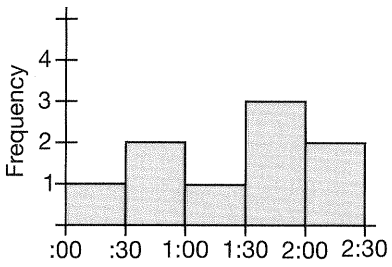
Suppose we want to know about how much time the students in your grade spend doing homework each day. We may select a sample of students, then ask them to record how much time they spent doing homework that day. Sample data for nine responses are shown below.

Time Spent on Homework

1 hr, 10 min	2 hr, 5 min	20 min
55 min	30 min	1 hr, 40 min
1 hr, 30 min	1 hr, 45 min	2 hr

We could then display this data in a **histogram.** A histogram displays quantitative data in adjacent intervals, represented by bars that touch. We show an example for the homework sample data. We sort the data into 30 minute intervals.

Time	Tally	Frequency
:00–:29	I	1
:30–:59	II	2
1:00–1:29	I	1
1:30–1:59	III	3
2:00–2:29	II	2



Thinking Skill

Discuss

Why would a bar graph *not* represent the data well?

5. A movie theater collected data on the ages of customers attending a new movie. The ages are listed below. Create a frequency table for the data by setting intervals and tallying the numbers for each interval. Then create a histogram to display the data.

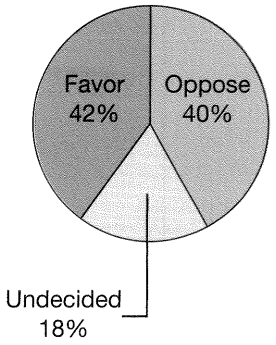
7	8	8	9	9	9	10	10	11	12
12	12	13	14	15	16	16	17	18	20
23	28	32	33	34	34	35	37	40	41
48	51	53	57	58	62	68	70	72	75

Discuss How does changing the interval affect the display?

Another kind of survey that is often conducted is an **opinion survey.** Sample results of an opinion survey are shown below.

"Do You Favor or Oppose Ballot Measure A?"

Response	Number	%
Favor	546	42
Oppose	520	40
Undecided	234	18



The data are summarized and displayed in a **circle graph.** A circle graph is often used to display qualitative data and is particularly useful to illustrate the relative sizes of parts of a whole. The central angle of a sector is computed by multiplying the fraction or percent of responders by 360°.

6. Conduct a closed-option opinion survey in your class, tally the results, and display the data in a circle graph.

Visit www.SaxonPublishers.com/ActivitiesC3 for a graphing calculator activity.

7. One hundred eighth graders were surveyed and asked what extra-curricular activities they planned to be involved with in high school. The students were given several choices and could select as many as they wanted. The results are shown below.

music	𝍸 𝍸 𝍸 𝍸 𝍸 ||
sports	𝍸 𝍸 𝍸 𝍸 |
service clubs	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 |||
student government	𝍸 𝍸 𝍸
other	𝍸 𝍸 |||

Choose a type of graph (bar graph, histogram, or circle graph) for representing these data, and explain your choice. Then graph the data.

LESSON 61

Sequences

Power Up

Building Power

facts

Power Up M

mental math

a. **Percent:** 10% of $90

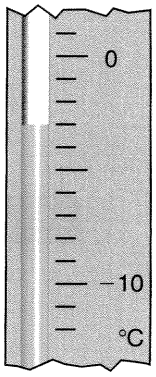
b. **Algebra:** Evaluate: $a^2 - b^2$ when a is 5 and b is 4.

c. **Estimation:** $5 \times \$0.97 + \$9.97$

d. **Fractional Parts:** $\frac{3}{4}$ of 240

e. **Rate:** Thirty minutes per day is how many hours per week?

f. **Measurement:** What temperature is indicated on this thermometer?



g. **Select a Method:** To find the number of minutes in 3 hours, which would you use?

A mental math
B pencil and paper
C calculator

h. **Calculation:** 400 ÷ 2, ÷ 2, ÷ 2, ÷ 2, ÷ 5, ÷ 5, ÷ 5

problem solving

Which of the following is the greatest?

A $(-95) + (-35) + (-5) + (5) + (35) + (95)$

B $(-95)^2 + (-35)^2 + (-5)^2 + (5)^2 + (35)^2 + (95)^2$

C $(-95)^3 + (-35)^3 + (-5)^3 + (5)^3 + (35)^3 + (95)^3$

New Concept

Increasing Knowledge

A **sequence** is an ordered list of numbers, called **terms,** that follow a certain pattern or rule.

3, 6, 9, 12, ...

The first four terms are given. To find more terms in the sequence, we study the sequence to understand its pattern or rule, then we apply the rule to find additional terms.

Reading Math

Recall that the three dots is called an ***ellipsis.*** The ellipsis indicates that the sequence continues without end.

Example 1

Describe the pattern in this sequence, and then find the next three terms.

3, 6, 9, 12, ...

Solution

We see that the first term is 3 and each succeeding term is 3 more than the previous term.

$$\overset{+3\ +3\ +3\ \ +3\ \ +3\ \ +3}{3,\ 6,\ 9,\ 12,\ \mathbf{15,\ 18,\ 21}}$$

This sequence is an example of an **arithmetic sequence.** An arithmetic sequence has a **constant difference** between terms. By subtracting consecutive terms we find the constant difference.

$$\begin{array}{rrr} 6 & 9 & 12 \\ -3 & -6 & -9 \\ \hline 3 & 3 & 3 \end{array} \quad \text{and so on}$$

Example 2

Describe the pattern in this sequence, and then find the next three terms.

1, 3, 9, 27, ...

Solution

Each term is three times the preceding term. To find the next term we multiply 27 by 3, then that term by 3, and so on.

$$\overset{\times3\ \times3\ \times3\ \ \times3\ \ \times3\ \ \times3}{1,\ 3,\ 9,\ 27,\ \mathbf{81,\ 243,\ 729}}$$

The sequence in example 2 is a **geometric sequence.** A geometric sequence has a **constant ratio** between terms. By dividing consecutive terms we find the constant ratio.

$$\frac{3}{1} = 3 \qquad \frac{9}{3} = 3 \qquad \frac{27}{9} = 3 \qquad \text{and so on}$$

The terms of a numerical sequence have a **position** and a **value.** The position of the term, such as 1st, 2nd, 3rd, etc., is often called the number of the term. The number of the term is found by counting and may be abbreviated with the letter *n.* The value of the term, which is the actual number that appears in the sequence, may be abbreviated with the letter *a.*

Number of Term (*n*)	1	2	3	4	5
Value of Term (*a*)	3	6	9	12	15

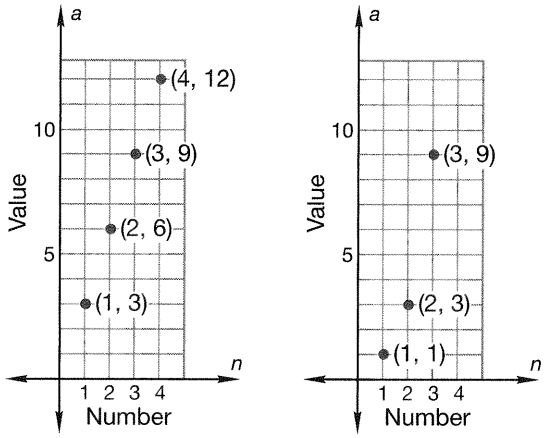
If we know the numbers and values of several terms of a sequence, we can visually represent the sequence as a graph.

Arithmetic Sequence

n	1	2	3	4
a	3	6	9	12

Geometric Sequence

n	1	2	3	4
a	1	3	9	27



Notice that the graphed points are aligned for the arithmetic sequence. Visually we could easily predict the value of the next term or terms. The graphed points are not aligned for the geometric sequence. Instead the distance from the *x*-axis to the point triples from term to term. We could not plot the 4th term, 27, on the graph because it far exceeded the scale of the graph.

We may describe the rule of a function using words or using a formula. A formula relates the value of a term (*a*) with its number (*n*). Studying a sequence table can help us find a formula.

Example 3

Write a formula that describes this sequence.

3, 6, 9, 12, . . .

Solution

First we make a table that shows the number and the value of the terms.

Number (*n*)	1	2	3	4
Value (*a*)	3	6	9	12

Studying the table we see that the value (*a*) is three times the number (*n*). We write this formula.

$$a_n = 3n$$

The little *n* after the *a* is called a **subscript.** The expression a_n means *the value of the nth term.* (It does not mean that *a* and *n* are multiplied.) On the right side of the formula we see that the constant difference, 3, is multiplied

by *n*. The formula tells us that to find the *n*th term of the sequence, multiply *n* by 3. For example, the tenth term of the sequence is $3 \cdot 10$, which is 30. Using the formula, it looks like this:

$$a_{10} = 3(10)$$

$$a_{10} = 30$$

Example 4

Write a formula that describes this sequence.

1, 3, 9, 27, ...

Solution

First we make a table.

n	1	2	3	4
a	1	3	9	27

The rule of this sequence involves a constant ratio, 3, as the base, and an exponent related to the number of the term. We try $a_n = 3^n$

$$3^1 = 3 \qquad 3^2 = 9 \qquad 3^3 = 27$$

We see that these terms are one place out of position, so we modify the formula and try again.

$$\boldsymbol{a_n = 3^{(n-1)}}$$

$$a_1 = 3^{1-1} = 3^0 = 1$$

$$a_2 = 3^{2-1} = 3^1 = 3$$

$$a_3 = 3^{3-1} = 3^2 = 9$$

$$a_4 = 3^{4-1} = 3^3 = 27$$

Practice Set

Describe each sequence as arithmetic, geometric, or neither.

a. 1, 2, 4, 8, 16, ...

b. 2, 4, 6, 8, 10, ...

c. 1, 4, 9, 16, 25, ...

d. What is the constant difference in this sequence?

1, 5, 9, 13, ...

e. What is the constant ratio in this sequence?

5, 25, 125, 625, ...

Write the first four terms of the sequence described by each formula.

f. $a_n = 2n$

g. $a_n = 2^n$

Written Practice *Strengthening Concepts*

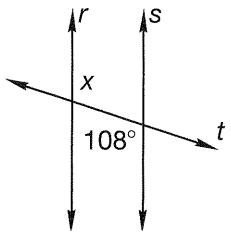
1. (45) A shoe company makes 7 pairs of white shoes for every 4 pairs of black shoes. If it makes 121,000 pairs of white shoes and black shoes combined, how many pairs are white?

2. (3, 4) When Karen serves jury duty, she will receive $15 each day for the first three days she serves. After three days, she will receive $24 each day she serves. How much will Karen receive if she serves for 10 days?

3. (3, 4) A truck rental costs Arturo $89 for the weekend, plus $1.30 per mile it is driven. How much would Arturo have to pay for the rental if he drives 60 miles?

4. (7) Find the mean, median, and mode of these temperatures: 56, 50, 56, 63, 75.

5. (54) Transversal t intersects parallel lines r and s. Find m $\angle x$.

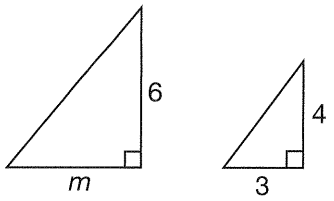


*** 6.** (41) ***Explain*** How can you decide if the point $(-4, -1)$ is on the graph of the equation $y = \frac{3}{4}x + 2$ without graphing the equation?

7. (43) Kataya wants to paint the outside of her house. The perimeter of the house is 160 feet and the height is nine feet. To know how much paint to buy she needs to calculate the surface area. What is the actual surface area of the house?

8. (39, 40) Kurt traces a 6-inch salad plate onto his paper. Find the **a** area and **b** circumference of Kurt's circle. Use $\pi = 3.14$.

9. (35) These triangles are similar. Find the scale factor from the smaller to larger triangle and solve for m.



Analyze Solve.

*** 10.** (50) $0.4x + 1.3 = 1.5$

*** 11.** (50) $0.002x + 0.03 = 0.92$

*** 12.** (50) $3x + 8 - x = 20$

*** 13.** (50) $2(x + 3) = 16$

14. (38) $\frac{2}{5}x = \frac{2}{3}$

15. (38) $\frac{x}{4} = 1.25$

*** 16.** (7) ***Formulate*** Suppose that a mountain grows at a rate of 10 inches in 4 years. Express the growth as a unit rate.

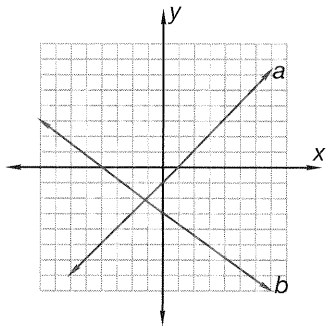
* **17.** (52) A window that is 54 inches wide is how many feet wide? Use a unit multiplier.

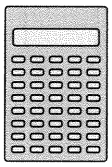
18. (31) Combine like terms: $x + 1 + x^2 + 4x + 4$

19. (12) **a.** Write $\frac{17}{100}$ as a decimal and as a percent.

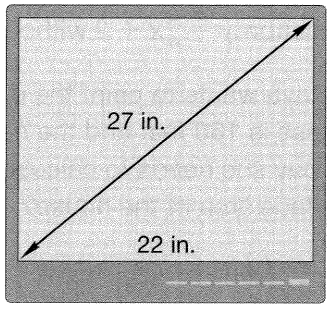
b. Select one of these three forms and use it in the following sentence replacing the underlined words. Seventeen out of 100 customers registered for the discount card.

* **20.** (56) ***Represent*** Write the equation of each line in slope-intercept form.





21. (Inv. 2) The advertised size of a television screen is the length of its diagonal measure. For example, a "27-inch" screen might be only 22 inches wide. If so, what would be its height to the nearest inch?



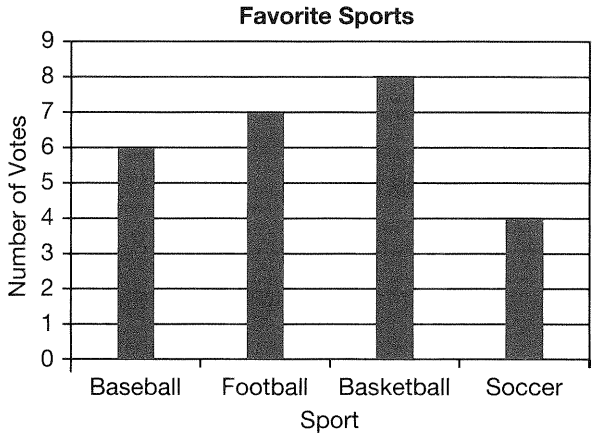
Simplify.

22. (33, 51) $(-3) - |-3| - 3^{-1}$

23. (27) $\frac{t^2u^2r}{rut^3}$

24. (24, 25) $\frac{3.6 - 0.36}{0.03}$

25. *(Inv. 6)* The favorite professional sports of 25 students are shown in the graph below.



Which set of data matches the information in the graph?

A

Sport	Number of Votes
Baseball	𝍸
Football	𝍸 II
Basketball	𝍸 IIII
Soccer	𝍸

B

Sport	Number of Votes
Baseball	IIII
Football	𝍸 IIII
Basketball	𝍸 I
Soccer	𝍸 III

C

Sport	Number of Votes
Baseball	𝍸 I
Football	𝍸 III
Basketball	IIII IIII
Soccer	𝍸

D

Sport	Number of Votes
Baseball	𝍸 I
Football	𝍸 II
Basketball	𝍸 III
Soccer	IIII

LESSON

62

Graphing Solutions to Inequalities on a Number Line

Power Up

Building Power

facts

Power Up M

mental math

a. **Powers/Roots:** $x^4 \cdot x^3$

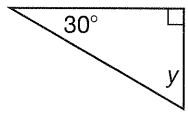
b. **Algebra:** Evaluate: $5^2 - 4(a)(2)$ when $a = 2$

c. **Number Sense:** Compare $\frac{1}{4} + \frac{3}{4} \bigcirc \frac{1}{4} \times \frac{3}{4}$

d. **Proportions:** The ratio of boys to girls is 10 to 11. If there are 55 girls, how many boys are there?

e. **Probability:** If a number cube is rolled, what is the probability of rolling a prime number?

f. **Geometry:** What is the value of *y*?



g. **Measurement:** How many inches are in one yard? Two yards?

h. **Calculation:** $13 \times 2, + 2, \div 2, \div 2, + 2, \div 3, \div 3, \div 3$

problem solving

Jaime knows that 30^2 is 900. He wonders if knowing 30^2 can help him find 29×31. Raquel knows what 25^2 equals. How can she use that knowledge to find 24×26?

New Concept

Increasing Knowledge

Tom is thinking of a number between 1 and 10. Of what possible numbers could he be thinking?

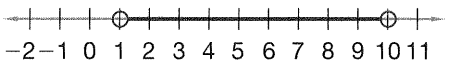
We might assume that Tom is thinking of a counting number greater than 1 and less than 10, such as 3, 6 or 7. However, Tom could be thinking of $2\frac{1}{2}$ or π or $\sqrt{20}$, because each of these numbers is also between 1 and 10.

We can write an **inequality** to indicate the range of possible numbers. Letting *x* represent a possible number, we write

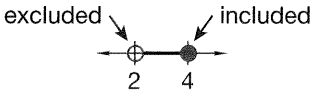
$$1 < x < 10$$

We read this inequality in both directions from *x*, "*x* is greater than 1 and less than 10." Notice that both the description and the inequality exclude 1 and 10.

We can use a number line to graph the possible numbers of which Tom could be thinking.



The shaded portion of the number line represents the range of choices for Tom's number. The word *between* suggests that Tom's number is greater than 1 and less than 10, so the small circles at 1 and 10 indicate that those numbers are excluded from the choices. To show that those numbers are included we make a shaded dot.



"Greater than 2 and less than or equal to 4"

Example 1

Christina is thinking of a number. If she doubles the number, the product is greater than 4. Write an inequality for this description. Graph on a number line all the possible choices for Christina's number.

Solution

If we let x represent Christina's number, then the description of the number can be represented by this inequality.

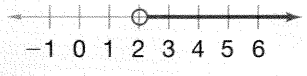
$$2x > 4$$

"Twice the number is greater than four."

We can solve this inequality like we solve an equation.

Step:	Justification:	Visual Representation:
$2x > 4$	Given inequality	$\boxed{x}\boxed{x} > \square\square\square\square$
$\frac{2x}{2} > \frac{4}{2}$	Divided both sides by 2	$\boxed{x}\ \boxed{x} > \square\square\ \square\square$
$\boldsymbol{x > 2}$	Simplified	$\boxed{x} > \square\square$

Christina's number is greater than 2. We are asked to graph all possible choices on a number line.



The circle at 2 indicates that the possible choices do not include 2. The shaded number line is a graph of the possible choices. The shaded arrowhead shows that the graphed choices continue without end.

Christina's possible choices are called the solution set. We can test our answer by selecting a number from the solution set and another number not in the solution set and decide if they satisfy the conditions of the problem. We pick 3, which is on the shaded part of the line, and 1, which is on the unshaded part.

- If Christina doubles 3, the answer is 6, which is greater than 4, so 3 is a number in the solution set.

- If Christina doubles 1, the answer is 2, which is not greater than 4, so 1 is not a number in the solution set.

These two tests support our answer.

Example 2

Solve and graph the solution to this inequality: $3x + 1 \leq 7$

Solution

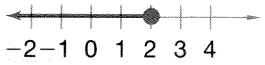
We may solve inequalities as we solve equations. (We will learn an exception in a later lesson.)

Thinking Skill

Explain

Why is the first step to subtract 1 from each side of the inequality?

Step:	Justification:	Visual Representation:
$3x + 1 \leq 7$	Given inequality	[x][x][x]□ ≤ □□□□□□□
$3x \leq 6$	Subtracted 1 from each side	[x][x][x] ≤ □□□□□□
$\frac{3x}{3} \leq \frac{6}{3}$	Divided each side by 3	[x] [x] [x] ≤ □□ □□ □□
$x \leq 2$	Simplified	[x] ≤ □□



We test selected numbers in the original inequality. We select 1, which is in the solution set, and 3, which is not.

Step: (try $x = 1$)	**Justification:**	**Step:** (try $x = 3$)
$3(1) + 1 \leq 7$	Substituted	$3(3) + 1 \leq 7$
$4 \leq 7$ (true)	Simplified	$10 \leq 7$ (false)
1 is a solution		3 is not a solution

Explain Why do we choose a number that is in the solution set and one that is not when testing our solution?

When applying inequalities to situations in the real world, we might be limited to positive numbers or whole numbers, as we see in the following example.

Example 3

Vincent goes to the store with $20 to buy a notebook for $4. He notices that packages of notebook paper are on sale for $2. Write and solve an inequality to show the number of packages of notebook paper he could buy if he also buys the notebook (ignoring sales tax). Then graph the solution.

Solution

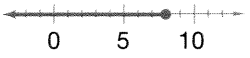
The number of packages of paper (p) Vincent could buy if he buys the notebooks is

$$2p + 4 \leq 20$$

We solve the inequality.

Step:	Justification:
$2p \leq 16$	Subtracted 4 from both sides
$p \leq 8$	Divided both sides by 2.

If we were to graph this inequality for real numbers, the graph would be



However, Vincent cannot buy a fraction of a package or a negative number of packages. He can buy none, or he can buy 1, 2, 3 or up to 8 packages of paper.

Example 4

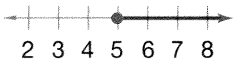
Solve and graph the solution: $3 \leq x - 2$

Solution

We isolate x by adding 2 to both sides.

Step:	Justification:
$3 \leq x - 2$	Given inequality
$5 \leq x$	Added 2 to both sides

We may read the inequality from right to left, "x is greater than or equal to 5." Alternately, we may reverse the position of x and 5 provided we reverse the direction of the inequality symbol to $x \geq 5$. (If 5 is less than or equal to x, then x is greater than or equal to 5.)



We test selected numbers in the original inequality. We select 6, which is a solution, and 4, which is not.

Step (try $x = 6$):	Justification:	Step (try $x = 4$).
$3 \leq (6) - 2$	Substituted	$3 \leq (4) - 2$
$3 \leq 4$ (true)	Simplified	$3 \leq 2$ (false)
6 is a solution		4 is not a solution

Justify Is 5 part of the solution? How do you know?

Practice Set

a. *Formulate* Alisha has a number in mind. If she adds three to her number the result is less than five. Use this information to write and solve an inequality about Alisha's number. Then graph the solution set.

Solve these inequalities and graph their solutions on number lines.

b. $4x > -12$

c. $6x + 1 \geq -5$

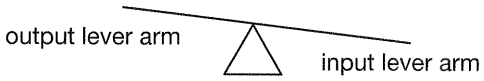
d. $2x - 5 \leq 3$

e. $7 \leq x - 8$

f. Jan is participating in a 6 mile run/walk for charity. If she completes the course and runs at least half the distance, then what inequality shows how far she might walk? Graph the inequality.

Written Practice *Strengthening Concepts*

1. (45) The ratio of the length of the input lever arm to the length of the output lever arm was 6 to 5. If the entire lever is 132 in. long, how long is the input lever arm?



*** 2.** (48) ***Analyze*** Eighty percent of the castles had been preserved. If there were 135 castles in all, how many had not been preserved?

3. (Inv. 4, 42)

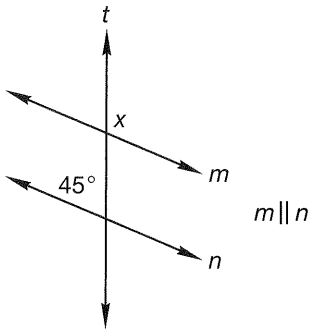
a. Sketch a cube that has a volume of 1 cm^3.

b. Sketch a cube with edges 2 cm long.

c. Find the volume of the larger cube. How many of the smaller cubes would fit in the larger?

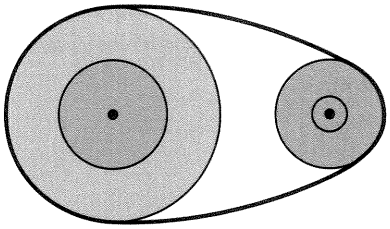
4. (7) Find the mean, median, and mode(s) of the distances in feet from home plate to the left-field fence at various ball parks: 303, 279, 297, 321, 310, 310, 301.

5. (54) Find x.



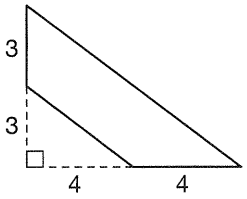
6. (41) Graph $y = 4x - 4$. Is point $(-2, -4)$ on the line?

7. (39) A belt is wrapped around two wheels. As the larger wheel turns it moves the belt which moves the smaller wheel. The diameter of the larger wheel is 6 in. and the diameter of the smaller wheel is 3 in. When the larger wheel turns once, how many times does the smaller wheel turn?



*** 8.** (Inv. 2, 37) *Classify* **a.** Find the area and perimeter of the figure. (Dimensions are in yds.)

b. What type of quadrilateral is the figure?



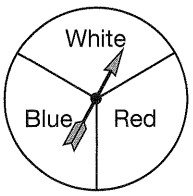
9. (7) World class male sprinters run 100 meters in about 10 seconds. Express this as a unit rate.

10. (52) Kilani bought a cell phone service plan that provides 300 minutes of phone use each month. Use a unit multiplier to convert 300 minutes to hours.

11. (32) This spinner is spun twice.

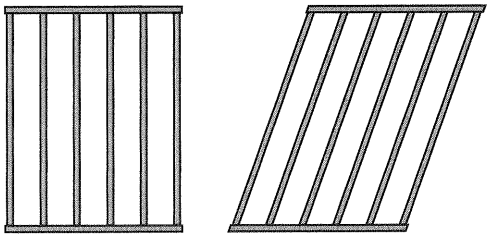
a. Find the sample space of the experiment.

b. What is the probability that the same color will be spun twice?

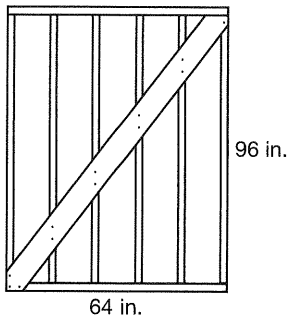


12. (12) Write 125% **a** as a decimal and **b** as a reduced fraction.

13. (Inv. 2) The walls of buildings are usually rectangles, but rectangular structures are not stable. They shift easily.



Triangles, however, are stable. So engineers require triangles in buildings to increase the stability of the building. Just one diagonal brace greatly increases the stability of a wall. Conrad will use a board to brace the wall of a shed as shown. Is a 10-foot long board long enough? Justify your answer.



Generalize Simplify:

*** 14.** (31, 51) $(-1)^2 + (-1)^1 + (-1)^0 + (-1)^{-1}$

15. (27) $\frac{race}{car} + e$

16. (13, 22) $\left(\frac{2}{3}\right)^2 - \frac{1}{3} \div \frac{3}{4}$

17. (31, 36) $x(x + 2) - 2(x + 2)$

Analyze Solve.

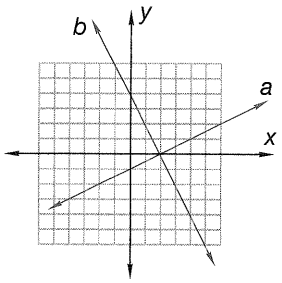
*** 18.** (50) $1.3x - 0.32 = 0.98$

*** 19.** (50) $0.001x + 0.09 = 1.1$

*** 20.** (50) $-4(2 + x) - 2(x + 3) = 4$

21. (38) $\frac{2}{7}x = \frac{3}{14}$

22. (56) Using slope-intercept form, write the equation of each line.



Graph each solution on a number line.

*** 23.** (62) $x + 2 < 6$

*** 24.** (62) $x + 5 \geq 3$

25. (Inv. 5) **a.** Square $ABCD$ has these vertices: $A(-2, 2)$, $B(2, 2)$, $C(2, -2)$ and $D(-2, -2)$. Use graph paper to draw square $ABCD$ and similar figure $A'B'C'D'$ using a scale factor of 4. (Assume that the origin is the center of both figures.)

b. What are the locations of the vertices of $A'B'C'D'$?

LESSON

63

• Rational Numbers, Non-Terminating Decimals, and Percents
• Fractions with Negative Exponents

Power Up

Building Power

facts

Power Up M

mental math

a. **Percent:** 30% of $80

b. **Statistics:** Find the mean of these numbers: 20, 40, 50, 30, 10

c. **Sequences:** Find the next three terms. 1, 2, 4, 8, ___, ___, ___, ...

d. **Fractional Parts:** $\frac{1}{9}$ of 7200

e. **Measurement:** The odometer read 438.1 miles before the trip. Now it reads 449.9 miles. How long was the trip?

f. **Proportion:** $\frac{2}{3} = \frac{8}{x}$

g. **Scientific Notation:** $(2.0 \times 10^5)(3.0 \times 10^6)$

h. **Calculation:** Square 10, − 1, ÷ 11, $\sqrt{\ }$, × 5, + 1, $\sqrt{\ }$, $\sqrt{\ }$

problem solving

Greg rode his bike up the 30 mile hill at 10 miles per hour. Then, he rode back down the hill at 30 miles per hour. How far did he go altogether? How long did it take him? What was his average speed?

New Concepts

Increasing Knowledge

rational numbers, non-terminating decimals, and percents

Recall that every rational number can be expressed as a ratio of two integers. Converting the ratio to a decimal number results in a decimal that terminates (ends) or does not terminate but has repeating digits.

Terminating: $\frac{1}{8} = 0.125$

Non-terminating but repeating: $\frac{1}{11} = 0.0909090909...$

Also recall that we can indicate repeating digits by writing a bar over the repetend.

$$\frac{1}{11} = 0.\overline{09}$$

We do not perform computations with a decimal number that has a bar over the repetend. Instead we use the fraction equivalent, or we round the decimal number to an appropriate number of decimal places.

Analyze Which produces a more exact product for multiplying by $0.\overline{09}$, multiplying by $\frac{1}{11}$ or by 0.0909?

Reading Math

Recall that the three dots (...) is called an **ellipsis.** It indicates that the pattern of repetition continues. An ellipsis may be used in place of a bar.

Example 1

Express $\frac{2}{3}$ as an equivalent decimal and percent. Then express $\frac{2}{3}$ as a decimal rounded to the thousandths place.

Solution

To express $\frac{2}{3}$ as a decimal we divide 2 by 3.

$$3\overline{)2.000}\quad 0.666\ldots$$

The decimal equivalent to $\frac{2}{3}$ is $\mathbf{0.\overline{6}}$.

To express $\frac{2}{3}$ as a percent, we multiply $\frac{2}{3}$ by 100%.

$$\frac{2}{3} \cdot 100\% = \frac{200\%}{3} = \mathbf{66\frac{2}{3}\%}$$

To express $\frac{2}{3}$ as a decimal rounded to the thousandths place, we write the number with four places and then round back to three places.

$$0.\overline{6} \approx 0.6666$$

$$\approx \mathbf{0.667}$$

Example 2

Express $16\frac{2}{3}\%$ as a reduced fraction and as a decimal.

Solution

A percent is the numerator of a fraction with a denominator of 100.

$$16\frac{2}{3}\% = \frac{16\frac{2}{3}}{100}$$

We perform the division that is indicated.

$$16\frac{2}{3} \div 100$$

$$\frac{50}{3} \times \frac{1}{100} = \mathbf{\frac{1}{6}}$$

One way to convert $16\frac{2}{3}\%$ to a decimal is to convert the equivalent fraction $\frac{1}{6}$ to a decimal.

$$16\frac{2}{3}\% = \frac{1}{6} = \mathbf{0.1\overline{6}}$$

The result is reasonable because removing the percent sign shifts the decimal point two places.

$$16\frac{2}{3}\% = 0.16\frac{2}{3}$$

Later in this book we will learn a method for converting decimals with a repetend to fractions and percents.

Example 3

Arrange these numbers in order from least to greatest.

$$\frac{4}{5},\ 83\frac{1}{3}\%,\ 0.83$$

Solution

To help us compare we will express each number as a decimal rounded to three decimal places.

$$\frac{4}{5} = 0.800$$

$$83\frac{1}{3}\% \approx 0.833$$

$$0.83 = 0.830$$

Now we write the numbers in order.

$$\frac{4}{5},\ 0.83,\ 83\frac{1}{3}\%$$

Example 4

The incumbent received $41\frac{2}{3}\%$ of the 1260 votes cast in the town council election. Describe how to estimate the number of votes the incumbent received. Then calculate the exact number of votes.

Solution

As an approximation we see that the incumbent received somewhat less than half the votes cast, so the number of votes is probably fewer than 600.

For a closer estimate we could find 40% of 1260. Since 10% of 1260 is 126, and since 40% is $4 \times 10\%$, we could multiply 4×125 to find that the total number of votes should be a little more than 500.

Since the percent includes a non-terminating fraction we choose to convert the percent to a fraction to perform the calculation.

$$41\frac{2}{3}\% = \frac{125}{300} = \frac{5}{12}$$

We translate the problem into an equation using $\frac{5}{12}$ in place of the percent.

The incumbent's votes (v) were $41\frac{2}{3}\%$ of the 1260 votes.

$$v = \frac{5}{\cancel{12}_{1}} \times \cancel{1260}^{105}$$

$$v = 525$$

The incumbent received **525 votes.**

fractions with negative exponents

Recall that a negative exponent indicates the reciprocal of the positive power of the base.

$$x^{-n} = \frac{1}{x^n} \qquad 3^{-2} = \frac{1}{3^2}$$

Also recall that with fractions we reverse the position of the numerator and the denominator to form the reciprocal.

$$\text{The reciprocal of } \frac{x}{y} \text{ is } \frac{y}{x}.$$

If the base of a negative exponent is a fraction, we make the exponent positive by replacing the fraction with its reciprocal.

$$\left(\frac{x}{y}\right)^{-n} = \left(\frac{y}{x}\right)^{n}$$

Example 5

Simplify: $\left(\frac{1}{3}\right)^{-2}$

Solution

We replace $\frac{1}{3}$ with its reciprocal, 3, and make the exponent positive. Then we apply the positive exponent.

$$\left(\frac{1}{3}\right)^{-2} = 3^2 = \mathbf{9}$$

Practice Set

Convert each fraction to a decimal and a percent. Then write the decimal rounded to the nearest thousandth.

a. $\frac{1}{3}$ **b.** $\frac{5}{6}$ **c.** $\frac{2}{11}$

Convert each percent to a fraction and a decimal. Then write the decimal rounded to the nearest hundredth.

d. $66\frac{2}{3}\%$ **e.** $8\frac{1}{3}\%$ **f.** $22\frac{2}{9}\%$

g. Arrange in order from least to greatest.

$$16\%, \frac{1}{6}, 0.165$$

h. The bill for the meal was \$24.00. Dario left a tip of $16\frac{2}{3}\%$. How much was the tip?

Simplify.

i. $\left(\frac{1}{2}\right)^{-3}$ **j.** $\left(\frac{1}{10}\right)^{-2}$ **k.** $\left(\frac{3}{2}\right)^{-1}$

Written Practice

Strengthening Concepts

1. *(4)* For the centerpieces at the party, four stems of flowers were to be placed in every vase. If there were 72 stems, how many vases could be filled?

2. *(48)* Sixty-five percent of the 1600 students wore school colors on school spirit day. How many students did not wear school colors?

3. *(3, 4)* Duke carried only dimes. Diana carried just nine nickels. Together they had \$1.95. How many dimes did Duke carry?

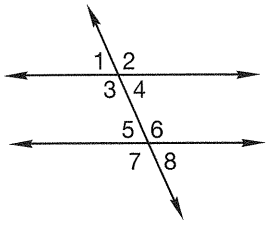
4. (53) The weights of the fish caught by a fisherman were in pounds:

1.7, 1.8, 3.0, 1.8, 3.5, 3.1, 3.3

a. Find the mean, median, mode, and range of the data.

b. Which measure of central tendency would the fisherman use to represent his fishing most favorably?

5. (54) Which angle corresponds to $\angle 3$?



6. (41) Graph $y = -\frac{2}{3}x + 1$. Is point $(-6, 4)$ a solution?

*** 7.** (63) *Formulate* **a.** Write $83\frac{1}{3}\%$ as a fraction and as a decimal.

b. Write the decimal rounded to the nearest hundredth.

*** 8.** (63) **a.** Write $\frac{4}{9}$ as a decimal and as a percent.

b. Then write $\frac{4}{9}$ as a decimal rounded to the nearest thousandth.

9. (32) Two red marbles (R_1 and R_2), one white marble (W), and one blue marble (B) are in a bag. Two marbles are selected.

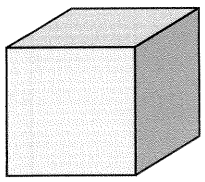
a. Find the sample space of the experiment.

b. What is the probability of selecting at least one red marble?

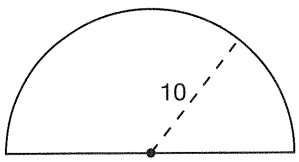
c. State the complement of this event and find its probability.

*** 10.** (Inv. 2) *Connect* If a rectangular computer screen is 17 inches wide and 12 inches high, then what is its diagonal measure to the nearest inch?

11. (43) Joyce's grandmother has a 4-inch cube with photos on each face. What is the surface area of the cube?



*** 12.** (39, 40) *Analyze* Jessica built a patio shaped like the figure at right. Find the **a** area and **b** perimeter of the patio. Use $\pi = 3.14$. (Units are in feet.)



13. (7) Express as a unit rate: 30 math problems in 30 minutes.

14. (52) Use a unit multiplier to convert 2460 inches to feet.

*** 15.** (21) Factor:

a. $7m^2 - 49$ **b.** $x^4 - 4x^3$

Simplify.

16. (51) $(-3)^2 - 3^2 - \left(\frac{1}{3}\right)^{-1}$

17. (27) $\frac{8cabs^2}{2bssa}$

18. (13, 23) $2\frac{1}{2} - 1\frac{1}{3} \cdot 1\frac{1}{4}$

19. (25) $\frac{(0.6)(0.3)}{9}$

Solve.

* **20.** (50) $0.02x + 0.1 = 1$

* **21.** (50) $1.2 + 0.2x = 0.8$

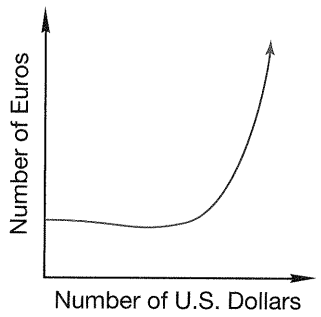
22. (38) $\frac{3}{5}x = 6$

23. (1, 14) $3|x| = 12$

24. (62) Solve and graph the solution on a number line: $x - 11 > -4$

25. (41) Identify the graph that best represents the relationship between the amount of Euros Simon received at an exchange rate of \$0.87 Euros for every U.S. dollar.

A



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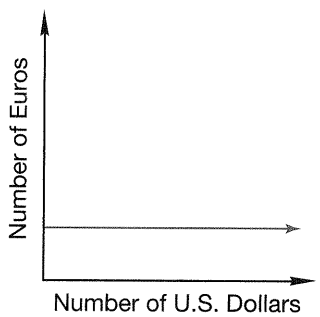

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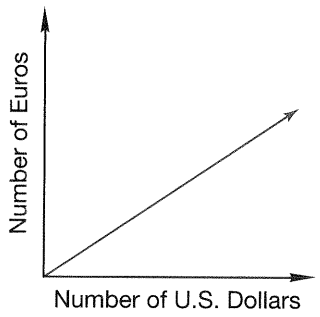

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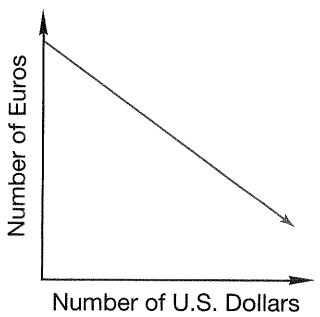


LESSON

64 • Using a Unit Multiplier to Convert a Rate

Power Up

Building Power

facts

Power Up M

mental math

a. **Algebra:** Evaluate: $7^2 - 4(1)(c)$ when $c = 12$

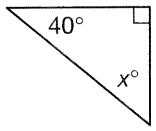
b. **Sequences:** Find the next three terms: 20, 15, 10, 5, ...

c. **Number Sense:** Compare $\frac{1}{2} + \frac{1}{2} \bigcirc \frac{1}{2} \times \frac{1}{2}$

d. **Powers/Roots:** $x \cdot x^4$

e. **Rate:** Rosie is reading an edition of *The Lord of the Rings* that is 1000 pages long. If she reads 50 pages per day, and Sam reads 40 pages per day, how much longer will it take Sam to read than Rosie?

f. **Geometry:** Find x.



g. **Measurement:** How many square feet is one square yard?

h. **Calculation:** $2 \times 2, \times 2, \times 2, \times 2, \times 2, \sqrt{\ }$

problem solving

If the water balloons are divided into 7 equal piles, there is one left over. If they are divided into 5 equal piles, there are two left over. If they are divided into 4 equal piles, there are two left over. If they are divided into 6 equal piles there are four left over. There are fewer than 70 water balloons. How many are there, exactly?

New Concept

Increasing Knowledge

Math Language
Recall that a **rate** is a ratio of two measures.

A rate, such as 60 miles per hour, can be written in fraction form.

$$\frac{60 \text{ miles}}{1 \text{ hour}}$$

We can use a unit multiplier to convert a rate to a different unit such as miles per minute. In this case, we would convert hours to minutes. Since 60 minutes equal 1 hour, we have these two unit multipliers available.

$$\frac{60 \text{ min}}{1 \text{ hour}} \quad \frac{1 \text{ hour}}{60 \text{ min}}$$

We choose the unit multiplier that cancels hours.

$$\underbrace{\frac{60 \text{ miles}}{\cancel{1 \text{ hour}}}}_{\text{Rate}} \cdot \underbrace{\frac{\cancel{1 \text{ hour}}}{60 \text{ min}}}_{\substack{\text{Unit} \\ \text{Multiplier}}} = \frac{60 \text{ miles}}{60 \text{ min}} = \frac{1 \text{ mile}}{1 \text{ min}}$$

So 60 miles per hour equals 1 mile per minute.

To convert rates to alternative units, we create a unit multiplier using the appropriate units. Then we multiply the rate by the appropriate unit multiplier to cancel the unit we want to eliminate and include the unit we want in the answer.

Example 1

Yasmine ran a mile in 6 minutes. Use a unit multiplier to find her average rate in miles per hour (mph).

Solution

We can express Yasmine's run as a rate.

$$\frac{1 \text{ mile}}{6 \text{ min}}$$

We are given miles over minutes; we are asked for miles over hours.

$$\frac{\text{mi}}{\text{min}} \times \left(\frac{\text{Unit}}{\text{Multiplier}}\right) = \frac{\text{mi}}{\text{hr}}$$

We need to convert from minutes below the division bar to hours. Sixty minutes equals one hour, so we have a choice of two unit multipliers.

$$\frac{60 \text{ min}}{1 \text{ hr}} \qquad \frac{1 \text{ hr}}{60 \text{ min}}$$

We choose the unit multiplier with minutes above the division bar so we can cancel minutes and replace minutes with hours.

$$\underbrace{\frac{1 \text{ mile}}{\cancel{6 \text{ min}}}}_{\text{Rate}} \cdot \underbrace{\frac{60 \cancel{\text{ min}}}{1 \text{ hr}}}_{\substack{\text{Unit} \\ \text{Multiplier}}} = \frac{60 \text{ mi}}{6 \text{ hr}} = \frac{10 \text{ mi}}{1 \text{ hr}}$$

We find that Yasmine's average rate was **10 mph.**

Thinking Skill

Conclude

What unit multiplier would we use if we wanted to convert miles per hour to miles per second?

Evaluate Determine the unit multipliers that would allow us to convert miles per hour to feet per hour. Then find Yasmine's average rate in feet per hour.

Example 2

Driving at 60 miles per hour, a car travels about how many kilometers in two hours? (1 mile is about 1.6 kilometers.)

Solution

One way to solve the problem is first to convert 60 miles per hour to kilometers per hour.

$$\frac{60 \text{ mi}}{1 \text{ hr}} \cdot \frac{1.6 \text{ km}}{1 \text{ mi}} = \frac{96 \text{ km}}{1 \text{ hr}}$$

We find the distance traveled in 2 hours by multiplying rate times time.

$$d = rt$$

$$d = \frac{96 \text{ km}}{1 \text{ hr}} \cdot 2 \text{ hr}$$

$$= 192 \text{ km}$$

The car travels **192 km.**

Practice Set

Analyze Use a unit multiplier to perform the following rate conversions.

a. 3 miles per minute to miles per hour

b. 880 yards in 2 minutes to feet per minute

c. 440 yards per minute to yards per second

d. 24 miles per gallon to miles per quart

e. Peter packed 32 pints of pickles in a minute. Find Peter's pickle packing rate in ounces per minute.

f. Shannon rode her bike 6 miles in 24 minutes. Find her average rate in miles per hour.

g. Find the average riding rate from **f** in kilometers per hour. Then find the number of kilometers Shannon could ride in 30 minutes at that rate.

Written Practice *Strengthening Concepts*

1. (4) Each tetherball game lasted about 3 minutes and then a new pair of students would start to play. If there are 45 min in recess, how many students will get to play ?

*** 2.** (48) *Analyze* Sixty percent of the students voted in the student elections. If there are 300 students, how many did not vote?

3. (3, 4) Kerry carried quarters. Doug carried nine dimes. Together they had $2.65. How many quarters did Kerry carry?

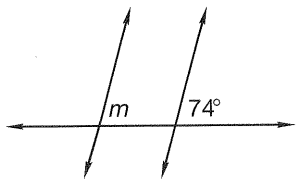
4. (53) The weights of the puppies at birth were:

16 oz, 18 oz, 17 oz, 10 oz, 15 oz, 13 oz, 16 oz

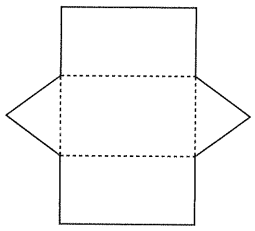
a. Find the mean, median, mode, and range of this data.

b. Which measure would you use to report the spread of the birth weights?

5. (54) Two of the lines are parallel. Find m.



*** 6.** *(Inv. 4)* The figure is a net for what geometric solid? Name and sketch the solid.



7. *(41)* Use the slope-intercept method to graph $y = 3x - 5$. Is $(3, -1)$ a solution?

*** 8.** *(32)* ***Evaluate*** A coin is tossed and a number cube is rolled.

a. What is the sample space of the experiment?

b. What is the probability of heads and a number greater than three?

*** 9.** *(64)* Use a unit multiplier to convert 1200 feet per minute to feet per second.

*** 10.** *(64)* Use a unit multiplier to convert 0.3 tons per day to pounds per day.

*** 11.** *(42, 43)* ***Represent*** **a.** Sketch a rectangular prism with dimensions 2 cm by 3 cm by 4 cm.

b. What is the volume?

c. What is the surface area?

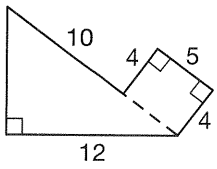
*** 12.** *(63)* **a.** Write $77\frac{7}{9}\%$ as a reduced fraction and decimal.

b. Then round the decimal to the nearest thousandth.

*** 13.** *(27, 63)* ***Generalize*** Simplify: $\left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^1 + \left(\frac{1}{2}\right)^0 + \left(\frac{1}{2}\right)^{-1}$

*** 14.** *(39, 40)* ***Analyze*** The diameter of a cylindrical soup can is 7 cm. Find **a** the circumference and **b** the area of the top of the can. Use $\frac{22}{7}$ for π.

15. *(Inv. 2, 37)* Find the **a** area and **b** perimeter of the figure at right. Dimensions are in feet.



16. *(21)* Factor:

a. $-3x + 27$

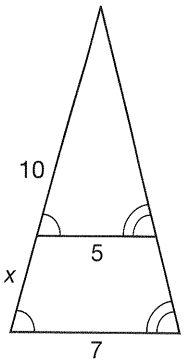
b. $10x - 100$

17. *(35)* Sketch the triangles separately.

a. State how you know they are similar.

b. Find the scale factor from the small to large triangle.

c. Find x.



Simplify.

18. (15, 33) $-(-2)^2 - 2^2 - (\sqrt{2})^2$

19. (27) $\frac{bake^2}{acake}$

Solve.

*** 20.** (50) $2.1 + 0.7x = 9.8$

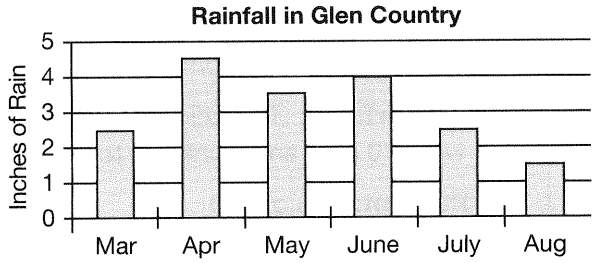
21. (50) $4(x - 4) - 3x = 10$

22. (38) $\frac{4}{5}x = 16$

23. (44) $\frac{12}{40} = \frac{30}{x}$

*** 24.** (62) ***Model*** Solve and graph the solution on a number line: $x + 3 < 2$

*** 25.** (Inv. 6) The graph shows the amount of rainfall in Glen County for the months of March through August.



a. About how many inches of rain fell during the months of March through August?

b. Which month received as about much rain as the months of July and August combined?

LESSON

65 • Applications Using Similar Triangles

Power Up

Building Power

facts

Power Up M

mental math

a. **Algebra:** Evaluate: $\frac{1}{2}m^2$ when $m = 6$

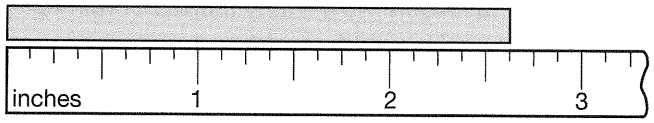
b. **Fractional Parts:** $\frac{7}{8}$ of 4800

c. **Probability:** Twelve of the 28 students are boys. If the teacher calls on one student at random, what is the probability a girl will be called?

d. **Proportions:** The ratio of cars to trucks in the lot was 5 to 2. If there were 70 cars and trucks all together, how many were trucks?

e. **Percent:** 5% of $70

f. **Measurement:** Find the length of this rectangle.



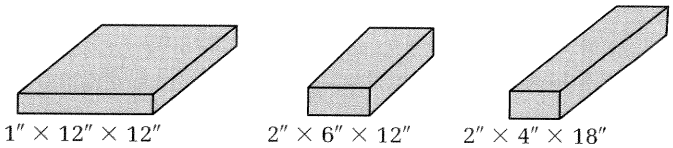
g. **Select a Method:** To find the square root of 200, which would you use?

A mental math
B pencil and paper
C calculator

h. **Calculation:** 55 ÷ 11, × 9, + 4, $\sqrt{\ }$, + 2, $\sqrt{\ }$ + 1

problem solving

The price of lumber is calculated by the board foot. One board foot is the amount of lumber in a board 12″ long, 12″ wide, and 1″ thick, or the equivalent. Below we show other dimensions equal to one board foot.



The lumber yard sells one type of lumber with the end dimensions of 1″ by 6″. What length of 1″ by 6″ lumber is equal to one board foot?

New Concept

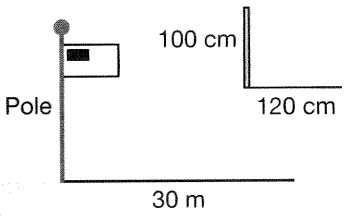
Increasing Knowledge

Math Language
Recall that **similar figures** have the same shape but not necessarily the same size. Corresponding sides of similar figures are proportional. Corresponding angles of similar figures are congruent.

We can find the measure of some objects that are difficult to measure by using similar triangles. Recall that the side lengths of similar triangles are proportional.

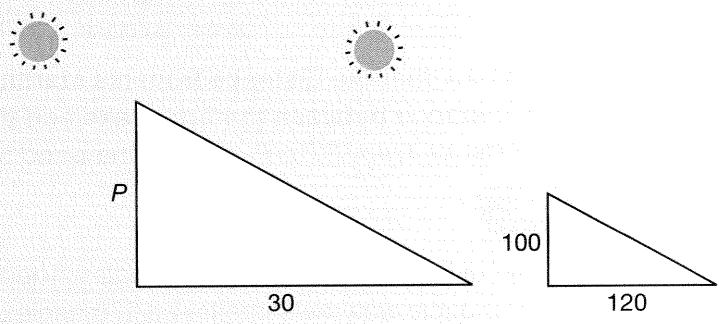
Example 1

Maricruz wants to know the height of a flag pole. She stands a meter stick in a vertical position and finds that the length of its shadow is 120 cm. At the same time the shadow of the flag pole is 30 m long. How tall is the flag pole?



Solution

We may think of the flagpole and its shadow as one triangle and the meter stick and its shadow as a smaller but similar triangle.



The triangles are similar because the flagpole and meter stick are vertical, and the angle of the sun is the same for both objects. Therefore, the corresponding angles are congruent, so the triangles are similar and the corresponding sides are proportional.

	Smaller	Larger
Height	p	100
Shadow	30	120

$$\frac{p}{30} = \frac{100}{120}$$

$$120p = 30 \cdot 100$$

$$p = \frac{30 \cdot 100}{120}$$

$$p = 25$$

The shadow of the pole was measured in meters, so the height of the pole is **25 meters.**

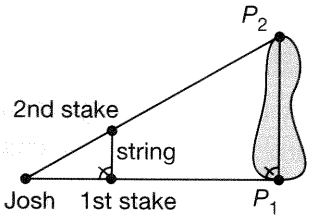
Thinking Skill
Explain
Why might Maricruz use indirect measure to measure the flagpole?

In example 1, Maricruz used **indirect measure** to find the height of the flagpole. Instead of placing a measuring tool against the flagpole, she measured the shadow of the flagpole and used proportional relationships to find the height of the flagpole. Here is another example of indirect measure.

Example 2

Josh stood facing a pond. From his viewpoint he could see two points on opposite sides of the pond: P_1 and P_2. He wanted to know the distance between P_1 and P_2 but he did not have a way to measure the distance directly.

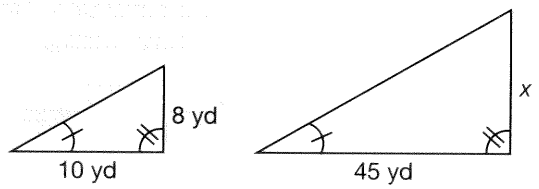
Josh had an idea: he could indirectly measure the distance. He marked his position with a large stone, walked 10 yards towards P_1, and drove a stake into the ground. He tied a string around the bottom of the stake and stretched it out in a line parallel to the line from P_1 to P_2. Josh then returned to his starting position and walked in a straight line towards P_2. When Josh reached the string, he drove another stake into the ground and tied off the string.



Josh knew that the distance from his starting position to P_1 is 45 yards. If the distance between the first stake and the second stake is 8 yards, the distance from P_1 to P_2 across the pond is how many yards?

Solution

We can divide the map into two triangles. The triangles are similar because the view angle was the same for each triangle and because two other corresponding angles of the triangles are also corresponding angles of parallel lines.



The sides of similar triangles are proportional, so we may write a proportion or use the scale factor to find the distance across the pond. This time we will use the scale factor.

$$\text{Scale factor} = \frac{45 \text{ yd}}{10 \text{ yd}} = 4.5$$

Now we multiply the length of the string (8 yards) by the scale factor to find the distance across the pond from P_1 to P_2.

$$8 \text{ yd} \cdot 4.5 = 36 \text{ yd}$$

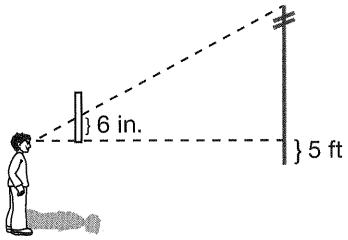
The distance across the pond from P_1 to P_2 is about **36 yards.**

Discuss Discuss other situations in which you might use indirect measure.

Practice Set

a. *Evaluate* Trevor took big steps to find the length of the shadow of the big pine tree in front of the school. He estimated that the shadow was 16 yards long, or about 48 feet. He also stepped off the shadow cast by the two-story school building and estimated that its shadow was 18 feet long. Trevor thinks the building is 24 feet tall. About how many feet tall is the big pine tree?

b. Holding a ruler upright at arm's distance (24 in.), Ronnie aligned the bottom of the ruler with a mark on the utility pole that was about 5 feet above the ground. He saw that the top of the pole aligned with the 6-inch mark on the ruler. Then he took 40 long strides to reach the pole. If each stride was about one yard (3 feet), then the top of the pole is about how many feet high?



c. Using a ruler or tape measure, perform a height-and-shadow activity at school or at home to estimate the height of a building, tree, or pole you cannot measure directly. Find the shadow length of the object you cannot measure directly on level ground. Then find the shadow length and height of an object that you can measure such as an upright ruler, meter stick of fence post. Create and solve a proportion relating the heights and shadow lengths of the two objects to estimate the height of the object.

Written Practice

Strengthening Concepts

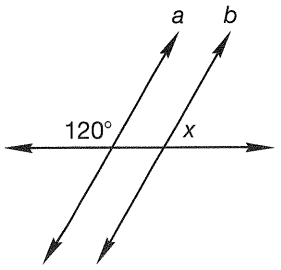
1. (45) A recipe calls for 5 cans of stew and 2 cans of chili. To feed the group it will take 210 cans total. How many of the 210 cans should be chili?

2. (48) Eighty-four percent of the audience dozed during the 4-hour film. If there were 75 people in the audience, how many did not doze?

3. (3, 4) The beagle buried 5 big bones and 3 small ones. For how long must the beagle search for the bones if it takes 4 minutes to find each big bone and 10 minutes to find each small one?

4. (7) Five students measured the mass of an object. Their measurements were 7.02 g, 6.98 g, 6.98 g, 6.99 g, and 6.98 g. Find the mean, median, and mode of the measurements.

5. (54) Lines a and b are parallel. Find $m\angle x$.



*** 6.** (43, Inv. 4) ***Justify*** **a.** Sketch a rectangular prism with a 10 mm square base and a height of 20 mm.

b. Find the surface area of the prism in **a.**

c. Sketch a pyramid with a 10 mm square base and a height of 20 mm. Which has the greater volume, the prism or the pyramid? How do you know?

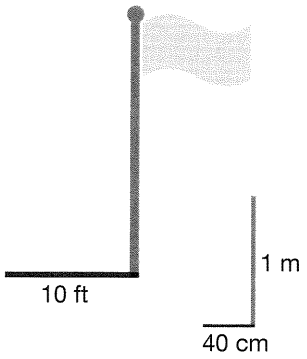
7. (56) Use the slope-intercept method to graph $y = -x + 3$. Is $(3, -6)$ a solution?

8. (32) The Big Prize was behind curtain 1, 2, or 3. Dexter gets two choices.

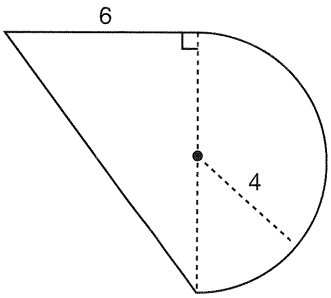
a. What is the sample space of the experiment?

b. What is the probability he will choose the Big Prize?

*** 9.** (65) ***Connect*** A vertical meter stick casts a shadow 40 cm long at the same time a flagpole casts a shadow 10 feet long. How tall is the flagpole?



10. (Inv. 2, 39) ***Analyze*** Find the perimeter of the figure to the right. Dimensions are in centimeters. (Use 3.14 for π.)



*** 11.** (64) Use a unit multiplier to convert 90 meters per minute to meters per second.

*** 12.** (64) Use a unit multiplier to convert 1.2 feet per second to inches per second.

13. (21) Factor:

a. $4y - 32$ **b.** $2x^2 - 16x$

14. (63) **a.** Write $3\frac{1}{3}\%$ as a reduced fraction and as a decimal.

b. Which form would you use to find $3\frac{1}{3}\%$ of \$720.00?

15. (63) Write $\frac{7}{16}$ as a decimal and as a percent.

16. (58) The regular price was \$45, but the item was on sale for \$27. What percent of the regular price was the sale price?

Simplify.

17. (15) $3^1 - 2^2 + 1^3$

18. (27) $\dfrac{x^4y^3z^2}{x^2y^3z^4}$

19. (21, 63) $\dfrac{7}{12} - \dfrac{3}{8} \cdot \left(\dfrac{9}{4}\right)^{-1}$

20. (24, 25) $\dfrac{4.2 + 3}{0.6}$

Solve.

*** 21.** (50) $0.8 + 0.3x = 5$

22. (50) $\dfrac{7}{8}x + \dfrac{1}{2} = \dfrac{7}{8}$

Model Graph the solutions to Exercises **23–24** on a number line.

*** 23.** (62) $x + 5 > 1$

*** 24.** (62) $2x + 1 \leq -1$

25. (41) Julie's car has a digital fuel gauge and Julie decided to chart the amount of fuel she burns when she drives certain numbers of miles. Her data is shown in the table below. Is the relationship proportional? If so, what is the constant of proportionality? Why do you think the information in the table looks the way it does?

Gallons Used	Distance Travelled (miles)
1	18
3	80
9	162
15	450

LESSON 66

Special Right Triangles

Power Up

Building Power

facts

Power Up N

mental math

a. **Statistics:** Find the median of these numbers: 28.5, 32.9, 17.9, 16.1, 27.2

b. **Estimation:** $4.9 \times \sqrt{50}$

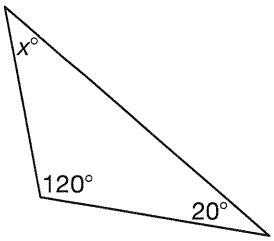
c. **Number Sense:** If a number is a perfect square, then its last digit cannot be

A 0. **B** 1. **C** 2.

d. **Powers/Roots:** $x^2 \cdot x^2$

e. **Proportion:** $\frac{1}{5} = \frac{x}{15}$

f. **Geometry:** Find the measure of $\angle x$.

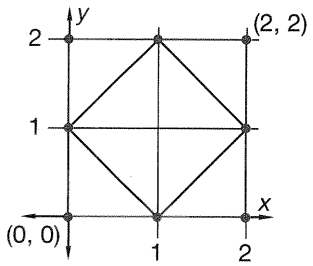


g. **Scientific Notation:** Write 1.9×10^4 in standard notation.

h. **Calculation:** $8 \times 2, \sqrt{\ }, \sqrt{\ }, -1, \sqrt{\ }, -1, \sqrt{\ }$

problem solving

The vertices of the larger square are at (0, 0), (2, 0), (2, 2), and (0, 2). The vertices of the smaller square are at (1, 0), (2, 1), (1, 2), and (0, 1). What is the ratio of the area of the smaller square to the area of the larger square?



New Concept

Increasing Knowledge

Thinking Skill

Analyze

Can you calculate the measures of the three angles of each triangle? Explain your thinking.

In this lesson we will focus attention on two special right triangles. One triangle is half of a square and the other triangle is half of an equilateral triangle.