1.1 Algebra Fundamentals

Introducing Variables

Student Logbook

1. 7,000 kg
2. 2,500 kg
3. cubic
4. $v = l \times w \times h$
5. rectangular prism
6. length; 4 m
7. $w = 8(h) + 0.5$
8. $h = \frac{1}{16} \times l$
9. variables
10. $v = 4 \times [8(h) + 0.5] \times [\frac{1}{16}(l)]$

Your Turn

1. rectangular prism
2. length, width, height
3. length
4. width, height
5. Answers will vary but should be similar to: length = l; height = h; width = w
6. $h = \frac{1}{2}(l) - 15$ cm
7. $w = \frac{4}{5}(h)$ cm
8. $v = 90 \text{ cm} \times [\frac{1}{2}(l) - 15] \text{ cm} \times \frac{4}{5}(h)$ cm

Identifying Components of Algebraic Expressions

Student Logbook

1. width
2. Answers will vary. Sample: a number that multiplies a variable in an expression
3. 8
4. 1, because multiplying by 1 does not change the value of a variable
5. Answers will vary. Sample: a fixed quantity or numerical quantity
6. $8 \times h$; $8 \bullet h$; $8(h)$
7. a number, a variable, or a product or quotient of one or more numbers and variables
8. Answers will vary but should be similar to: a combination of algebraic terms
9. yes
10. variable; numbers; variables

Your Turn

1. **a.** Coefficients: 3, 18 Constants: −21 Number of terms: 3

   b. Coefficients: −2, −7, 1 Constants: none Number of terms: 3

   c. Coefficients:1 Constants: none Number of terms: 1
2. $C = 3.14d$
3. 3.14
4. $C = 3.14 \times 5$ m
5. 15.7 m

Replacing Variables in a Formula

Student Logbook

1. $\frac{1}{16}(4)$
2. $h = \frac{1}{16}(4) = \frac{1}{16}\left(\frac{4}{1}\right) = \frac{4}{16} = \frac{1}{4}$
3. $w = 8\left(\frac{1}{4}\right) + 0.5$
4. 2.5
5. $v = 4 \times 2.5 \times \frac{1}{4}$
6. $v = 2.5 \text{ m}^3$
7. cubic meters
8. weight of concrete section $= 2.5 \text{ m}^3 \times 2{,}500 \text{ kg/m}^3 = 6{,}250$ kg
9. Yes, the lifting capacity of the helicopter is 7,000 kg, and the section weighs only 6,250 kg.
10. An algebraic formula can be worked out by substituting known values for variables.
11. Dijit did not know the weight of the section but did know the weight of a section of concrete with a volume of 1 m^3. By finding the volume of the concrete section, Dijit could find its weight.

Your Turn

1. $v = l \times w \times h$

2. $l = \frac{1}{2}$ cm

3. $w = l + 5$ cm

4. $h = 50$ cm

5. $v = \frac{1}{2}(h)$ cm $\times$ $(l + 5)$ cm $\times$ 50 cm

6. $l = \frac{1}{2}(50 \text{ cm})$

7. 25 cm

8. $w = 25 \text{ cm} + 5 \text{ cm}$

9. 30 cm

10. $v = 25 \text{ cm} \times 30 \text{ cm} \times 50 \text{ cm}$

11. 37,500

12. 37.5 L

13. number of cans needed = 175 L ÷ 37.5 L

Unit Review

1. a. width

b. height; length

c. $v = l \times w \times h = 2(w)$ cm $\times$ 180 cm $\times$ $[2(w) - 318]$ cm

d. v; w

2. a. 2; 1; 1

b. none

c. 2; l; w; P

d. $2(l + w)$

3. a. $l = 2w = 2(180 \text{ cm}) = 360$ cm

b. $h = 2(w) - 318 = 2(180 \text{ cm}) - 318 = 360 - 318 = 42$ cm

c. $v = 360 \text{ cm} \times 180 \text{ cm} \times 42 \text{ cm}$

d. 2,721,600 cm^3

4. a. $v = 50 \text{ m} \times [\frac{1}{5}(l) + 5 \text{ m}] \times (w - 8 \text{ m})$

b. 50; 5; 8

c. v; l; $-w$

d. $\frac{1}{5}$

e. $w = \frac{1}{5}l + 5$ m

f. $h = w - 8$ m

g. 15 m

h. 7 m

i. 5,250 m^3

Unit Assessment

1. a. $l = w + 3.5$

b. $h = \frac{1}{2}w$

c. $v = l \times w \times h = (w + 3.5) \times w \times \frac{1}{2}w$

d. cost $= 0.18\,[(w + 3.5) \times w \times \frac{1}{2}w]$

2. a. 4π

b. none

c. $\frac{4}{3}\pi$

d. $A = 4 \times 3.14 \times 6{,}380 \text{ km} \times 6{,}380 \text{ km}$

e. 511,000,000 km^2

f. $v = \frac{4}{3} \times 3.14 \times 6{,}380 \text{ km} \times 6{,}380 \text{ km} \times 6{,}380 \text{ km}$

g. 1,087,252,500,000 km^3

3. a. rock and pop CDs $= 8x + 11x$

b. total $= 8x + 11x + 3x$

c. borrowed CDs $= \frac{1}{3}(8x) + \frac{1}{4}(11x)$

d. the number of CDs in each rack

4. a. $v = \frac{1}{3}(A) \times h = \frac{1}{3}(230 \text{ m})^2 \times h$

b. v; $\frac{1}{3}$; $(230 \text{ m})^2$; h

c. $\frac{1}{3}$; 230

d. $h = v \div [\frac{1}{3}(230)^2]$

e. 147 m

1.2 Evaluating an Algebraic Expression

Representing the Dimensions & Area of a Rectangle

Student Logbook

1. w

2. width + 5

3. $w + 5$

4. $\frac{1}{2}[(w + 5) + 2w] - \frac{5}{2}$

5. larger

6. length, l; width, w

Your Turn

1. $w \times (w + \frac{2}{3})$

2. a. $2(w + 5) + \frac{4}{3}$

b. $[2(w + 5) + \frac{4}{3}] \times (w + 5)$

3. a. $(w + 5) - w$

b. $[2(w + 5) + \frac{4}{3}] - (w + \frac{2}{3})$

4. a. $l + 20$

b. $w - (75 \text{ yd} - 53\frac{1}{3})$, or $w - 21\frac{2}{3}$

Combining Like Terms

Student Logbook

1. length $\times$ width

2. $(w + 5) \times w$

3. $w(w + 5)$; $w^2 + 5w$

4. $(w + 5 + 2w) \times \{\frac{1}{2}[(w + 5) + 2w] - \frac{5}{2}\}$

5. $3w + 5$

6. Write $(w + 5) + 2w$ as $3w + 5$.

7. $\frac{3}{2}w$

8. distributive

9. $\frac{9}{2}w^2 + \frac{15}{2}w$

10. like; operations

Your Turn

1. $4w + 3$

2. $21x - 28$

3. distributive property

4. a. $5x + 10$ **b.** $x^2 + x$ **c.** $4x^2 + 6x$

5. $-10x - 18$

6. $3x + 8$

7. $-4t - 7$

8. $5x^2 + 3x$

9. a. $2\frac{1}{4}w$

b. $1\frac{2}{5}w$

c. $A = 2\frac{1}{4}w \times 1\frac{2}{5}w$; $A = 3\frac{3}{20}$

Evaluating Expressions Using Substitution

Student Logbook

1. $(\frac{9}{2}w^2 + \frac{15}{2}w) - (w^2 + 5w)$

2. $-1(w^2 + 5w)$; $-w^2 - 5w$

3. $\frac{7}{2}w^2 + \frac{5}{2}w$

4. 36

5. 6

6. 141; 141 meters^2

7. the number of square meters of overhanging branches and foliage to be cut back for the new landing pad

8. The minus sign must be applied.

Your Turn

1. $\frac{1}{2}x^2 + \frac{1}{4}x$

2. a. 6

b. $10\frac{1}{2}$

c. 16

d. $1\frac{1}{8}$

3. a. $(2w + \frac{3}{8}) \times w$

b. $(2w + 1) \times 2w$

c. $[(2w + 1) \times 2w] - [(2w + \frac{3}{8}) \times w]$

d. $2w^2 + 1\frac{5}{8}w$

e. $1{,}290\frac{5}{8}$ ft^2

Unit Review

1. a. $\frac{1}{80} + w$

b. $\frac{1}{120} + l$

c. $(\frac{1}{120} + l)(\frac{1}{80} + w)$

2. $6w - 3$

3. $3w + 14$

4. a. Simplify the expression inside the brackets by combining like terms.

b. $[(3w + 5) + 4w + (2w - 5)] = 3w + 4w + 2w + 5 - 6 = 9w - 1$

c. $\{4 \times [9w - 1]\} = \{36w - 4\}$

d. the distributive property of multiplication over addition

5. a. $w \times 10w$

b. $(w + \frac{1}{5}w) \times 10w$

c. $[(w + \frac{1}{5}w) \times 10w] - (w \times 10w)$; $12w^2 - 10w^2 = 2w^2$

d. 800 cm^2

6. a. -32 **b.** $-y^3z^3 + 3y^3z^2$

7.

	Length	Simplify length	Length × width	Formula for area	Area
Rectangle 1	$\frac{1}{2}(w+26)$	$\frac{w}{2}+13$	$w \times (\frac{w}{2}+13)$	w^2+13w	264 m^2
Rectangle 2	$14 \times (\frac{3}{7}w - 4)$	$6w - 56$	$w \times (62 - 56)$	$6w^2 - 56w$	1,342 m^2

Unit Assessment

1. a. 21 m **b.** $2.38w$

2. $(l_{us} \times w_{us}) - (l_{can} \times w_{can})$

3. a. $1\frac{69}{100} \times w^2$

b. 7,140.25 yd

c. $1\frac{69}{100} \times w$

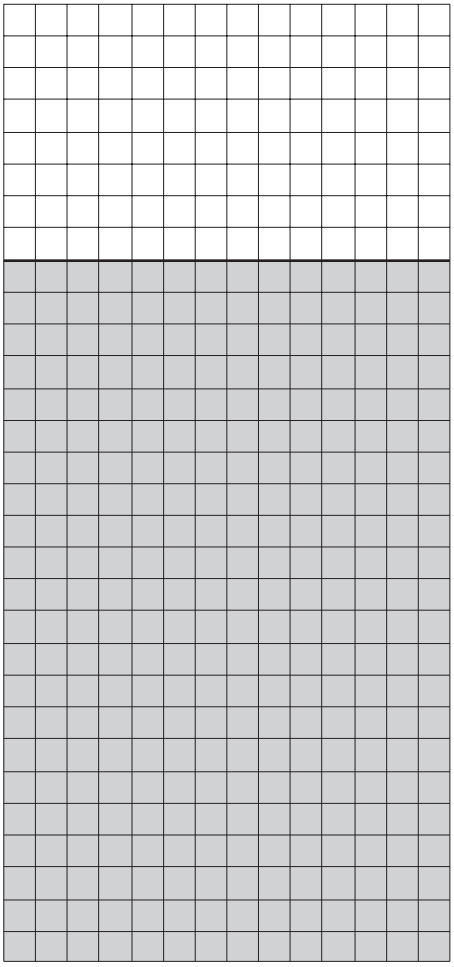
d. 110 yd

4. a. $l = 200{,}000 \text{ cm}^2 / 12\frac{1}{2} \text{ cm}$

b. 16,000 cm

c. $\left(\frac{2}{5}\right) \times (16{,}000)$

5. a.



b. $2w - 12$

c. 44 m

d. $(w - 12 \text{ m})w$

e. 448 m^2

1.3 Simple Equations

Using Variables to Express Relationships

Student Logbook

1. 102 tons

2. 102 tons; The ship is balanced, so both sides have equal weight.

3. *t, b, d*

4. *t, b*

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

6. $2.5t - 1$

7. $\frac{1}{2}(2.5t - 1) - 2$

8. c

9. unknown

Your Turn

1. a. $a + b + c$

b. $a + b + c = 2{,}856$ miles

2. $b = \frac{1}{2}a + 58$

3. $c = 4b - 241$

4. $a + (\frac{1}{2}a + 58) + [4(\frac{1}{2}a + 58) - 241]$
$= 2{,}856$

Simplifying Algebraic Expressions

Student Logbook

1. a. $\frac{5}{2}$

b. $34 + 2(\frac{5}{2}t - 1) + 2[\frac{1}{2}(\frac{5}{2}t - 1) - 2]$
$= 102$

2. the total weight of one dredger, two bulldozers and two trucks

3. a. $5t - 2$

b. the weight of two bulldozers

4. a. $\frac{5}{2}t - 5$

b. the weight of two trucks

5. a. $34 + 5t - 2 + (\frac{5}{2}t - 5)$

b. 102 tons

c. $34 + 5t - 2 + (2.5t - 5)$

d. $7.5t + 27$

e. $7.5t + 27 = 102$

f. The weight of seven-and-a-half trucks plus 27 tons equals 102 tons.

Your Turn

1. a. $\frac{a}{2} + 58$

b. $[(\frac{4}{2} \times a) + 232] - 241$

c. multiplication

d. $(2a + 232) - 241$

e. division

f. $2a - 9$

g. subtraction

h. $a + (\frac{a}{2} + 58) + (2a - 9) = 2{,}856$

2. a. $\frac{7a}{2} + 49$

b. $\frac{7a}{2} + 49 = 2{,}856$

c. Seven times the distance from New York to Chicago divided by two, plus 49 miles, is equal to 2,856 miles.

Solving Simple Equations

Student Logbook

1. a. $d + 2b + 2t + t$ or $d + 2b + 3t$

b. The same amount has to be added to both sides.

2. addition, subtraction, multiplication, division

3. a. Subtract 27 from both sides.

b. Multiply both sides by 10.

c. Divide both sides by 75.

d. 10 tons

4. a. Substitute the value found for t in the equation for the balanced cargo.

b. 102 tons

c. 102 tons

Your Turn

1. Subtract 49 from both sides.

2. $\frac{7a}{2} + 49 - 49 = 2{,}856 - 49$, or $\frac{7a}{2} = 2{,}807$

3. Multiply both sides by 2.

4. $2 \times \frac{7a}{2} = 2 \times 2{,}807$

5. $7a = 5{,}614$

6. Divide both sides by 7.

7. $b = 459$

8. $c = 1{,}595$

Unit Review

1. a. $m = \frac{1}{4}j - 2$

b. $s = 8m + 2$

c. $j + \left(\frac{1}{4}j - 2\right) + [8\left(\frac{1}{4}j - 2\right) + 2] = 36$

2. a. $\frac{j}{4} - 2$

b. $\frac{8j}{4} - 16$

c. $j + \left(\frac{j}{4} - 2\right) + \left(\frac{8j}{4} - 16\right) + 2 = 36$

d. $j = 16$

3. a. $c = -9$

b. $4(3(-9) + 7) - 5(-9) = -(-9) - 44$
$4(-27 + 7) + 45 = -(-9) - 44$
$-80 + 45 = 9 - 44$
$-35 = -35$

4. a. $\frac{13}{4}j = 52$
$13j = 208$
$j = 16$

b. $m = \frac{1}{4}j - 2$
$m = \frac{1}{4} \times 16 - 2$
$m = 4 - 2 = 2$

c. $s = 18$

5.

Equation	Simplified 2nd term	Simplified 3rd term	Simplified equation	Value of variable
$6+3(a+6)+\frac{2}{5}(10a-7.5)=91$	$3a+18$	$4a-3$	$7a+21=91$	10
$34-[\frac{1}{2}(6k-2)+8]+2(2k+12)=68$	$3k+7$	$4k+24$	$k+51=68$	17
$66+[\frac{7}{3}(f+54)]-[4(\frac{1}{3}f-16]=277$	$\frac{7}{3}f+126$	$\frac{4}{3}f-64$	$f+256=277$	21

6. a. Solving the equation results in an identity, $x = x$. So any value of x is a solution.

b. Solving this equation results in a false statement such as $0 = 12$ or $x = 4 + x$. (The result depends on how the student attempts to solve the equation.) Because the equation is false, it has no solution.

c. A linear equation with one variable may have a unique solution, an infinite number

of solutions, or no solution.

Unit Assessment

1. a. $i = 3 \times o + 2$

b. (3)

2. a. $c = \frac{1}{2}i + 7$

b. (2)

3. $o + i + c = 54$

4. $\frac{i}{3} - \frac{2}{3} + i + \frac{1}{2}i + 7 = 54$

5. $i = 26$

6. a. $2d + 5$

b. $2d + 5 + d = 47$, or $3d + 5 = 47$

c. Clarence, 14; Katie, 33

1.4 Variable on Both Sides of the Equation

Writing Equations

Student Logbook

1. $24,000

2. 50% of what's left over after Mary gets her share is the same amount as Mary's share plus $\frac{1}{4}$ of the total check.

3. x; Mary's share of the check

4. what's left over after Mary gets her share

5. $50\%(24,000 - x)$

6. $x + \frac{1}{4}(24,000)$

7. $12,000 - \frac{1}{2}x$; $x + 6,000$

8. variable; both; equals

9. Yes. Simplifying each side results in a simpler equation.

Your Turn

1. $\frac{1}{2}(100 + x)$

2. $2a = a + 20$

3. $\frac{1}{2}m = m - 10$

4. a. $5 + x$ **b.** $3x + 8$

5. a. $2x + 10$; $4 - \frac{1}{2}x$

b. $2x + 12$; $12x + 28$

c. $3x + 9$; $6x + 17$

Simplifying Both Sides of an Equation

Student Logbook

1. Mary's share of the check

2. subtract; inverse

3. add

4. mixed

5. $12,000 = \frac{3x}{2} + 6,000$

6. $6,000 = \frac{3x}{2}$

7. multiply; 2

8. $12,000 = 3x$

9. inverse; both

Your Turn

1. $2x = 3$

2. $4 = 4x$

3. Combine the like terms $-2x$ and $6x$ on the left-hand side to get $4x$. Then subtract $3x$ from both sides to obtain x on the left-hand side and no x terms on the right-hand side. Finally, subtract 5 from both sides.

4. b

5. c

6. $19,500 = \frac{3x}{2} - 7,800$

7. Multiply both sides by 2.

Checking the Solution to an Equation

Student Logbook

1. $12,000 = 3x$; x

2. $4,000

3. 4,000; divided; 3

4. b

5. Answers will vary. Sample: The left-hand side (LHS) and the right-hand side (RHS) of the equation will be equal.

6. subtracted; total; $20,000

7. a. isolated

b. substitution; original

c. solution; conditions

Your Turn

1. $x = 1$

2. $x = 6$

3. $y = -3$

4. $w = 3$

5. $x = 3$; Check: $3(3 + 2) = 3 + 12$, or $15 = 15$, which is true, so $x = 3$ is correct.

6. $2a = a + 30$; 30 years

7. \$15,000

Unit Review

1. $\frac{3}{5}w = w - 10$

2. a. $28x + 84$; $8 - \frac{1}{4}x$

b. $\frac{1x}{6} + 6$; $3x + 6$

3. a. $184 = \frac{5x}{3} - 14$

b. $9{,}650 = \frac{7x}{2} + 870$

c. $123 = 3x - 87$

4. c

5.
$$\begin{aligned} x &= 130 \\ 225 - \tfrac{1}{2}x &= x + 30 \\ 225 &= \tfrac{3x}{2} + 30 \\ 195 &= \tfrac{3x}{2} \\ 390 &= 3x \\ 130 &= x \end{aligned}$$

Check: $225 - \frac{1}{2}(130) = 130 + 30$

$225 - 65 = 160$

$160 = 160$

6. a. \$24 **b.** \$96

7. a. 3

b. no greater than 3

c. 1, -1, -2

Unit Assessment

1. a

2. a. $\frac{1}{3}x + 40$ **b.** $x + 1.90$

3. d

4. a. $23{,}720 = \frac{1}{3}x - 645$

b. $93 = 4x + 141$

c. $884 = x - 25$

5. $18{,}544 = 4x$

6.
$$\begin{aligned} x &= 212 \\ 485 - \tfrac{1}{2}x &= 2x - 45 \\ 485 &= \tfrac{5x}{2} - 45 \\ 485 + 45 &= \tfrac{5x}{2} \\ 530 &= \tfrac{5x}{2} \\ 1{,}060 &= 5x \\ 212 &= x \end{aligned}$$

Check:

$485 - \frac{1}{2}(212) = 2(212) - 45$

$485 - 106 = 424 - 45$

$379 = 379$

7. a. \$3.80

b. \$24.70

work:

$$\begin{aligned} 50\%(28.50 - x) &= x + 30\%(28.50) \\ 14.25 - \tfrac{1}{2}x &= x + 8.55 \\ 14.25 &= \tfrac{3x}{2} + 8.55 \\ 5.70 &= \tfrac{3x}{2} \\ 11.40 &= 3x \\ 3.80 &= x \\ 28.50 - 3.80 &= \text{Geena's share} \end{aligned}$$

Check:

$14.25 - \frac{1}{2}(3.80) = 3.80 + 8.55$

$14.25 - 1.90 = 12.35$

$12.35 = 12.35$

1.5 Solving Literal Equations

Identifying the Variables in a Given Formula

Student Logbook

1. frustum

2. a. height

b. radius of the bottom base

c. radius of the top base

d. volume

3. radius; circumference

4. Radius is half the diameter (or diameter is twice the radius).

5. top; bottom

6. substitution; variable; like

Your Turn

1. a. d = distance; r = rate; t = time

b. $r = \frac{d}{t}$

2. sample: $A = l \times w$

3. 15 cm

4. 10 cm

5. multiplication

6. $v = 4\pi(r^2 + 4r + 16)$

Rewriting a Formula in Terms of a Different Variable

Student Logbook

1. $v = 660\ \text{m}^3$ and $\pi = \frac{22}{7}$

2. r

3. h

4. Multiply both sides by 3, or $\frac{3}{1}$.

5. Divide both sides by π or multiply by $\frac{1}{\pi}$.

6. $\frac{1}{7r^2}$

7. b

8. inverse; equation

Your Turn

1. a. p = perimeter; l = length; w = width

b. $l = \frac{p-2w}{2}$, or $l = \frac{p}{2} - w$

c. $w = \frac{p-2l}{2}$, or $w = \frac{p}{2} - l$

2. a. $d = \frac{C}{\pi}$ **b.** $r = \frac{C}{2\pi}$

3. $r = \sqrt{\frac{A}{\pi}}$

4. a. $r = 0.29$ km/min or 291 m/min

b. $r = 0.14$ km/min or 140 m/min

c. 24.1 min

d. 14.3 min

e. 3.48 km

f. 6.3 km

Substituting Values & Solving an Equation

Student Logbook

1. a. $660\ \text{m}^3$ **b.** 3 m **c.** $\frac{22}{7}$

2. $h = \frac{3(660)}{\left(\frac{22}{7}\right)7(3^2)}$

3. 10 m

4. by substituting all the values into the formula and checking that the equation is balanced

5. a. variables

b. order; operations

6. substitute; balance

Your Turn

1. $2.7\ \text{g/cm}^3$

2. a. $m = dv$ **b.** 2,219.5 g or 2.220 kg

3. a. 60 m **b.** 376.8 m **c.** $11{,}304\ \text{m}^2$

4. a. $h = \frac{3v}{\pi r^2}$ **b.** 15 cm

Unit Review

1. a. $R = 8r$

b. $v = \frac{1}{3}\pi h\,(73r^2)$

c. $D = 8d$

2. a. $A = \frac{9}{25}\pi R^2$

b. $1{,}810\ \text{m}^2$

c. $1{,}600\ \text{m}^2$

d. $3{,}410\ \text{m}^2$

3. a. $r = \frac{l}{2\pi h}$ **b.** 9.80 m

4. a. $v = \pi r^2 h$ **b.** $h = \frac{v}{\pi r^2}$ **c.** $h = 10.0$ m

Unit Assessment

1. $r = \frac{C}{2\pi}$

2. a. $s = \frac{p}{4}$ **b.** $s = 9$ cm

3. $\frac{l}{pt} = r$

4. Solve the equation for the base by multiplying both sides by 2, and then dividing both sides by h; $b = \frac{2A}{h}$.

5. **a.** $v = 33.49$ cubic inches **b.** $r^3 = \frac{3v}{4\pi}$

6. **a.** $h = \frac{V}{l \times w}$ **b.** $h = 20$ cm

7. **a.** $h = \frac{3V}{B}$ **b.** $h = 73.5$ m

2.1 Geometry Fundamentals

Naming & Measuring Angles

Student Logbook

1. find the measure of angles
2. degrees
3. right
4. perpendicular
5. $\perp$
6. quadrilateral; opposite sides
7. 180
8. $\angle$
9. O
10. 90; 180
11. right; measure is equal to 90 degrees

Your Turn

1. parallelogram
2. 90
3. The lines are perpendicular.
4. obtuse
5. protractor
6. $\angle$AEC or $\angle$CEA
7. a line segment; a line extends indefinitely

Defining Complementary & Supplementary Angles

Student Logbook

1. 90; 180
2. 45°
3. 0; 90
4. 180
5. 90
6. No, they add up to either 90 or 180. They cannot add up to both.

Your Turn

1. 30°
2. $\angle$AOB and $\angle$COD
3. obtuse; the angle measure is greater than 90° and less than 180°
4. $\angle$DOE
5. $3x + 30 = 180$
6. $x = 50$

Recognizing Congruent Angles

Student Logbook

1. supplementary
2. measure of angle A
3. vertical angles
4. $\cong$
5. $\angle$c; $\angle$d
6. yes
7. They are inside of the parallel lines and on alternate sides of the line made by the cue.
8. The measures are the same.
9. **a.** vertical
   b. $\angle$J and $\angle$H
   c. alternate exterior angles
   d. The measures are equal.

Your Turn

1. $\angle$B , $\angle$D, $\angle$F, and $\angle$H
2. Yes, vertical angles are always congruent.
3. $\angle$A, $\angle$C, $\angle$G
4. $\angle$G and $\angle$E
5. They are the same.
6. $\angle$D and $\angle$F; $\angle$C and $\angle$E
7. No, they are not on alternate sides of the parallel lines.

Unit Review

1. ∠MOP, ∠TOP

2. ∠MOR

3. ∠TOM

4. RO and SM

5. PO and TM

6. ∠AOB, ∠BOC

7. ∠COD or ∠DOE

8. ∠COA

9. ∠1 and ∠3, ∠2 and ∠4, ∠5 and ∠7, and ∠6 and ∠8

10. ∠3 and ∠5, ∠4 and ∠6

11. ∠7 and ∠1, ∠8 and ∠2

12. ∠7, ∠1, ∠3

13. If Rose Ave were perpendicular to Oak Street, ∠d would be a right angle, not an acute angle.

14. obtuse

15. alternate exterior

16. Answers may vary. Sample: ∠g and ∠a are supplementary (alternate exterior) and ∠a and ∠d are supplementary (straight angle), so ∠g and ∠d must be supplementary.

Unit Assessment

1. parallelogram

2. ∠BAD or ∠DAB or ∠BCD or ∠DCB

3. acute

4. See students' work.

5. 90°; right

6. ∠AFD and ∠BFD

7. ∠DBA

8. They are the same.

9. $x + 80 = 180$

10. $x = 100$

11. No, they are not vertical angles. They are not the angles formed by a pair of intersecting lines.

12. a. alternate interior angles

b. 180°

c. 180°

d. 180°

e. 360°

2.2 Triangles

Classifying Triangles by Sides

Student Logbook

1. 168

2. 168

3. 4; 4

4. 15 feet; 24 feet

5. right; 90

6. isosceles

7. yes; 90°

8. by drawing like marks on each of the equal sides

9. scalene; no

10. yes

11. by sides and by angles

Your Turn

1. No, it is not a quadrilateral because it does not have 4 sides and 4 angles.

2. c

3. △*ABF*

4. △*AFE*

5. c

6. d

7. scalene

8. △*FED*

Exploring the Area of a Triangle

Student Logbook

1. triangles; equal

2. base × height; triangle

3. perpendicular; vertex

4. He multiplies the area he found by 2.

5. 180 ft^2

6. 180°

7. three; 60

8. three equal

9. No, since all the angles have the same measurement, all the sides opposite the angles must have the same measurement.

Your Turn

1. Area $= \frac{1}{2}$(base $\times$ height)

2. d

3. b

4. 90°

5. scalene right triangle

6. 23 units

7. 12 units

8. 138 square units

9. 42 square units

10. 96 square units

Classifying Triangles by Angles

Student Logbook

1. a protractor

2. 0°; 90°; acute

3. 180°

4. one

5. 180°

6. no

7. A triangle cannot contain a straight angle because a triangle has 3 angles that add up to 180°.

8. 3 acute

9. 90°; 180°

10. 1 obtuse

11. No; two obtuse angles have a sum of greater than 180°, so the lines will never intersect to form a triangle.

Your Turn

1. $\triangle AFB$, $\triangle AFE$

2. $\triangle AFB$, $\triangle AFE$

3. $\triangle BFC$, $\triangle DFE$

4. $\triangle BFC$, $\triangle DFE$

5. $\triangle CFD$

6. $\triangle CFD$

7. $\angle BFE$

8. a. $\triangle ABF$ and $\triangle AFE$

b. $\triangle ABF$ is an isosceles right triangle and $\triangle AFE$ is a scalene right triangle.

Unit Review

1. isosceles and obtuse

2. scalene

3. 90°

4. a right triangle

5. $A = \frac{1}{2}(8 \times 5) = 20$ cm^2

6. Accept either *BE* or *CB*.

7. No; at least two of its sides have different lengths.

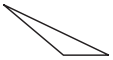
8. 35°

9. obtuse

10. It could be acute, right, or obtuse, depending on the location of *E*.

11.

Triangles

	Scalene	Isosceles	Equilateral
Acute			
Right			not possible
Obtuse			not possible

Unit Assessment

1. a triangle with 3 unequal sides

2. No; an isosceles triangle has 2 equal sides.

3. $\triangle ABD$

4. $\triangle ADC$

5. 3.3 units

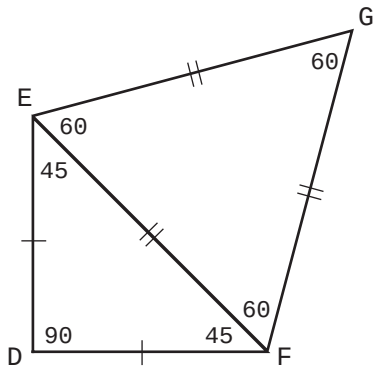
6. $A = \frac{1}{2}(6.6 \times 3.8) = 12.5$ square units

7. $A = \frac{1}{2}(3.3 \times 3.8) = 6.3$ square units

8. $A = \frac{1}{2}(3.3 \times 3.8) = 6.3$ square units

9. The areas are the same. Both triangles have the same base length ($BD = DC$) and the same height (AE).

10.



2.3 Volume & Surface Area

Calculating the Volume of a Right Triangular Prism

Student Logbook

1. volume

2. volume; space

3. his new apartment

4. $B \times l$

5. B = area of the base rectangle of the prism; b = width of the base

6. rectangular prism

7. right rectangular prism

8. right triangular prism

9. volume $= \frac{1}{2}(b \times h) \times l$

10. 4,500 ft^3

Your Turn

1. right triangular prism

2. volume; marbles fill space, so she needs to find the volume because volume is a three-dimensional measure of space

3. volume $= B \times l$, or volume $= \frac{1}{2}(b \times h) \times l$

4. area $= \frac{1}{2}(b \times h)$

5. area $= \frac{1}{2}(b \times h) = \frac{1}{2}(24 \text{ in.} \times 16 \text{ in.})$
$= 192 \text{ in.}^2$

6. volume $= B \times l = 192 \text{ in.}^2 \times 50 \text{ in.}$
$= 9{,}600 \text{ in.}^3$

Calculating the Surface Area of a Right Triangular Prism

Student Logbook

1. the surface area of the walls of his new apartment

2. surface area; faces

3. because they will not put aluminum foil on the floor

4. by multiplying the length by the width, $l \times w$

5. by multiplying one-half times the base times the height, $\frac{1}{2}(b \times h)$

6. faces

Your Turn

1. surface area; Sophie needs to find the surface area of the outside of the table.

2. 5

3. The two triangular ends have the same area; the two rectangular sides have the same area.

4. 50 in. $\times$ 24 in.

5. 1,200 $in.^2$

6. 50 in. $\times$ 20 in.

7. 1,000 $in.^2$

8. base = 24 in. and height = 16 in.

9. 192 $in.^2$

10. 1,200 $in.^2$ + 1,000 $in.^2$ + 1,000 $in.^2$ + 192 $in.^2$ + 192 $in.^2$ = 3,584 $in.^2$

Calculating the Volume & Surface Area of a Right Cylinder

Student Logbook

1. perpendicular

2. $A = \pi r^2$

3. area of base $\times$ length of cylinder

4. radius $= \frac{1}{2}$ of the diameter

5. circumference

6. $C = 2\pi r$

7. The circumference of the circles equals the width of the rectangular face.

8. 3.14

9. the radius of the circle

Your Turn

1. area; length or height

2. 9 in.

3. 254.3 $in.^2$

4. 4,578.1 $in.^3$

5. No, Dijit needs 5,021.9 $in.^3$ more.

Unit Review

1. a. right rectangular prism

b. 25 $in.^2$

c. 500 $in.^3$

2. a. 6

b. 5 in. $\times$ 5 in. $=$ 25 $in.^2$

c. 20 in. $\times$ 5 in. $=$ 100 $in.^2$

d. (25 $in.^2 \times 2$) $+$ (100 $in.^2 \times 4$) $=$ 450 $in.^2$

3. a. 314 $in.^2$

b. 7,536 $in.^3$

4. a. Divide the volume by the height to find the area of the base.

b. 12.6 ft^2

c. Divide the area by π and take the square root to find the radius.

d. 2 ft

e. the circumference of the circular bases and then the area of the rectangular face of the column

f. circumference of each circle $= 4\pi$ or about 12.6 feet;
area of rectangular face $=$ 226.8 ft^2;
total surface area $=$
226.8 ft^2 $+$ 12.6 ft^2 $+$ 12.6 ft^2 $=$
252 ft^2

Unit Assessment

1. Both are prisms, but a right triangular prism has a base shaped like a triangle while a right rectangular prism has a base shaped like a rectangle.

2. area $= \pi r^2$

3. volume $=$ area of the base $\times$ length of the cylinder

4. diameter $= 2 \times$ radius

5. circumference $= 2\pi \times$ radius

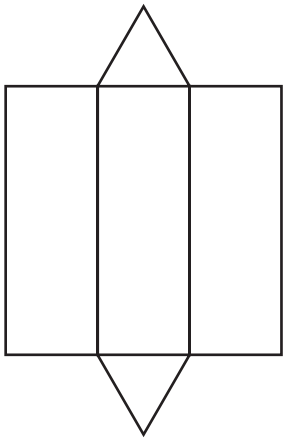
6. 3

7. The friend has confused *B* with *b.*
The correct formula is volume $= B \times l$.

8. a circle

9. You need the area of the base and the length of the prism. For the area of the base, you need the width of the base and the height of the base.

10. Answers will vary, but should be reasonably similar to the figure below.



11. The right triangular prism should be 16 in. tall: Volume of rectangular prism $=$ 96 $in.^3$
Area of triangular prism base $=$ 6 $in.^2$
The height of the triangular prism must be 16 in. to give the same volume as the rectangular prism (6 in $\times$ 6 in = 96 $in.^3$)

3.1 Introduction to Radicals & Pythagorean Theorem

Exploring the Pythagorean Theorem

Student Logbook

1. solar panels

2. 9 ft^2; 16 ft^2; 25 ft^2

3. 36; 64

4. side × side, or length × width

5. **a.** 4

   b. 5

6. 3 ft, 4 ft, 5 ft

7. square

8. $3^2 + 4^2 = 5^2$

9. b. Pythagoras

10. **a.** the side opposite the right angle

    b. It is the longest side.

11. a number raised to the second power

Your Turn

1. Check to see whether 13^2 plus 14^2 is equal to 15^2.

2. 365

3. 225

4. No, it is not a right triangle because $13^2 + 14^2$ is not equal to 15^2.

5. $5^2 + 12^2 = 13^2$

6. 169

7. 169

8. Yes, it is a right triangle because the equation from the Pythagorean theorem holds.

9. side *c*, 13 meters (the longest side)

Investigating Squares & Square Roots

Student Logbook

1. second

2. 64

3. $x \times x$

4. square numbers

5. square root

6. 8

7. radical symbol

8. **a.** the number under the radical symbol

   b. 64

9. 3 ft

10. closer to 5

11. side × side × side

12. radical; 3

13. $\sqrt[3]{27} = 3$

Your Turn

1.

Square Root	6	7	8	9
Square Number	*36*	*49*	*64*	*81*

2. 49 and 64

3. 7 and 8

4. closer to 8 because 60 is closer to 64 than to 49

5. 36 and 49

6. 6 and 7

7. (4) 6.6; the answer must be closer to 7 because 44 is closer to 49 than to 36

Defining Irrational Numbers

Student Logbook

1. 12 ft and 20 ft

2. 8 ft

3. right angle; longest

4. 12; 20

5. **a.** 144

   b. 400

6. $b^2 = 400 - 144$; 256

7. $b = \sqrt{256} = 16$

8. forever

9. a nonterminating, nonrepeating decimal

10. $2\sqrt{3}$

11. a number that can be expressed in the form $\frac{a}{b}$, where b is not equal to 0

12. no

Your Turn

1. $a^2 + b^2 = c^2$

2. $48^2 + b^2 = 50^2$

3. $2304 + b^2 = 2500$

   $2304 - 2304 + b^2 = 2500 - 2304$

   $b^2 = 196$

4. 1, 2, 4, 7, 28, 49, 98, 196

5. 1, 4, 49, 196

6. 196

7. $\sqrt{4 \times 49} = \sqrt{4} \times \sqrt{49} = 2 \times 7 = 14$

8. 14 meters

9. a rational number, because it can be written as a fraction $\left(\frac{14}{1}\right)$

Unit Review

1. a. 35 ft

b. It is opposite the right angle, or it is the longest side.

c. 1225 ft^2

d. 1225 ft^2

2. a. 7

b. 12

c. 8

d. 27

e. 2

3. 12 and 13

4. 13 feet

5. 40 m;

$a^2 + 75^2 = 85^2$

$a^2 = 85^2 - 75^2$

$a^2 = 7225 - 5625$

$a^2 = 1600$

$a = \sqrt{1600} = 40$ m

6.

Number	Rational/Irrational	Fractional/Decimal Form
0.3333...	*rational*	$\frac{1}{3}$
$\sqrt{15}$	*irrational*	
$\sqrt{6}$	*irrational*	
$\frac{1}{7}$	*rational*	*0.142857*
$\sqrt{5^2}$	*rational*	*5*
$\sqrt{289}$	*rational*	*17*

7. 1, 8, 27, 64, 125

Unit Assessment

1. a. 10

b. 11

c. 64

d. 64

e. 1

2.a. Pythagorean theorem

b. Answers will vary. Sample: In a right triangle, the square of the hypotenuse equals the sum of the squares of the other two sides.

c. Side *c* represents the hypotenuse; *a* and *b* represent the legs.

3. $\sqrt{225} = 15$

4. 3^2

5. $\sqrt{25}$

6. for $n = 0$ or $n = 1$

7. 530 is much closer to 529 than to 576, so $\sqrt{530}$ is much closer to 23 than to 24.

8. yes; $18^2 + 24^2 = 30^2$

9. 7 in.

10. Answers will vary. Sample rational square roots: $\sqrt{4}$, $\sqrt{9}$, $\sqrt{16}$.

11. Sample irrational square roots: $\sqrt{3}$, $\sqrt{5}$, $\sqrt{7}$.

3.2 Introduction to Scientific Notation

Writing Numbers using Scientific Notation

Student Logbook

1. 10^4

2. a. $10 \times 10 \times 10 \times 10$ **b.** 10,000

3. 23,700

4. zeros in the power of 10 by which you are multiplying

5. 4

6. exponent

7. 1; 10; 10

Your Turn

1. a. 10,000,000 **b.** 7

c. 93000000.0000 **d.** 93,000,000 miles

2. c

3. 7,500,000,000; 43,000; 9.2×10^3; 2,800,000,000,000; 1.6×10^9

Comparing Numbers in Scientific Notation

Student Logbook

1. left; one

2. 1,000

3. 1,000

4. For every 1,000 meters there is 1 kilometer, so you divide the total number of meters by 1,000 to get the total number of kilometers.

5. 1.36×10^9 km

6. 1,360,000,000 km

7. Answers will vary. Sample: The exponent shows the number of places that the decimal point moves. The greater the exponent, the greater the number.

8. 2.3×10^6; when written in correct scientific notation, a number with an exponent of 6 is larger than one with an exponent of 5

Your Turn

1. a. 36,000,000

b. 3.6×10^7

c. Mercury

d. 10^6 is less than 10^8

2. 33,000,000,000,000,000,000; more compact, easier to read

3. 3.5×10^{11}

Writing Numbers Between 0 & 1 in Scientific Notation

Student Logbook

1. 0.0000000002 m

2.

Power of 10	Standard form	Exponent	Number of zeros
10^3	*1,000*	*3*	*3*
10^2	*100*	*2*	*2*
10^1	*10*	*1*	*1*
10^0	*1*	*0*	*0*
10^{-1}	$\frac{1}{10}$	−1	1

3. The value is divided by 10.

4. because $\frac{10}{10} = 1$

5. the fraction bar

6. 2×10^{-10} m

7. 3×10^{-10} m

8. 0.0000000003 m

Your Turn

1.

Standard form	Scientific notation	
0.23	2.3×10^1	*2.3×10^{-1}*
0.0006	6×10^{-4}	*correct*
0.0081	8.1×10^{-3}	*correct*
0.9	0.9×10^{-1}	*9×10^{-1}*
0.00000007	7×10^{-7}	*7×10^{-8}*

2.

Scientific notation	Standard form	
4.3×10^1	43	*correct*
7×10^{-3}	0.0007	*0.007*
3.9×10^{-5}	0.0000039	*0.000039*
6.65×10^{-2}	0.0665	*correct*
1.2×10^{-6}	$\frac{1}{1{,}200{,}000}$	*0.0000012*

Unit Review

1. a. 55,700,000 km **b.** 5.57×10^7 km

2. a. 399,000,000 km **b.** 3.99×10^8 km

3. 5.57×10^{10} m

4. 3.99×10^{11} m

5. Venus

6. a. 1×10^{-6} m **b.** 1×10^{-4} cm

7. a. the number 1 followed by 100 zeros

b. 1×10^{100}

c. Answers will vary. Sample: It is much easier to write very large and very small numbers in scientific notation because you do not have to write so many digits. Without scientific notation, we would have to write large numbers like the googol in standard form, which is difficult because a googol has so many zeros.

Unit Assessment

1. a. 2×10^{-2}

b. 1.453×10^{6}

c. 1.058×10^{1}

d. 6×10^{-6}

e. 7.67×10^{11}

f. 1.2×10^{7}

2. a. 0.000136

b. 93,000,000

c. 0.02

d. 0.0017

e. 0.000000809

f. 0.00000005602

3. a. 1×10^{-4} m

b. 8×10^{1} m

c. 6.3×10^{11} m

d. 9.045×10^{-1} m

4. least to greatest: 6.023×10^{-9} km; 6 mm; 60.23 mm; 6.023×10^{-4} km; 6,023 m; 6,023,000 cm

4.1 Ratio

Defining Ratio

Student Logbook

1. paper, glass, plastics

2. compost

3. 16 : 24

4. ratio

5. a colon

6. terms

7. 8 : 12

8. Divide the terms by the greatest common factor.

9. 8

10. 2 : 3

Your Turn

1. a. 36 : 48 **b.** 12 **c.** 3 : 4

2. 5 : 17 : 2

3. a. 1 : 3 **b.** 4

4. 9 boys, 12 girls

5. a. yes **b.** 2 : 1

Expressing Ratios as Equivalent Fractions & Decimals

Student Logbook

1. denominator; numerator

2. $\frac{2}{5}, \frac{3}{5}$

3. 0.4, 0.6

4. 40%, 60%

5. 300 tons

6. 120 tons

7. 180 tons

8. Add the terms to get the whole. Express each term as a fraction. $1 + 2 = 3$, $\frac{1}{3}$ of 100 kg $= 33$ kg.

Your Turn

1. a. $\frac{3}{8}$ **b.** $\frac{5}{8}$ **c.** 37.5% **d.** 62.5%

2. 3,092 recycle and 5,154 do not.

3. 3 : 1

4. a. 29% **b.** yes

Forming Ratios Between Unlike Quantities

Student Logbook

1. paper, plastic, glass, metal

2. 10

3. paper

4. 1

5. 100%

6. 36 tons

7. pie chart or circle graph

8. because there are 10 total parts

9. 5

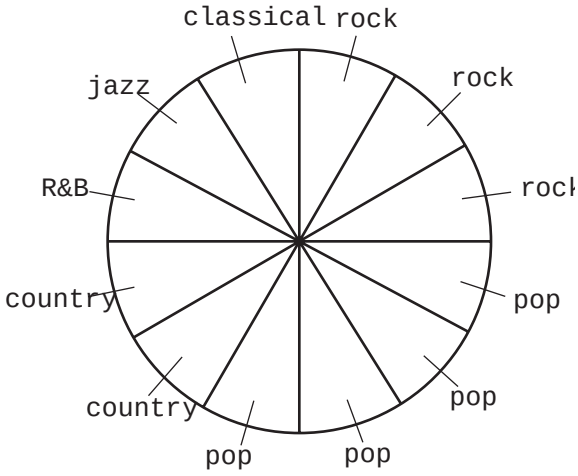
10. It stays the same.

Your Turn

1. a. 12 **b.** Pop **c.** $\frac{12}{12}$

d. 25% **e.** 2,000 CDs

2. a.



b. 12

c. 2

Unit Review

1. a. 56 : 32 **b.** d (8) **c.** 7 : 4

2. a. $\frac{7}{9}$, $\frac{2}{9}$

b. 78% in land, 22% in water

c. Change the ratio into fractions, then decimals, then multiply the decimals by 100 to get the percents.

3. a. 3 : 2 : 1

b. (1) 3 : 2 : 1

4. a.

Dimensions	Actual Stadium	Scale Model
Length	225 m	75 cm
Width	*75 m*	25 cm
Height	30 m	*10 cm*

b. 1 : 300 (because 1 cm on the model = 300 cm, or 3 m on the actual stadium)

Unit Assessment

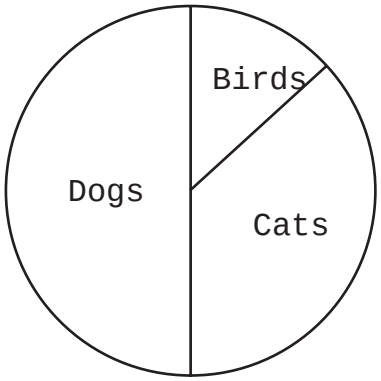
1. a. 5 : 3 **b.** 5 and 3

2. a. dogs $\frac{1}{2}$, cats $\frac{5}{14}$, birds $\frac{1}{7}$

b. dogs 50%, cats 36%, birds 14%

c. 86 dogs, 62 cats, 24 birds

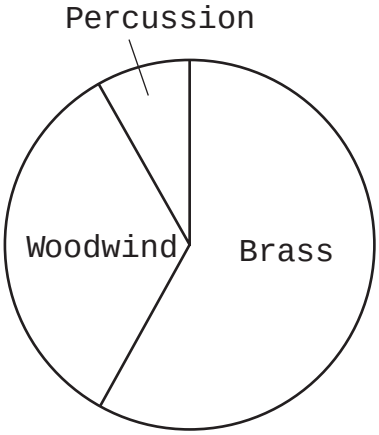
d.



3. a. 6 : 3 : 1

b. woodwind

c.



d. 67 brass players, 34 woodwind players, 11 percussion players

4.2 Proportion

Defining a Proportion

Student Logbook

1. security, police, doctors, and paramedics

2. 37,500 people

3. 2

4. 2 : 250

5. 4

6. They are equivalent ratios.

7. $\frac{2}{250}$, $\frac{4}{500}$

8. equal; equal

9. equality; two ratios

10. increase

11. 1 : 4

12. ratios; fractions

Your Turn

1. 3 : 1,125

2. d

3. 3 : 1,125 = 6 : 2,250

4. b

5. a. 10 : 40

b. $\frac{10}{40} = \frac{30}{120}$

Solving for a Variable in a Proportion

Student Logbook

1. 2 : 250 = *c* : 37,500

2. the total number of race officials required

3. 300

4. means; extremes

5. its middle terms, which are its second and third terms

6. extremes; outside

7. 75,000; 75,000

8. that the product of the means equals the product of the extremes

9. a variable

10. *a* : *b* = *c* : *d*; *ad* = *bc*

Your Turn

1. 3 : 1,125 = *r* : 37,500

2. $\frac{3}{1{,}125} = \frac{r}{37{,}500}$

3. b

4. 100 recycling bins

5. 22,500

6. a

Applying the Means/Extremes Property

Student Logbook

1. 2,667 lb

2. 0.45

3. the weight of the mobile first-aid unit in kg

4. 1 lb : 0.45 kg = 2,667 lb : *d*

5. units; units

6. the means and extremes, which are the second and third terms and the first and fourth terms

7. 1,200 kg

8. same order

9. the variable

Your Turn

1. 60 cm

2. a. No; the product of the means is 8, but the product of the extremes is 10, so Dijit's proportion cannot be correct.

b. 5 : 2 = 4 : 1.6

3. 135

Unit Review

1. a. 4 : 7

b. 8 : 14

2. a. 21 feet

b. 4 feet 3 inches

3. a. No; Eight people would weigh 1,200 pounds, and the unit can only carry 1,143 pounds.

b. 520 kg

4. d

Unit Assessment

1. a. 320 : 80

b. 640 : 160

c. 320 : 80 = 640 : 160

d. $\frac{320}{80} = \frac{640}{160}$

2. a. 108

b. 4 : 9 = 108 : 243; 9 and 108; 4 and 243

c. 194

3. No; the cross-products in the proportion are not equal. There are only enough hotel rooms for 12,900 spectators.

4.

Place	Time	Miles/Hour	Kilometers/Hour
1	30 min	*24 mi/hr*	*38.4 km/hr*
2	32 min	*22.5 mi/hr*	*36.0 km/hr*
3	38 min	*19 mi/hr*	*30.4 km/hr*
4	41 min	*17.6 mi/hr*	*28.2 km/hr*
5	46 min	*15.7 mi/hr*	*25.1 km/hr*

4.3 Direct & Inverse Variation

Exploring & Solving Direct Variation Problems

Student Logbook

1. more than 1,000 feet

2. weight

3. deeper; shallow

4. increase; decrease

5. constant; directly proportional

6. $\propto$

7. you cannot change one without affecting the other

8. 53.4 psi; 120 ft

9. $P : D = p : d$

10. 350 feet

Your Turn

1. d

2. a. 12 miles

b. 42 miles

c. 5 min : 1 mile = 210 min : 42 miles

Exploring Inverse Variation

Student Logbook

1. inversely proportional

2. the number of times a cog makes a complete turn in one minute

3. $R \propto \frac{1}{T}$

4. reciprocal

5. $\frac{1}{T}$

6. decrease; slower

7. $R : \frac{1}{T}$

8. equivalent ratios

9. $\frac{r}{\frac{1}{t}} = \frac{R}{\frac{1}{T}}$

10. $rt = RT$

Your Turn

1. a. $P = \frac{1}{V}$

b. $P : \frac{1}{V} = p : \frac{1}{v}$

c. $PV = pv$

2. a

3. Javier wants the wheel, but not the pedals, to turn faster. Because his speed (rpm) is inversely proportional to the number of cogs on the sprocket, he should shift the chain to a sprocket with fewer cogs. His speed is inversely proportional to the number of cogs; a sprocket with fewer cogs will turn faster.

Solving Inverse Variation Problems

Student Logbook

1. revolutions; teeth

2. The cog turns at 30 rpm.

3. equal

4. 24 teeth

5. twice

6. increase

7. 20 rpm

8. $\frac{1}{3}$; 3

9. 180 rpm

10. equivalent products; quantity

11. opposite

Your Turn

1. a. half

b. 40 psi

c. 50 feet

2. No. If it were an inverse variation, the number of butterflies would decrease as the temperature increased, or vice versa.

3. a. $\frac{1}{2}$ unit

b. 100 m

Unit Review

1. a. $d \propto t$

b. 3 miles

2. a. 50

b. 528

c. 1

3. a. $M \propto \frac{1}{P}$

b. an increase in the number of trees with moss on them

4. As the interest rate r increases, the time required to double an investment decreases.

5. a. Temperature must be inversely proportional to altitude.

b. The equipment on airliners is most likely designed for very low temperatures, because temperature decreases as altitude increases.

Unit Assessment

1. a. They are directly proportional.

b. 135.8°F

c. 74.3°F

d. No, because the proportion is not correct. If it had been sunny all day, the temperature in the car should have been 96.6°F.

2. a. $F_1 : \frac{1}{B_1} = F_2 : \frac{1}{B_2}$

b. $F_1 B_1 = F_2 B_2$

3. a. $I \propto \frac{1}{d^2}$

b. 2.1 meters

4. a–c. Answers will vary, depending on the relationships students choose as examples.

4.4 Similar Polygons

Defining Similarity

Student Logbook

1. recycled plastic

2. The molding unit heats recycled plastic and molds it into cycle helmet casings.

3. The assembly unit puts the cycle helmet casing parts together and packages the helmets.

4. by way of a conveyor belt

5. 2 : 3

6. 12 m; 10 m

7. the new length

8. $2 : 3 = 12 : x$; $\frac{2}{3} = \frac{12}{x}$

9. 18 m; 15 m

10. ratio

11. change; shape

Your Turn

1. 6 feet; 2 feet

2. a

3. impossible to tell

4. they look similar, but insufficient information is provided.

Identifying Equivalent Ratios

Student Logbook

1. a. The length of the molding unit stays the same.

b. It is to be expanded so that both dimensions are proportional to the dimensions of the new assembly unit.

2. proportional

3. 18 m

4. equal

5. They are similar rectangles.

6. 20 m

7. congruent; proportion

8. a closed figure with 3 or more sides

9. True

10. proportions

Your Turn

1. 60 meters; 45 meters; 30 meters.

2. Yes; triangles are closed figures having 3 sides, so they meet the definition of polygon.

3. impossible to tell

4. In order to be similar, triangles must have congruent angles and congruent sides. It is not possible to determine whether these triangles are similar because the measures of the angles not shown is unknown and the measures of the sides is unknown.

5. $1\frac{1}{2}$

6. 2 : 1

Setting up & Solving Proportions in Similar Polygons

Student Logbook

1. the conveyor belt

2. 10 m

3. opposite; conveyor belt

4. Pythagorean theorem; hypotenuse; legs

5. 16 m

6. 8 m

7. Divide by 2 because it forms the hypotenuse of a similar right triangle that is proportionally smaller by $\frac{1}{2}$.

8. congruent; proportion

9. 1 : 2

Your Turn

1. b

2. c

3. a. 24

b. Yes; their corresponding angles are congruent and their corresponding sides are proportional in the ratio 1 : 1.

4. 30 ft

Unit Review

1. 25 m; 18.75

2. a, c

3. 1.5 units: 5 units

4. 30 meters; 45 meters

5. a. 48 square units; 108 square units

b. 4 : 9

c. This is not the same as the ratio of the sides, 2 : 3. The ratio of the areas is equal to the ratio of the sides squared.

Unit Assessment

1. a. Going counterclockwise from the given length of $1\frac{1}{4}$, the lengths of the sides are 0.9, 1.8, 2.5, 0.4, and 2.1.

b. 17 : 5

c. 17 : 5; Because it is the same as the ratio between one of the sides of the large hexagon and the corresponding side of the small hexagon

2. a. no

b. 37.5 feet

3. 64.7 cm (Note: Explain to students that the dotted line divides the triangle into 2 right triangles. It also splits the bottom side in half. That means that the length of the bottom segment, from the angle to the dotted line is $\frac{1}{2}c$. Substituting this into the Pythagorean theorem gives you $(\frac{1}{2}c)^2 + 56^2 = c^2$, which can then be solved for c.)

4. Answers will vary.

5.1 Interpreting & Constructing Graphs

Exploring Line Graphs

Student Logbook

1. global monthly revenues for 6 months

2. September

3. He wanted to find the month in which the company earned the most money.

4. Month; millions

5. to show a higher predicted revenue for October and November

6. up

7. Draw a line going up from November and another line across from $12 million. The point at which the two lines cross shows sales for November.

8. July

9. positive trend

10. trend line

11. a tendency or a pattern

12. Sales are decreasing.

Your Turn

1. the average number of games sold each month

2. Points should be marked for October and November for Space Mission and for January and February for Paragon.

3. All points should be connected for both lines.

4. Space Mission

5. March

6. Paragon

7. Space Mission shows a negative trend and Paragon shows a positive trend.

Exploring Bar Graphs

Student Logbook

1. city

2. number of units sold

3. to compare sales in different cities in the same time period

4. Data are pieces of information.

5. axes

6. scale

7. 5,500 to 13,500

8. A range is a minimum value, a maximum value, and all the values in between.

9. You can show 1,000 on the graph; if 100 were used, the scale would be too large to fit on the graph.

10. the range of values and the divisions in the scale

11. He used a broken axis.

Your Turn

1. Computers in Four Countries (1995)

2. b

3. Scale b should be drawn on the vertical axis; axis should be labeled Number of Computers (in millions).

4. Bars for the four countries should reflect the data given and should be of the same width and be spaced equally apart.

5. a. 4 million more **b.** France **c.** 32.73%

Interpreting Pie Charts

Student Logbook

1. game sales in August

2. sectors or sections

3. percent; 100 percent

4. 360; 100 percent

5. sectors; size

6. $\frac{60}{100} = \frac{x}{360}$

7. He used a protractor.

8. $\frac{90{,}000}{200{,}000} = \frac{x}{100}$

9. 45

10. $\frac{45}{100} = \frac{d}{360}$; 162

11. 100

12. 360

Your Turn

1. Home and Education and Government

2. 46%

3. no

4. 122.4°

5. Homework: 42%; 151.2°
Surfing the Net: 25%; 90°
Playing Computer Games: 29%; 104.4°
Writing E-mail: 4%; 14.4°

Unit Review

1. a. negative trend **b.** positive trend

2. February

3. a. *The Rock*

b. The range is approximately 125–300

c. about 25%

4. Check pie chart for correct labels and correct percentages. Percents and angles should be: swimming 10% and 36°, tennis 15% and 54°, basketball 25% and 90°, football 20% and 72°, soccer 12.5% and 45°, and golf 17.5% and 63°.

5. Check that the graph is appropriately labeled, that the calculations are correct, and, if a scale is used, that it is appropriate.

6. Answers will vary. The student should give a reasonable explanation for choosing a particular graph.

Unit Assessment

1. a line graph

2. c

3. make comparisons

4. a pie chart

5. Write a proportion: $\frac{\text{percent}}{100} = \frac{d \text{ (for degree)}}{360}$. Then solve for d.

6. c

7. a

8. $\frac{11}{24} = \frac{x}{100}$; $1100 = 24x$; $x = 45.8\%$

9. 140.4° (39% × 360°)

10. a. Rentals decreased.

b. Grant's Video Store

c. Grant's: negative trend line; Video Warehouse: positive trend line

11. 9.3%

5.2 The Mean, Median, & Mode

Defining the Mean & Median

Student Logbook

1. "raw data" means pieces of information that have not been analyzed or processed

2. 20

3. sample

4. bought Max Orbit

5. typical value

6. sum; dividing; number

7. median; increasing; decreasing

8. the middle value in the data set

9. a. equal **b.** mean

10. $\frac{14}{20}$, or 70%, of people are within a 5-year range of the median age, so it gives a good indication of the typical age of the game buyer

Your Turn

1. a. 27 to 115 **b.** 74 to 148

c. 27 to 148

2. 18

3. a. 83; 93 **b.** 98; 83

c. 91; 90.5

4. The mean. The mean for Week 2 is 98, which shows an improvement over the mean mean for Week 1 of 83. The median shows a decline with 93 for Week 1 and 83 for Week 2.

5. Yes. The range for Week 1 is 27 to 115 and for Week 2 it is 74 to 148. This shows that both the lowest and highest scores improved the second week.

Defining the Mode

Student Logbook

1. mode

2. 9

3. older

4. 12

5. Find out which value most accurately represents the typical age.

6. most of the people in the sample are under 24 years of age

7. 70

8. median; Because most of the people surveyed are over 9 years old.

9. adults; 13

10. data

Your Turn

1. 3; 11

2. 7 hours

3. 6.8 hours

4. Arrange the values in increasing or decreasing order, then find the middle value.

5. 7 hours

6. 7 hours

7. No, all three are good measures of central tendency. Because all three measures are approximately 7 hours, the mean, the median, and the mode are all good measures of central tendency.

Calculating the Mean, Median, & Mode

Student Logbook

1. 1; 10

2. typical

3. mean; median; mode

4. 6.5 marks

5. increasing; 6 marks; he found the mean of the two middle values in the data set

6. 6 marks

7. small; different

8. there were a few extreme values in the sample

9. when there is a narrow range of values

Your Turn

1. b

2. 3.3

3. 3

4. 4

5. The mode shows that most players thought the game was difficult, though the mode only represents $\frac{10}{30}$ players, or about 33%. The median shows that the game is moderately difficult. The median is close to the mean of 3.3. The mean shows that players thought the game was a bit more than moderately difficult.

6. mean; the range of the data is narrow

Unit Review

1. 20

2. 5; 45

3. 15

4. 18.5

5. 2, 3, 3, 3, 4, 5, 6, 6, 7, 9

6. mode

7. 4.8; 4.5

8. 75.7; 80; 80

9. The median and mode of 80 most typically represent Paula's sales. 50% of the days are within a 5-point range of the median and mode. Only 40% of the days fall within a 5-point range of the mean, so the mean is not the best measure of central tendency.

10. 1; 115

11. 22.8; 15; 15

12. Stock 15 games for the sale. The mean is about 23 games, but the range is wide, with sales ranging from 1 to 115 games per day. Only 5 games sold within a 5-point range of the mean. That is only about 17% of the games. The median and mode are both at 15, and 14 games sold within a 5-point range of that. That represents about 47% of the games. Since the median and mode represent the most typical value of games sold, 15 games should be stocked for the sale.

Unit Assessment

1. a. 16

b. 17

2. a. 3.3 hours **b.** 2; mode **c.** 3; median

3. 1; 5; 20

4. 2

5. 2.75

6. A mode of 2 indicates that most subscribers think the newsletter is just okay. It was rated less than good by $\frac{9}{20}$,or 45%, of the subscribers. The mean is just under 3 and the median is 3. The editor probably wants to improve the newsletter so it will receive a higher rating.

7. 14.1; 10.5; 7

8. 38; 43; 23

9. 47; 50; 49

5.3 Frequency Distribution

Creating and Interpreting a Frequency Table

Student Logbook

1. Beginners; Intermediate; Expert

2. 40

3. 3

4. ~~THL~~ I

5. numerals

6. frequency; the number of times that each score occurred

7. sum; score; number of values

8. frequency; add the results

9. $\frac{\Sigma f(x)}{\Sigma f}$

10. 40; 300; Level 2

11. data; each data item appears

Your Turn

1.

Number of rejects	45	60	80	85	87	95	100	123	125
Frequency									

2. 9

3.

Number of rejects	45	60	80	85	87	95	100	123	125
Frequency	III	III	IIII	II	~~THL~~ I	IIII	II	II	IIII

4.

Number of rejects	45	60	80	85	87	95	100	123	125
Frequency	*3*	*3*	*4*	*2*	*6*	*4*	*2*	*2*	*4*

5.

Number of rejects	45	60	80	85	87	95	100	123	125
Frequency	3	3	4	2	6	4	2	2	4
	135	*180*	*320*	*170*	*522*	*380*	*200*	*246*	*500*

6. 88 ($\frac{2653}{30} \approx 88.4$)

Defining a Histogram

Student Logbook

1. grouped frequency table

2. Frequency: 2, 14, 7, 11, 4, 1, 1

3. histogram; frequency

4. horizontal; vertical; measured data

5. mid-interval; highest; lowest; 2

6. frequency; sum; scores; 270.5

7. less

Your Turn

1. Number of rejects: 21–40; 41–60; 61–80; 81–100; 101–120; 121–140

2. Frequency: 0, 0, 6, 4, 14, 0, 6

3. Bars should be next to each other. Divisions should be 2 or 3. There should be two spaces provided for the intervals 1–20 and 21–40. The horizontal axis should be *Rejects*, and the vertical axis should be *Frequency*. The bars should be drawn according to the frequency. Title should indicate that the histogram measures rejected helmets.

4. Mid-interval values: 50.5, 70.5, 90.5, 110.5, 130.5

5. 87 ($303 + 282 + 1267 + 221 + 522 = \frac{2595}{30} = 86.5$)

Exploring Cumulative Frequency Graphs

Student Logbook

1. 80th

2. cumulative frequency; curve

3. all the frequencies added in succession

4. The last number is 40 because there were 40 scores to begin with.

5. 50; game scores; 5; cumulative frequency

6. b

7. fits

8. at; below

9. The curve is approximate.

10. c

Your Turn

1. Cumulative frequency: 3, 6, 10, 12, 18, 22, 24, 26, 30

2. 30; there were 30 employees in all

3. Points: (45, 3), (60, 6), (80, 10), (85, 12), (87, 18), (95, 22), (100, 24), (123, 26), (125, 30)

4. Check the curve for fit.

5. **a.** 3
b. 6

Unit Review

1. The table should contain the following numbers and tally marks: 63, 1; 67, 1; 69, 1; 72, 2; 73, 1; 75, 2; 76, 1; 77, 2; 78, 6; 82, 2; 84, 1; 85, 2; 87, 1; 88, 2; 90, 3; 94, 1; 96, 1.

2. 80.16 (accept 80.2) $\frac{2405}{30} = 80.16$

3. Intervals and numerals: 61–70, 3; 71–80, 14; 81–90, 11; 91–100, 2

4. Vertical axis: Title is *Frequency* in divisions of 1 from 0 to 14; Horizontal axis: Title is *Test Scores*; bars should be next to each other: 0–10, 0; 11–20, 0; 21–30, 0; 31–40, 0; 41–50, 0; 51–60, 0; 61–70, 3; 71–80, 14; 81–90, 11; 91–100, 2.

5. 79.5 ($\frac{2385}{30} = 79.5$)

6. Cumulative frequency: 1, 2, 3, 5, 6, 8, 9, 11, 17
Cumulative frequency: 19, 20, 22, 23, 25, 28, 29, 30

7. Points: 1, 63; 2, 67; 3, 69; 5, 72, 6, 73; 8, 75; 9, 76; 11, 77; 17, 78; 19, 82; 20, 84; 22, 85; 23, 87; 25, 88; 28, 90; 29, 94; 30, 96. Curve should be smooth and steeply vertical.

8. approximately 84 (use a range of 2 points on either side of 84)

9. 78; 78 is close to 80.16 and 79.5, so the mean and the 50th percentile are approximately equal.

Unit Assessment

1. a. Table should have the following ranks: 1, 2, 3, 4, 5, 6, 7, 9

Frequencies should be: 2, 3, 5, 3, 4, 5, 4, 4

b. $f(x)$: 2, 6, 15, 12, 20, 30, 28, 36

c. Mean: $\frac{149}{30} = 4.96$ or approximately 5

d. No; no; Super Nova Soda should not make and sell the new soda because it is not very popular.

2. a. Groups: 1–2, 3–4, 5–6, 7–8, 9–10

Frequency: 5, 8, 9, 4, 4

b. 1.5, 3.5, 5.5, 7.5, 9.5

c. 7.5, 28.0, 49.5, 30.0, 38.0

d. 5.1

3. Sample answer: Vertical axis can have divisions of 1, from 0 to 9. Label is *Frequency*. Horizontal axis should have 5 bars next to each other, each one covering at least 2 grids. Each bar should be labeled. Label for axis is *Rank*. Correctly drawn bars: 1–2 is 5, 3–4 is 8, 5–6 is 9, 7–8 is 4, 9–10 is 4. Title: Rankings for Super Nova Soda

4. a. 5–6

b. 17

c. $\frac{17}{30}$ or 56.6%

5. Cumulative frequency: 2, 5, 10, 13, 17, 22, 26, 30

6. Vertical axis should be labeled *Cumulative frequency*, with divisions of 2 from 0 to 30.

Horizontal axis should be labeled *Rank*, with divisions of 1 from 0 to 9.

Plot points: 2,1; 5,2; 10,3; 13,4; 17,5; 22,6; 26,7; 30,9

Curve should be smooth and drawn in on the graph.

7. a. approximately a little over 6

b. It means that 80% of the customers ranked Super Nova Soda at a little over 6 or below.

c. 20%

6.1 Simple Probability

Defining & Expressing Probability

Student Logbook

1. random; equal

2. two; coin

3. outcome

4. desired outcome

5. desired; possible

6. probability

7. $\frac{1}{2}, \frac{1}{2}$

8. 1

9. 0

10. sample space

11. Yes. There is a 50% chance that the coins will match, and Dijit will win. There is also a 50% chance that the coins will not match, and Zack will win.

Your Turn

1. a. 3

b. No; a coin toss works only when there are two choices.

c. 1

d. $\frac{1}{3}$

e. 1

2. a. Alison's chart:

	S	L	R
S	SS	*SL*	*SR*
L	*LS*	*LL*	LR
R	RS	*RL*	*RR*

b. $\frac{1}{3}$

Calculating Probabilities on a Color Wheel

Student Logbook

1. a. $\frac{\text{Number of desired outcomes}}{\text{Number of possible outcomes}}$

b. sector

c. 6

d. 3

2. number of sectors; there are 6 possible outcomes

3. 1

4. $\frac{1}{6}$

5. 2

6. $\frac{1}{3}$

7. $\frac{1}{2}$

8. Blue; the probability of blue is $\frac{1}{2}$, which is greater than the probabilities for red and for yellow.

9. No; it is possible that the other colors will occur.

Your Turn

1. 6

2. $\frac{1}{6}$

3. 2

4. $\frac{2}{6}$ or $\frac{1}{3}$

5. 3

6. $\frac{3}{6}$ or $\frac{1}{2}$

7. $\frac{6}{6}$ or 1

8. $\frac{0}{6}$ or 0

9. a–c. Answers will vary. Check students' work.

Determining Probabilities of Complementary Events

Student Logbook

1. Nobody

2. $\frac{1}{6}$

3. 1

4. $1 - \frac{1}{6} = \frac{5}{6}$

5. 2

6. $\frac{1}{2}$

7. 2

8. $\frac{1}{2}$

9. No; all numbers on the wheel are either odd or even, so the number of desired outcomes for neither Zack nor Dijit winning is zero.

Your Turn

1. a. 7

b. $\frac{1}{7}$

c. $\frac{4}{7}$

d. 4

e. $\frac{3}{7}$

f. $\frac{4}{7}$

g. $\frac{4}{7}$

h. $\frac{2}{7}$

2. a. 5

b. $\frac{5}{6}$

c. $\frac{1}{6} + \frac{5}{6} = \frac{6}{6}$ or 1

Unit Review

1. a. 7

b. (1)

c. 6

d. $\frac{6}{7}$

2.

P(2)	P(odd number)	P(9)	P(prime number)	P(≥ 3)	P(number)
$\frac{1}{8}$	$\frac{1}{2}$	0	$\frac{4}{8} = \frac{1}{2}$	$\frac{6}{8} = \frac{3}{4}$	1
12.5%	50%	0%	50%	75%	100%

3. a. $\frac{8}{100}$ or 8%

b. 1 or 100%

c. 100% − 8% = 92% or $\frac{92}{100}$

d. $\frac{999}{1000}$ or 99.9%

4. a. $\frac{3}{4}$ **b.** $\frac{1}{4}$

Unit Assessment

1. a. 5

b. 4

c. $\frac{4}{5}$

d. 80%

e. $\frac{1}{5}$, or 20%

f. $\frac{0}{5}$, or 0

g. 1

2. $\frac{1}{6}$

3. a. $\frac{4}{8}$, $\frac{1}{2}$, or 50%

b. The probability is $\frac{4}{8}$, or 50%. The prime numbers are 2, 3, 5, and 7, so the number of possible outcomes is 4.

4. $\frac{6}{24}$, or $\frac{1}{4}$; 25%

5. 60 min - 18 min = 42 min; $\frac{7}{10}$; 70%

6. a. $\frac{1}{4}$ **b.** $\frac{1}{2}$ **c.** $\frac{1}{4}$

6.2 Probability of Combined Events

Calculating the Probability of Independent Events

Student Logbook

1. 3; 2

2. 2

3. a. AD, AE, BD, BE, CD, CE

b. 6 possible combinations

4. independent

5. Probability = $\frac{\text{Number of desired outcomes}}{\text{Number of possible outcomes}}$

6. 6

7. c

8. Answers will vary. Check students' work.

Your Turn

1. a. Yes

b.

Pool \ Route	R1	R2	R3	R4	R5
P1	*P1R1*	*P1R2*	*P1R3*	*P1R4*	*P1R5*
P2	*P2R1*	*P2R2*	*P2R3*	*P2R4*	*P2R5*
P3	*P3R1*	*P3R2*	*P3R3*	*P3R4*	*P3R5*

c. 5

d. 15

e. $\frac{1}{3}$

f. $\frac{1}{5}$

g. $\frac{1}{15}$

Determining the Sample Space of an Experiment

Student Logbook

1. the probability that it will be clear one or both days

2. True

3. mutually exclusive

4. sample space

5. $\frac{25}{49}$

6. $\frac{45}{49}$

7. 45

8. snow on both days

9. Answers will vary. Check students' work.

Your Turn

1. a. yes **b.** 1 **c.** $\frac{4}{10}$ **d.** $\frac{6}{10}$; no

e. 0.36; 0.16 **f.** 0.48 **g.** 0.84

2. a. 0.98 **b.** 0.0004 **c.** 0.0188

Calculating the Probability of Dependent Events

Student Logbook

1. No, they are independent events.

2. mutually exclusive

3. because it branches like a tree

4. event

5. multiplying

6. independent

7. dependent

8. Answers will vary. The tree should show two events with three branches for each event. If order of flavors does not matter, then there are six different ice cream cones.

Your Turn

1. a. yes

b. $\frac{1}{4}$; The probability the first serve will be successful is $\frac{3}{4}$. A serve is either successful or not. So the total probability is 1 and $1 - \frac{3}{4} = \frac{1}{4}$

c. $\frac{1}{10}$; The probability the second serve will be successful is $\frac{9}{10}$. A serve is either successful or not. So the total probability is 1 and $1 - \frac{9}{10} = \frac{1}{10}$.

d. $\frac{1}{40}$; $\frac{1}{4} \times \frac{1}{10} = \frac{1}{40}$

e. Since the total probability must be 1, the probability a top notch player will serve successfully is $1 - \frac{1}{40} = \frac{39}{40}$.

2. a. The choices are dependent events, because the first choice does affect the outcome of the second choice.

b. $\frac{1}{3}$

Unit Review

1. a. $\frac{1}{4}$

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

c. $\frac{1}{2}$

FIRST ROLL \ SECOND ROLL	R	O	Y	B	G	V
R	*R,R*	*R,O*	*R,Y*	*R,B*	*R,G*	*R,V*
O	*O,R*	*O,O*	*O,Y*	*O,B*	*O,G*	*O,V*
Y	*Y,R*	*Y,O*	*Y,Y*	*Y,B*	*Y,G*	*Y,V*
B	*B,R*	*B,O*	*B,Y*	*B,B*	*B,G*	*B,V*
G	*G,R*	*G,O*	G,Y	*G,B*	*G,G*	*G,V*
V	*V,R*	*V,O*	*V,Y*	*V,B*	*V,G*	*V,V*

2. a. $\frac{1}{6}$ **b.** $\frac{21}{36}$ or $\frac{7}{12}$ **c.** $\frac{3}{36}$ or $\frac{1}{12}$ **d.** $\frac{9}{36}$ or $\frac{1}{4}$

3. a. dependent; the number of coins was different after the first grab

b. $\frac{10}{24} \times \frac{9}{23} = \frac{90}{552} = \frac{15}{92}$

4. a. yes

b. $\frac{4}{10}$ or 40%

c. $\frac{6}{10} \times \frac{6}{10} = \frac{36}{100}$

d. $\frac{4}{10} \times \frac{4}{10} = \frac{16}{100}$

Unit Assessment

1. a. yes

b. $\frac{1}{3}$

c. $\frac{1}{3}$

2. a. yes

b. $\frac{1}{2}$

c. $\frac{1}{3}$

d. Check students' diagrams. There should be two events, one with two branches and one with three branches, for a total of six outcomes.

e. $2 \times 3 = 6$

3. $\frac{24}{100}$ or 24%

4. $\frac{6}{10} \times \frac{1}{3} = \frac{6}{30}$ or $\frac{1}{5}$

5. a. $\frac{6}{30}$ or $\frac{1}{5}$

b. $\frac{6}{120}$ or $\frac{1}{20}$

c. 0

d. dependent