Skill 56

SKILL 56 WARM UP

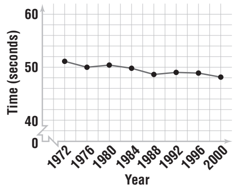
Constructing and Interpreting Graphs

The chart at the right lists the winning times for the men's 100-meter freestyle swimming event in the Summer Olympic Games. Construct and interpret a graph of the data.

To graph the data, first label the axes and graph the points named by the data. Then connect the points to complete the graph. The completed graph is shown below.

Summer Olympics Men's 100-meter Freestyle	
Year	Time (seconds)
1972	51.22
1976	49.99
1980	50.40
1984	49.80
1988	48.63
1992	49.02
1996	48.74
2000	48.30

Summer Olympics
Men's 100-meter Freestyle



The graph shows that the times generally tend to decrease with each successive Olympic game. This means that swimmers competing in this event are getting faster as time goes on!

Student Workbook, p. 111

SKILL 56 Name ______________ Date ______

Constructing and Interpreting Graphs

The chart at the right shows scores in the annual Springboard Diving event.

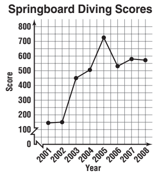
Springboard Diving Event	
Year	Score
2001	145.00
2002	150.77
2003	450.03
2004	506.19
2005	725.91
2006	530.70
2007	580.23
2008	572.40

EXAMPLE *Construct and interpret a graph of the data.*

To graph the data, first label the axes and graph the points named by the data. Then connect the points as shown in the graph at the right.

The graph shows that the scores generally tended to increase with each successive year.

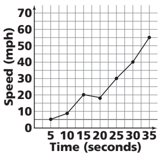
Springboard Diving Scores



EXERCISES *Construct and interpret a graph of each set of data.*

1.

Time (seconds)	Speed (mph)
5	5
10	8
15	20
20	18
25	30
30	40
35	55

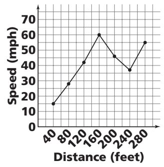


The speed generally tends to increase over time.

Student Workbook, p. 112

2.

Distance (feet)	Speed (mph)
40	15
80	28
120	42
160	60
200	46
240	37
280	55



The speed fluctuates with the distance.

APPLICATIONS *The chart at the right lists the winning times for the men's 110-meter hurdles at the state championships. Use the data to answer Exercises 3–6.*

Year	Time (seconds)
1994	13.6
1996	13.3
1998	13.24
2000	13.30
2002	13.20
2004	13.20
2006	12.98
2008	13.12

3. Construct a graph of the data.
See students' work.

4. Interpret the graph of the data.
The time generally tends to decrease with each successive state championship.

5. Why do you think the times do *not* always show a consistent pattern?
Many factors can affect the time, such as weather conditions, health of the competitor, and so on.

6. What would you predict the time for this event to be in the next state championship? Explain why you chose this time.
Answers may vary.

7. Suppose you are driving down a street that has many traffic lights. What do you think a graph of your time versus your speed would look like? Why? Sketch your graph.
Answers may vary.

SKILL 57

TEACHER NOTES

Adding and Subtracting Fractions

OBJECTIVE: Add and subtract fractions. (Strand: Number and Operation)

USING THE TRANSPARENCY: Use measuring cups and water to model addition and subtraction of unlike fractions, such $\frac{1}{2} + \frac{1}{4}$ and $\frac{3}{4} - \frac{1}{2}$. Have students explain the importance of renaming unlike fractions to add and subtract.

USING THE STUDENT WORKBOOK: Have pairs of students make and use drawings to model examples such as $12 - 3\frac{1}{4}$.

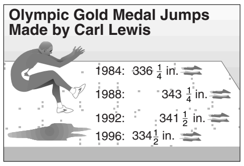
EXTENSION: Write $15\frac{23}{24}$ on the chalkboard, and tell students it is a sum. Ask students to write $15\frac{23}{24}$ as a sum of two mixed numbers.

Transparency, Skill 57

SKILL 57 WARM UP

Adding and Subtracting Fractions

Carl Lewis won three Olympic gold medals for the long jump. The length of these jumps are given at the right.



In 1984, Carl Lewis set the world indoor record for the long jump. This jump was $4\frac{3}{4}$ inches longer than his Olympic-winning jump in 1992. What is the length of his indoor record jump?

Add $341\frac{1}{2}$ and $4\frac{3}{4}$. To add or subtract fractions with unlike denominators, rename the fractions so that they have a common denominator.

$$\begin{array}{rcr} 341\frac{1}{2} & = & 341\frac{2}{4} \\ +\ 4\frac{3}{4} & = & +\ 4\frac{3}{4} \\ \hline & & 345\frac{5}{4} \text{ or } 346\frac{1}{4} \end{array}$$

The length of Carl Lewis' indoor record was $346\frac{1}{4}$ inches.

How much longer was the Olympic-winning long jump made by Carl Lewis in 1992 than the Olympic-winning long jump he made in 1984?

Subtract $336\frac{1}{4}$ from $341\frac{1}{2}$.

$$\begin{array}{rcr} 341\frac{1}{2} & = & 341\frac{2}{4} \\ -\ 336\frac{1}{4} & = & -\ 336\frac{1}{4} \\ \hline & & 5\frac{1}{4} \end{array}$$

The 1992 jump was $5\frac{1}{4}$ inches longer than the 1984 jump.

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Student Workbook, p. 113

SKILL 57 Name ______________________ Date __________

Adding and Subtracting Fractions

Lina is making trail mix for a hiking trip. She has $2\frac{1}{2}$ cups of peanuts, $3\frac{1}{4}$ cups of raisins, and $2\frac{2}{3}$ cups of carob chips.

EXAMPLE ***How many cups of trail mix will Lina have?***

$$\begin{array}{rcl} 2\frac{1}{2} & = & 2\frac{6}{12} \\ 3\frac{1}{4} & = & 3\frac{3}{12} \\ +\ 2\frac{2}{3} & = & +\ 2\frac{8}{12} \\ \hline & & 7\frac{17}{12} = 7 + \frac{12}{12} + \frac{5}{12} \\ & & \quad = 7 + 1 + \frac{5}{12} \\ & & \quad = 8 + \frac{5}{12} \\ & & \quad = 8\frac{5}{12} \end{array}$$

Lina will have $8\frac{5}{12}$ cups of trail mix.

If Lina wants 15 cups of trail mix, how many more cups of trail mix does she have to make?

$15 = 14 + 1 = 14 + \frac{12}{12} = 14\frac{12}{12}$

$$\begin{array}{rcr} 15 & = & 14\frac{12}{12} \\ -\ 8\frac{5}{12} & = & -\ 8\frac{5}{12} \\ \hline & & 6\frac{7}{12} \end{array}$$

She needs to make another $6\frac{7}{12}$ cups of trail mix.

EXERCISES ***Add or subtract. Write each answer in simplest form.***

1. $\frac{7}{12} + \frac{2}{12}$ **$\frac{3}{4}$**
2. $\frac{9}{10} - \frac{3}{10}$ **$\frac{3}{5}$**
3. $\frac{7}{9} + \frac{5}{9}$ **$1\frac{1}{3}$**

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Student Workbook, p. 114

4. $\frac{7}{16} - \frac{3}{16}$ **$\frac{1}{4}$**
5. $\frac{1}{6} + \frac{1}{2}$ **$\frac{2}{3}$**
6. $\frac{2}{3} - \frac{1}{2}$ **$\frac{1}{6}$**
7. $\frac{1}{4} + \frac{7}{8}$ **$1\frac{1}{8}$**
8. $\frac{9}{10} - \frac{3}{5}$ **$\frac{3}{10}$**
9. $\frac{4}{5} + \frac{1}{12}$ **$\frac{53}{60}$**
10. $\frac{11}{15} - \frac{1}{3}$ **$\frac{2}{5}$**
11. $\frac{1}{9} + \frac{1}{6}$ **$\frac{5}{18}$**
12. $\frac{1}{2} - \frac{7}{16}$ **$\frac{1}{16}$**
13. $\frac{3}{10} + \frac{4}{5}$ **$1\frac{1}{10}$**
14. $\frac{4}{5} - \frac{1}{6}$ **$\frac{19}{30}$**
15. $7\frac{1}{10} + 2\frac{1}{5}$ **$9\frac{3}{10}$**
16. $9\frac{1}{2} - 5\frac{1}{6}$ **$4\frac{1}{3}$**
17. $5\frac{3}{4} + 2\frac{5}{8}$ **$8\frac{3}{8}$**
18. $9\frac{3}{4} - 2\frac{1}{6}$ **$7\frac{7}{12}$**

APPLICATIONS

19. The route from Ramon's house to city hall and then to the school is $\frac{9}{10}$ mile. It is $\frac{3}{10}$ mile from city hall to the school. What is the distance from Ramon's house to city hall? **$\frac{3}{5}$ miles**
20. To make a salad, Henry used $\frac{3}{4}$ pound of Boston lettuce and $\frac{2}{3}$ pound of red lettuce. How much lettuce did he use? **$1\frac{5}{12}$ lb**
21. Donna has $10\frac{3}{4}$ yards of ribbon. She needs $3\frac{1}{2}$ yards of ribbon to make a bow. How much ribbon will she have after she makes the bow? **$7\frac{1}{4}$ yd**
22. Part of the daily diet of polar bears at the Bronx Zoo is $1\frac{1}{4}$ pounds of apples and a $1\frac{1}{2}$-pound mixture of oats and barley. What is the combined weight of these items? **$2\frac{3}{4}$ lb**
23. Ani has two chores to do on Saturday. She has to wash the car which will take her $\frac{3}{4}$ hour and rake the leaves which will take her $1\frac{1}{2}$ hours. How much time should she plan to spend on these chores? **$2\frac{1}{4}$ hr**
24. Mr. Vazquez wants to put a fence around his rectangular vegetable garden. If the garden is $18\frac{3}{4}$ feet long and $10\frac{1}{2}$ feet wide, how much fence will he need? **$58\frac{1}{2}$ feet**

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SKILL 58 TEACHER NOTES

Multiplying and Dividing Fractions

OBJECTIVE: Multiply and divide fractions. (Strand: Number and Operation)

USING THE TRANSPARENCY: Use transparency overlays to illustrate multiplication. For example, illustrate $\frac{2}{5} \times \frac{1}{2}$ by drawing a ectangle, shading $\frac{2}{5}$ of it, then using darker shading for $\frac{1}{2}$ of the shaded part.

USING THE STUDENT WORKBOOK: Illustrate division of fractions by drawing $\frac{3}{4}$ of a circle on the chalkboard. Ask students how many $\frac{1}{8}$ sections are in the drawing.

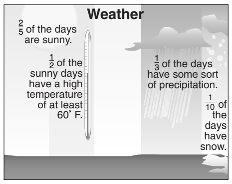
EXTENSION: Ask students to write a division problem that has a quotient of $\frac{4}{5}$.

Transparency, Skill 58

SKILL 58 WARM UP

Multiplying and Dividing Fractions

A meteorologist notices certain trends in the weather of her community. Her observations are recorded at the right.



What fraction of the days are both sunny and have a high temperature of 60°F or higher?

To find the fraction representing these days, multiply $\frac{2}{5}$ by $\frac{1}{2}$. To multiply fractions, multiply the numerators and multiply the denominators.

$\frac{2}{5} \times \frac{1}{2} = \frac{2 \times 1}{5 \times 2}$ *Multiply the numerators. Multiply the denominators.*

$= \frac{2}{10}$ or $\frac{1}{5}$ *Simplify.*

One fifth of the days are sunny and have a high temperature of at least 60°F.

What fraction of the days that have precipitation have snow?

To find the fraction representing these days, divide $\frac{1}{10}$ by $\frac{1}{3}$. To divide by a fraction, multiply by its reciprocal.

$\frac{1}{10} \div \frac{1}{3} = \frac{1}{10} \times \frac{3}{1}$ *Multiply by the reciprocal of $\frac{1}{3}$.*

$= \frac{1 \times 3}{10 \times 1}$ *Multiply the numerators. Multiply the denominators.*

$= \frac{3}{10}$

Three tenths of the days that have precipitation have snow.

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Multiplying and Dividing Fractions

A new industrial park is being developed. The ABC Manufacturing Company owns a rectangular piece of property that is $\frac{2}{5}$ mile long and $\frac{1}{4}$ mile wide.

EXAMPLE ***What is the area of the property owned by the ABC Manufacturing Company?***

To find the area of a rectangle, you multiply the length by the width.

$\frac{2}{5} \times \frac{1}{4} = \frac{2 \times 1}{5 \times 4}$ *Multiply the numerators. Multiply the denominators.*

$= \frac{2}{20}$ or $\frac{1}{10}$ *Simplify.*

The ABC Manufacturing Company owns $\frac{1}{10}$ square mile of land.

The A to Z Distribution Company owns $\frac{1}{8}$ square mile of land in the industrial park. If the land is in the shape of a rectangle and the length of the land is $\frac{1}{3}$ mile, what is the width of their land?

To find the width, divide the area of the rectangle by the length.

$\frac{1}{8} \div \frac{1}{3} = \frac{1}{8} \times \frac{3}{1}$ *Multiply by the reciprocal of $\frac{1}{3}$.*

$= \frac{1 \times 3}{8 \times 1}$ *Multiply the numerators. Multiply the denominators.*

$= \frac{3}{8}$

The width of the land owned by A to Z Distributing Company is $\frac{3}{8}$ mile.

EXERCISES ***Multiply or divide. Write each answer in simplest form.***

1. $\frac{2}{3} \times \frac{1}{4}$ **$\frac{1}{6}$**
2. $\frac{1}{4} \div \frac{2}{5}$ **$\frac{5}{8}$**
3. $\frac{3}{7} \times \frac{1}{2}$ **$\frac{3}{14}$**

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4. $\frac{5}{8} \div \frac{4}{5}$ **$\frac{25}{32}$**
5. $\frac{1}{3} \times \frac{3}{5}$ **$\frac{1}{5}$**
6. $\frac{2}{9} \div \frac{3}{5}$ **$\frac{10}{27}$**
7. $\frac{1}{2} \times \frac{6}{7}$ **$\frac{3}{7}$**
8. $\frac{2}{5} \div \frac{2}{3}$ **$\frac{3}{5}$**
9. $\frac{3}{8} \div \frac{1}{6}$ **$\frac{1}{16}$**
10. $\frac{1}{3} \div \frac{2}{5}$ **$\frac{5}{6}$**
11. $\frac{7}{10} \times \frac{5}{7}$ **$\frac{1}{2}$**
12. $\frac{2}{3} \div \frac{1}{2}$ **$\frac{4}{3}$ or $1\frac{1}{3}$**
13. $\frac{2}{3} \times \frac{5}{6}$ **$\frac{5}{9}$**
14. $\frac{3}{5} \div \frac{3}{10}$ **2**
15. $\frac{3}{4} \times \frac{1}{3}$ **$\frac{1}{4}$**
16. $\frac{1}{9} \div \frac{5}{6}$ **$\frac{2}{15}$**
17. $\frac{2}{3} \times \frac{5}{7}$ **$\frac{10}{21}$**
18. $\frac{1}{4} \div \frac{1}{2}$ **3**
19. $\frac{4}{7} \times \frac{5}{9}$ **$\frac{20}{63}$**
20. $\frac{1}{2} \div \frac{7}{8}$ **$\frac{4}{7}$**
21. $\frac{2}{3} \times \frac{2}{3}$ **$\frac{4}{9}$**

APPLICATIONS

22. About $\frac{1}{8}$ of the world's population lives in Africa. About $\frac{1}{13}$ of the population of Africa lives in Ethiopia. About what fraction of the world's population lives in Ethiopia? **about $\frac{1}{104}$**
23. About $\frac{1}{20}$ of the world's water supply is fresh water. If about $\frac{5}{7}$ of Earth's surface is covered with water, about what fraction of Earth is covered with fresh water? **about $\frac{4}{28}$**
24. Two thirds of Esma's garden is planted in flowers. If $\frac{1}{4}$ of the flowers are gladiolas, what fraction of the garden is planted in gladiolas? **$\frac{1}{6}$**
25. One eighth of Jonas' garden is planted in green beans. If $\frac{3}{4}$ of his garden is planted in vegetables, what fraction of the vegetable garden is planted in green beans? **$\frac{1}{6}$**
26. Three fourths of the books sold at Bernie's Book Store are paperbacks. If $\frac{1}{3}$ of the paperbacks sold are adventure stories, what fraction of the books sold are paperback adventure books? **$\frac{1}{4}$**
27. A honeybee can produce $\frac{1}{10}$ pound of honey in its lifetime. How many honeybees does it take to make $\frac{1}{2}$ pound of honey? **5 honeybees**

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SKILL 59

TEACHER NOTES

Algebraic Fractions

OBJECTIVE: Simplify algebraic fractions using addition and subtraction. (Strand: Algebra)

USING THE TRANSPARENCY: Help students identify situations where having more people work on a project decreases the total time spent. See if they can identify situations where the time is increased by the number of people involved.

USING THE STUDENT WORKBOOK: Have students discuss which strategy they feel most comfortable using. See if students have another strategy for simplifying the algebraic fractions.

EXTENSION: Create index cards that have portions of algebraic fractions for students to use in creating fractions to simplify.

Transparency, Skill 59

SKILL 59 WARM UP

Algebraic Fractions

Patrick and his sister Chloe are helping paint a fence. Patrick can paint 10 fence panels in x minutes. It takes Chloe 10 minutes longer to paint 10 fence panels. How many do they paint together per minute?

Patrick paints $\frac{10}{x}$ in 1 minute.

Chloe paints $\frac{10}{(x + 10)}$ in 1 minute.

Adding the fractions together, you get the following.

$$\frac{10}{x} + \frac{10}{(x + 10)}$$

$$\frac{10(x + 10)}{x(x + 10)} + \frac{10(x)}{(x + 10)x}$$

$$\frac{(10(x + 10) + 10x)}{x(x + 10)}$$

So, $\frac{(20x + 100)}{x(x + 10)}$ represents their combined rate for painting the fence.

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SKILL 59 Name ________________ Date ________

Algebraic Fractions

EXAMPLE ***Find the sum of*** $\frac{3}{(x + 1)} + \frac{4}{(2x + 2)}$.

To add two algebraic fractions, convert them into fractions with a common denominator. Here are two strategies you could use to find a common denominator.

Strategy 1 Multiply the two denominators together and use that expression for the new denominator. This strategy will always work, but you may have do extra work when you simplify the fraction.

The new denominator is $(x + 1)(2x + 2)$.

$$\frac{3}{(x + 1)} \times \frac{(2x + 2)}{(2x + 2)} = \frac{3(2x + 2)}{(x + 1)(2x + 2)}$$

$$\frac{4}{(2x + 2)} \times \frac{(x + 1)}{(x + 1)} = \frac{4(x + 1)}{(2x + 2)(x + 1)}$$

So, $\frac{3}{(x + 1)} + \frac{4}{(2x + 2)}$ can be rewritten as $\frac{3(2x + 2)}{(x + 1)(2x + 2)} + \frac{4(x + 1)}{(2x + 2)(x + 1)}$.

Now that the two fractions have common denominators, you can add them and simplify the result.

$$\begin{aligned}\frac{3(2x + 2)}{(x + 1)(2x + 2)} + \frac{4(x + 1)}{(2x + 2)(x + 1)} &= \frac{3(2x + 2) + 4(x + 1)}{(x + 1)(2x + 2)} \\ &= \frac{6x + 6 + 4x + 4}{(x + 1)(2x + 2)} \\ &= \frac{10x + 10}{(x + 1)(2x + 2)} \\ &= \frac{10(x + 1)}{(x + 1)(2x + 2)} \\ &= \frac{10}{(2x + 2)} \\ &= \frac{5}{(x + 1)}\end{aligned}$$

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EXAMPLE **Strategy 2** Simplify one or both fractions until they have the same denominator. This strategy only works for fractions whose denominators share a common factor, and which can be simplified to get rid of the other factors in the denominator.

$$\frac{4}{(2x + 2)} = \frac{2 \cdot 2}{2(x + 1)} = \frac{2}{(x + 1)}$$

Now both fractions have the same denominator, $(x + 1)$. Add the fractions and simplify.

$$\frac{3}{(x + 1)} + \frac{2}{(x + 1)} = \frac{5}{(x + 1)}$$

These strategies also work for subtracting one algebraic fraction from another.

EXERCISES ***Find each sum or difference. Simplify your answer as much as possible.***

1. $\frac{1}{g} + \frac{3}{2g}$ $\boldsymbol{\frac{5}{2g}}$
2. $\frac{1}{(d + 2)} + \frac{9}{(3d + 6)}$ $\boldsymbol{\frac{4}{(d + 2)}}$
3. $\frac{x}{(x - 3)} - \frac{5}{(4x - 12)}$ $\boldsymbol{\frac{(4x - 5)}{4(x - 3)}}$
4. $\frac{m}{(m + 1)} + \frac{p}{(p + 1)}$ $\boldsymbol{\frac{(m + 2mp + p)}{(m + 1)(p + 1)}}$
5. $\frac{x}{(y + 1)} - \frac{y}{(x - 1)}$ $\boldsymbol{\frac{(x^2 - x - y^2 - y)}{(y + 1)(x - 1)}}$
6. $\frac{2}{(x^2 - 1)} - \frac{3}{(x + 1)}$ $\boldsymbol{\frac{(-3x^2 + 2x + 5)}{(x^2 - 1)(x + 1)}}$

APPLICATIONS ***Nikhil and Teresa are addressing newsletters to mail to the parents of all the students in the school. Nikhil can address 100 envelopes in x minutes. Teresa is a little faster so it takes her 1 minute less to address 100 envelopes than it takes Nikhil.***

7. Write an expression for the number of envelopes Nikhil can address in 1 minute. $\boldsymbol{\frac{100}{x}}$
8. Write an expression for the number of envelopes Teresa can address in 1 minute. $\boldsymbol{\frac{100}{(x - 1)}}$
9. Write an algebraic fraction to represent the number of envelopes can Teresa and Nikhil address in 1 minute, working together.

$$\boldsymbol{\frac{100}{x} + \frac{100}{(x - 1)} = 200x - \frac{100}{x(x - 1)}}$$

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