Exercise Set 2.5

1. ***Familiarize.*** Let x = the number. Then "two fewer than ten times a number" translates to $10x-2$.
Translate.
$$\underbrace{\text{Two fewer than ten times a number}}\ \text{is}\ 78.$$
$$\downarrow \qquad\qquad \downarrow\ \downarrow$$
$$10x-2 \qquad = \ 78$$
Carry out. We solve the equation.
$10x-2=78$
$10x=80$ Adding 2
$x=8$ Dividing by 10
Check. Ten times 8 is 80. Two less than 80 is 78. The answer checks.
State. The number is 8.

2. ***Familiarize.*** Let x = the number. Then "three less than twice a number" translates to $2x-3$.
Translate.
$$\underbrace{\text{Three less than twice a number}}\ \text{is}\ 19.$$
$$\downarrow \qquad\qquad \downarrow\ \downarrow$$
$$2x-3 \qquad = \ 19$$
Carry out. We solve the equation.
$2x-3=19$
$2x=22$ Adding 3
$x=11$ Dividing by 2
Check. Twice, or 2 times, 11 is 22. Three less than 22 is 19. The answer checks.
State. The number is 11.

3. ***Familiarize.*** Let x = the number. Then "five times the sum of 3 and some number" translates to $5(3+x)$.
Translate.
$$\underbrace{\text{Five times the sum of three and some number}}\ \text{is}\ 70.$$
$$\downarrow \qquad\qquad \downarrow\ \downarrow$$
$$5(3+x) \qquad = 70$$
Carry out. We solve the equation.
$5(3+x)=70$
$15+5x=70$ Distribitive Law
$5x=55$ Subtracting 15
$x=11$ Dividing by 5
Check. Three plus 11 is 14. Five times 14 is 70. The answer checks.
State. The number is 11.

4. ***Familiarize.*** Let x = the number. Then "twice the sum of 4 and some number" translates to $2(4+x)$.
Translate.
$$\underbrace{\text{Twice the sum of 4 and some number}}\ \text{is}\ 34.$$
$$\downarrow \qquad\qquad \downarrow\ \downarrow$$
$$2(4+x) \qquad = \ 34$$
Carry out. We solve the equation.
$2(4+x)=34$
$8+2x=34$ Distributive Law
$2x=26$ Subtracting 8
$x=13$ Dividing by 2
Check The sum of 4 and 13 is 17. Twice 17 is 34. The answer checks.
State. The number is 13.

5. ***Familiarize.*** Let p = the price of the 8-GB iPod Nano. At 20% more, the 16-GB iPod Nano is 120% of the 8-GB iPod Nano.
Translate.
$$\$180\ \text{is}\ 120\%\ \text{of}\ \underbrace{\text{the 8-GB iPod Nano}}.$$
$$\downarrow\ \ \downarrow\ \ \downarrow \qquad \downarrow \qquad\qquad \downarrow$$
$$180\ = 1.20 \quad \cdot \qquad\qquad p$$
Carry out. We solve the equation.
$180=1.20\cdot p$
$\dfrac{180}{1.20}=p$ Dividing by 1.20
$150=p$
Check. 120% of \$150, or 1.20(\$150), is \$180. The answer checks.
State. The price of the 8-GB iPod Nano was \$150.

6. ***Familiarize.*** Let p = the price of the TI-89 Titanium graphing calculator. At 20% less, the TI-84 Plus graphing calculator is 80% of the cost of the TI-89 Titanium.
Translate.
$$\$120\ \text{is}\ 80\%\ \text{of}\ \underbrace{\text{the TI-89 Titanium}}.$$
$$\downarrow\ \ \downarrow\ \ \downarrow \qquad \downarrow \qquad\qquad \downarrow$$
$$120\ = 0.80 \quad \cdot \qquad\qquad p$$

Carry out. We solve the equation.

$$120 = 0.80 \cdot p$$
$$\frac{120}{0.80} = p \quad \text{Dividing by } 0.80$$
$$150 = p$$

Check. 80% of \$150, or 0.80(\$150), is \$120. The answer checks.

State. The price of the TI-89 Titanium graphing calculator was \$150.

7. ***Familiarize.*** Let p = the cost of the Nike running shoes. The sales tax is 7%.

Translate.

$$\underbrace{\text{Price of Nike shoes}}_{\displaystyle p} \;\; \underset{\displaystyle +}{\text{plus}} \;\; \underbrace{\text{sales tax}}_{\displaystyle 0.07p} \;\; \underset{\displaystyle =}{\text{is}} \;\; \underset{\displaystyle 90.95}{\$90.95.}$$

Carry out. We solve the equation.

$$p + 0.07p = 90.95$$
$$1.07p = 90.95 \quad \text{Combining like terms}$$
$$p = \frac{90.95}{1.07} \quad \text{Dividing by } 1.07$$
$$p = 85$$

Check. The Nike running shoes cost \$85 and the sales tax is $0.07 \cdot \$85 = \$5.95$. Because \$85 + \$5.95 = \$ 90.95, the answer checks.

State. The cost of the running shoes is \$85.

8. ***Familiarize.*** Let p = the cost for a Cannon printer. The sales tax is 6%.

Translate.

$$\underbrace{\text{Price of printer}}_{\displaystyle p} \;\; \underset{\displaystyle +}{\text{plus}} \;\; \underbrace{\text{sales tax}}_{\displaystyle 0.06p} \;\; \underset{\displaystyle =}{\text{is}} \;\; \underset{\displaystyle 275.60}{\$275.60.}$$

Carry out. We solve the equation.

$$p + 0.06p = 275.60$$
$$1.06p = 275.60 \quad \text{Combining like terms}$$
$$p = \frac{275.60}{1.06} \quad \text{Dividing by } 1.06$$
$$p = 260$$

Check. The Cannon printer costs \$260 and the sales tax is $0.06 \cdot \$260 = \$15.60$. Because \$260 + \$15.60 = \$260.60, the answer checks.

State. The cost of the printer is \$260.

9. ***Familiarize.*** Let d = Kouros' distance, in miles, from the start after 16 hr. Then the distance from the finish line is $2d$.

Translate.

$$\underbrace{\begin{matrix}\text{Distance}\\ \text{from start}\end{matrix}}_{\displaystyle d} \;\; \underset{\displaystyle +}{\text{plus}} \;\; \underbrace{\begin{matrix}\text{distance}\\ \text{from finish}\end{matrix}}_{\displaystyle 2d} \;\; \underset{\displaystyle =}{\text{is}} \;\; \underset{\displaystyle 433}{433\text{ km.}}$$

Carry out. We solve the equation.

$$d + 2d = 433$$
$$3d = 433 \quad \text{Combining like terms}$$
$$d = \frac{433}{3} \quad \text{Dividing by 3}$$
$$d = 144\frac{1}{3}$$

Check. If Kouros is $\frac{433}{3}$ mi from the start, then he is $2 \cdot \frac{433}{3}$, or $\frac{866}{3}$ mi from the finish. Since $\frac{433}{3} + \frac{866}{3} = \frac{1299}{3} = 433$, the total distance run. The answer checks.

State. Kouros had run approximately $144\frac{1}{3}$ mi.

10. ***Familiarize.*** Let d = the distance from Nome, in miles. Then $2d$ = the distance from Anchorage.

Translate.

$$\underbrace{\begin{matrix}\text{Distance from}\\ \text{Anchorage}\end{matrix}}_{\displaystyle 2d} \;\; \underset{\displaystyle +}{\text{plus}} \;\; \underbrace{\begin{matrix}\text{distance}\\ \text{to Nome}\end{matrix}}_{\displaystyle d} \;\; \underset{\displaystyle =}{\text{is}} \;\; \underset{\displaystyle 1049}{1049\text{ mi.}}$$

Carry out. We solve the equation.

$$2d + d = 1049$$
$$3d = 1049 \quad \text{Combining like terms}$$
$$d = \frac{1049}{3} \quad \text{Dividing by 3}$$
$$d = 349\frac{2}{3}$$

Check. If the distance to Nome is $349\frac{2}{3}$ mi, then the distance to Anchorage is $2 \cdot 349\frac{2}{3}$, or $699\frac{1}{3}$ mi. So the total distance from

Anchorage to Nome is $349\frac{2}{3}+699\frac{1}{3}$, or 1049 mi. The result checks.

State. The distance the musher has traveled is $699\frac{1}{3}$ mi.

11. ***Familiarize.*** Let d = the distance the driver had traveled when he was 20 mi closer to the finish line than the start. At that point, his distance to the finish line is $d-20$.

Translate.

$$\underbrace{\text{Distance from start}}_{\downarrow\ d}\ \overset{\text{plus}}{\downarrow\ +}\ \underbrace{\text{distance from finish}}_{\downarrow\ d-20}\ \overset{\text{is}}{\downarrow\ =}\ \overset{\text{300 mi.}}{\downarrow\ 300}$$

Carry out. We solve the equation.

$d+(d-20)=300$

$2d-20=300$ Combining like terms

$2d=320$ Adding 20

$d=160$ Dividing by 2

Check. When the driver is 160 mi from the start, he has 300 – 160, or 140 mi left to go. 140 mi is 20 mi less than 160 mi. The answer checks.

State. The driver had traveled 160 mi.

12. ***Familiarize.*** Let d = the distance the driver had traveled when he was 80 mi closer to the finish line than the start. At that point, his distance to the finish line is $d-80$.

Translate.

$$\underbrace{\text{Distance from start}}_{\downarrow\ d}\ \overset{\text{plus}}{\downarrow\ +}\ \underbrace{\text{distance from finish}}_{\downarrow\ d-80}\ \overset{\text{is}}{\downarrow\ =}\ \overset{\text{400 mi.}}{\downarrow\ 400}$$

Carry out. We solve the equation.

$d+(d-80)=400$

$2d-80=400$ Combining like terms

$2d=480$ Adding 80

$d=240$ Dividing by 2

Check. When the driver is 240 mi from the start, he has 400 – 240, or 160 mi left to go. 160 mi is 80 mi less than 240 mi. The answer checks.

State. The driver had traveled 240 mi.

13. ***Familiarize.*** Let n = Lara's apartment number. Then her next-door neighbor's apartment number is $n+1$.

Translate.

$$\underbrace{\text{Lara's number}}_{\downarrow\ n}\ \overset{\text{plus}}{\downarrow\ +}\ \underbrace{\text{next-door's number}}_{\downarrow\ n+1}\ \overset{\text{is}}{\downarrow\ =}\ \overset{\text{2409.}}{\downarrow\ 2409}$$

Carry out. We solve the equation.

$n+(n+1)=2409$

$2n+1=2409$ Combining like terms

$2n=2408$ Subtracting 1

$n=1204$ Dividing by 2

Check. If = Lara's apartment number is 1204, then her next-door neighbor's apartment number is 1205. The sum of these two numbers is 2409. The answer checks.

State. The apartment numbers are 1204 and 1205.

14. ***Familiarize.*** Let n = Jonathan's apartment number. Then his next-door neighbor's apartment number is $n+1$.

Translate.

$$\underbrace{\text{Jonathan's number}}_{\downarrow\ n}\ \overset{\text{plus}}{\downarrow\ +}\ \underbrace{\text{next-door's number}}_{\downarrow\ n+1}\ \overset{\text{is}}{\downarrow\ =}\ \overset{\text{1419.}}{\downarrow\ 1419}$$

Carry out. We solve the equation.

$n+(n+1)=1419$

$2n+1=1419$ Combining like terms

$2n=1418$ Subtracting 1

$n=709$ Dividing by 2

Check. If Jonathan's apartment number is 709, then his next-door neighbor's apartment number is 710. The sum of these two numbers is 1419. The answer checks.

State. The apartment numbers are 709 and 710.

15. ***Familiarize.*** Let n = Chrissy's house number. Then Bryan's house number is $n+2$.

Translate.

$$\underbrace{\text{Chrissy's number}}_{\downarrow\; n} \;\; \underset{\downarrow\; +}{\text{plus}} \;\; \underbrace{\text{Bryan's number}}_{\downarrow\; n+2} \;\; \underset{\downarrow\; =}{\text{is}} \;\; \underset{\downarrow\; 794}{794.}$$

Carry out. We solve the equation.

$n+(n+2)=794$

$2n+2=794$ Combining like terms

$2n=792$ Subtracting 2

$n=396$ Dividing by 2

Check. If Chrissy's house number is 396, then Bryan's house number is 398. The sum of these number is 794. The answer checks.

State. The house numbers are 396 and 398.

16. ***Familiarize.*** Let n = Art's house number. Then Colleen's house number is $n+2$.

Translate.

$$\underbrace{\text{Art's number}}_{\downarrow\; n} \;\; \underset{\downarrow\; +}{\text{plus}} \;\; \underbrace{\text{Colleen's number}}_{\downarrow\; n+2} \;\; \underset{\downarrow\; =}{\text{is}} \;\; \underset{\downarrow\; 572}{572.}$$

Carry out. We solve the equation.

$n+(n+2)=572$

$2n+2=572$ Combining like terms

$2n=570$ Subtracting 2

$n=285$ Dividing by 2

Check. If Art's house number is 285, then Colleen's house number is 287. The sum of these number is 572. The answer checks.

State. The house numbers are 285 and 287.

17. ***Familiarize.*** Let x = the first page number. Then $x+1$ = the second page number, and $x+2$ = the third page number.

Translate.

$$\underbrace{\text{The sum of three consecutive page numbers}}_{\downarrow\; x+(x+1)+(x+2)} \;\; \underset{\downarrow\; =}{\text{is}} \;\; \underset{\downarrow\; 60}{60.}$$

Carry out. We solve the equation.

$x+(x+1)+(x+2)=60$

$3x+3=60$ Combining like terms

$3x=57$ Subtracting 3

$x=19$ Dividing by 3

If x = 19, then $x+1=20$, and $x+2=21$.

Check 19, 20, and 21 are consecutive integers, and $19+20+21=60$. The result checks.

State. The page numbers are 19, 20, and 21.

18. ***Familiarize.*** Let x = the first page number. Then $x+1$ = the second page number, and $x+2$ = the third page number.

Translate.

$$\underbrace{\text{The sum of three consecutive page numbers}}_{\downarrow\; x+(x+1)+(x+2)} \;\; \underset{\downarrow\; =}{\text{is}} \;\; \underset{\downarrow\; 99}{99.}$$

Carry out. We solve the equation.

$x+(x+1)+(x+2)=99$

$3x+3=99$ Combining like terms

$3x=96$ Subtracting 3

$x=32$ Dividing by 3

If x = 32, then $x+1=33$, and $x+2=34$.

Check 32, 33, and 34 are consecutive integers, and $32+33+34=99$. The result checks.

State. The page numbers are 32, 33, and 34.

19. ***Familiarize.*** Let x = the age of the groom. Then $x+19$ = the age of the bride.

Translate.

$$\underbrace{\text{The sum of their ages}}_{\downarrow\; x+(x+19)} \;\; \underset{\downarrow\; =}{\text{is}} \;\; \underset{\downarrow\; 185}{185.}$$

Carry out. We solve the equation.

$x+(x+19)=185$

$2x+19=185$ Combining like terms

$2x=166$ Subtracting 19

$x=83$ Dividing by 2

If the groom was 83, then the bride was 83 + 19, or 102.

Check The sum of the ages of the groom and the bride is 83 + 102, or 185. The result checks.
State. The groom was 83, and the bride was 102.

20. ***Familiarize.*** Let x = the age of Jessica Tandy. Then $x-59$ = the age of Marlee Matlin.
Translate.

$$\underbrace{\text{The sum of their ages}}_{x+(x-59)} \underbrace{\text{is}}_{=} \underbrace{101.}_{101}$$

Carry out. We solve the equation.

$x+(x-59)=101$

$2x-59=101$ Combining like terms

$2x=160$ Adding 59

$x=80$ Dividing by 2

Jessica Tandy was 80, and Marlee Matlin was 80 – 59, or 21.
Check The sum of the ages is 80 + 21, or 101. The result checks.
State. Jessica Tandy was 80 and Marlee Matlin was 21.

21. ***Familiarize.*** Let x = the number of nonspam messages. Then $5x$ = the number of spam messages.
Translate.

$$\underbrace{\text{The sum of spam and nonspam messages}}_{x+5x} \underbrace{\text{is}}_{=} \underbrace{210}_{210} \text{ billion e-mails.}$$

Carry out. We solve the equation.

$x+5x=210$

$6x=210$ Combining like terms

$x=35$ Dividing by 6

If the number of nonspam messages was 35 billion, then number of spam messages was $5\cdot 35$, or 175 billion.
Check The sum of the nonspam and spam messages was 35 + 175 = 210 billion messages. The results check.
State. If the number of nonspam messages was 35 billion and the number of spam messages was 175 billion.

22. ***Familiarize.*** Let x = the number of netbooks in millions sold in 2009. Then $4x$ = the number of laptops sold that are not netbooks in millions.
Translate.

$$\underbrace{\text{The sum netbooks and not netbooks}}_{x+4x} \underbrace{\text{is}}_{=} \underbrace{160}_{160} \text{ million.}$$

Carry out. We solve the equation.

$x+4x=160$

$5x=160$ Combining like terms

$x=32$ Dividing by 5

If 32 million netbooks were sold , then $4\cdot 32=128$ million laptops that are not netbooks.
Check The sum of netbooks and laptops that were not netbooks was 32 million + 128 million, or 160 million.
State. 32 million netbooks were sold in 2009, and 128 million laptops that are not netbooks were sold in 2009.

23. ***Familiarize.*** Let x = the page number of the left page and $x+1$ = the page number of the right page.
Translate.

$$\underbrace{\text{The sum of the pages}}_{x+(x+1)} \underbrace{\text{is}}_{=} \underbrace{281.}_{281}$$

Carry out. We solve the equation.

$x+(x+1)=281$

$2x+1=281$ Combining like terms

$2x=280$ Subtracting 1

$x=140$ Dividing by 2

Check The pages are numbered 140 and 141, so they are consecutive. The sum of the pages is $140+141=281$. The results check
State. The facing pages are numbered 140 and 141.

24. ***Familiarize.*** Let x = the length of the first side, $x+2$ = the length of the second side, and $x+4$ = the length of the third side of the triangle.
Translate.

$$\underbrace{\text{The sum of the lengths}} \text{ is } 195 \text{ mm.}$$
$$\downarrow \qquad\qquad \downarrow \ \downarrow$$
$$x+(x+2)+(x+4) \ = \ 195$$

Carry out. We solve the equation.

$$x+(x+2)+(x+4)=195$$
$$3x+6=195 \quad \text{Combining like terms}$$
$$3x=189 \quad \text{Subtracting 6}$$
$$x=63 \quad \text{Dividing by 3}$$

If 63 mm is the length of the first side, then the second side is $x+2=65$ mm, and the third side is $x+4=67$ mm.
Check The lengths, 63, 65, and 67, are consecutive odd integers. The sum of the lengths is $63+65+67=195$ mm. The result checks.
State. The sides measure 63 mm, 65 mm, and 67 mm.

25. ***Familiarize.*** Let x = the width of the rectangular top, in feet. Then $x+60$ = the length of the rectangular top, in feet. Recall that the perimeter is given by the formula: $P=2w+2l$
Translate.

$$\underbrace{\text{The perimeter}} \text{ is } 520 \text{ ft.}$$
$$\downarrow \qquad\qquad \downarrow \ \downarrow$$
$$2x+2(x+60) \ = 520$$

Carry out. We solve the equation.

$$2x+2(x+60)=520$$
$$2x+2x+120=520 \quad \text{Distributive Law}$$
$$4x+120=520 \quad \text{Combining like terms}$$
$$4x=400 \quad \text{Subtracting 120}$$
$$x=100 \quad \text{Dividing by 4}$$

If the width is 100 ft, then the length is 100 + 60, or 160 ft.
Check The length, 160 ft, is 60 ft more than the width, 100 ft. The perimeter is $2\cdot100+2\cdot160=520$. These results check
State. The width of the rectangular top of the building is 100 ft, and the length of the top is 160 ft. The area of the top is length times width, or $100 \text{ ft}\cdot160 \text{ ft}$, or $16{,}000 \text{ ft}^2$.

26. ***Familiarize.*** Let x = the length of the state of Wyoming, in miles. Then $x-90$ = the width of the state, in miles. Recall that the perimeter is given by the formula: $P=2w+2l$
Translate.

$$\underbrace{\text{The perimeter}} \text{ is } 1280 \text{ mi.}$$
$$\downarrow \qquad\qquad \downarrow \ \downarrow$$
$$2(x-90)+2x \ =1280$$

Carry out. We solve the equation.

$$2(x-90)+2x=1280$$
$$2x-180+2x=1280 \quad \text{Distributive Law}$$
$$4x-180=1280 \quad \text{Combining like terms}$$
$$4x=1460 \quad \text{Adding 180}$$
$$x=365 \quad \text{Dividing by 4}$$

If the length of the state is 365 mi, then the width is 365 – 90, or 275 mi.
Check The length of the state, 365 mi, is 90 mi more than the width, 275 mi. The perimeter is $2\cdot275 \text{ mi}+2\cdot365 \text{ mi}$ = 1280 mi. These results check
State. The length of the state is 365 mi, and the width is 275 mi.

27. ***Familiarize.*** Let x = the width of the basketball court, in feet. Then $x+34$ is the length of the court, in feet. Recall that the perimeter is given by the formula: $P=2w+2l$
Translate.

$$\underbrace{\text{The perimeter}} \text{ is } 268 \text{ ft.}$$
$$\downarrow \qquad\qquad \downarrow \ \downarrow$$
$$2x+2(x+34) \ = 268$$

Carry out. We solve the equation.

$$2x+2(x+34)=268$$
$$2x+2x+68=268 \quad \text{Distributive Law}$$
$$4x+68=268 \quad \text{Combining like terms}$$
$$4x=200 \quad \text{Subtracting 68}$$
$$x=50 \quad \text{Dividing by 4}$$

If the width of the court is 50 ft, then the length is 50 ft + 34 ft, or 84 ft.

Check The length, 84 ft, is 34 ft more than the width, 50 ft. The perimeter is $2 \cdot 50$ ft + $2 \cdot 84$ ft = 268 ft. These results check.
State. The width of the basketball court is 50 ft, and the length is 84 ft.

28. ***Familiarize.*** Let x = the width of the garden, in feet. Then $x+4$ is the length of the garden, in feet. Since 92 m of fencing will surround the garden, the perimeter is 92 m. Recall that the perimeter is given by the formula: $P = 2w + 2l$
Translate.

$$\underbrace{\text{The perimeter}} \quad \text{is 92 m.}$$
$$\downarrow \qquad\qquad \downarrow \;\downarrow$$
$$2x + 2(x+4) \quad = 92$$

Carry out. We solve the equation.

$$2x + 2(x+4) = 92$$
$$2x + 2x + 8 = 92 \qquad \text{Distributive Law}$$
$$4x + 8 = 92 \qquad \text{Combining like terms}$$
$$4x = 84 \qquad \text{Subtracting 8}$$
$$x = 21 \qquad \text{Dividing by 4}$$

If the width of the garden is 21 m, then the length is 21 m + 4 m, or 25 m.
Check The length, 25 m, is 4 m longer than the width, 21 m. The perimeter is $2 \cdot 21$ m + $2 \cdot 25$ m = 92 m. These results check.
State. The garden is 21 m wide and 25 m long.

29. ***Familiarize.*** Let x = the width of the cross section and $x+2$ = the length of the cross section. Recall that the perimeter is given by the formula: $P = 2w + 2l$
Translate.

$$\underbrace{\text{The perimeter}} \quad \text{is 10 in.}$$
$$\downarrow \qquad\qquad \downarrow \;\downarrow$$
$$2x + 2(x+2) \quad = \; 10$$

Carry out. We solve the equation.

$$2x + 2(x+2) = 10$$
$$2x + 2x + 4 = 10$$
$$4x + 4 = 10 \qquad \text{Combining like terms}$$
$$4x + 4 - 4 = 10 - 4 \qquad \text{Subtracting 4 from both sides}$$
$$\frac{4x}{4} = \frac{6}{4} \qquad \text{Dividing by 4}$$
$$x = 1\tfrac{1}{2}$$

If the width of the cross section is $1\frac{1}{2}$ in., then the length is $3\frac{1}{2}$ in. $\left(1\frac{1}{2} + 2 = 3\frac{1}{2}\right)$.
Check The length of the cross section, $3\frac{1}{2}$ in. is two more than the width, $1\frac{1}{2}$ in. The perimeter is $2 \cdot \left(1\frac{1}{2}\right) + 2 \cdot \left(3\frac{1}{2}\right) = 10$ in. These results check.
State. The width of the cross section is $1\frac{1}{2}$ in., and the length is $3\frac{1}{2}$ in.

30. ***Familiarize.*** Let x = the width of the billboard sign, in feet. Then $3x+6$ is the length of the billboard, in feet. Recall that the perimeter is given by the formula: $P = 2w + 2l$
Translate.

$$\underbrace{\text{The perimeter}} \quad \text{is 124 ft.}$$
$$\downarrow \qquad\qquad \downarrow \;\downarrow$$
$$2x + 2(3x+6) \quad = 124$$

Carry out. We solve the equation.

$$2x + 2(3x+6) = 124$$
$$2x + 6x + 12 = 124 \qquad \text{Distributive Law}$$
$$8x + 12 = 124 \qquad \text{Combining like terms}$$
$$8x = 112 \qquad \text{Subtracting 12}$$
$$x = 14 \qquad \text{Dividing by 8}$$

If the width of the billboard is 14 ft, then the length is $3 \cdot 14 \text{ ft} + 6 \text{ ft}$, or 48 ft.
Check The length, 48 ft, is 6 ft more than 3 times the width, 14 ft. The perimeter is $2 \cdot 14 \text{ ft} + 2 \cdot 48 \text{ ft} = 124 \text{ ft}$. These results check.
State. The width of the billboard is 14 ft, and the length is 48 ft.

31. ***Familiarize.*** Let x = the measure of the first angle, in degrees. Then the measure of the second angle is $3x$ degrees, and the third angle measures $x+30$ degrees. Recall that the sum of the measures of the angles of any triangle is 180°.

Translate.

$$\underbrace{\text{The sum of the measures of the three angles}}_{x+3x+(x+30)} \quad \underbrace{\text{is}}_{=} \quad \underbrace{\text{180 degrees.}}_{180}$$

Carry out. We solve the equation.

$$\begin{aligned} x+3x+(x+30) &= 180 \\ 5x+30 &= 180 \quad \text{Combining like terms} \\ 5x &= 150 \quad \text{Subtracting 30} \\ x &= 30 \quad \text{Dividing by 5} \end{aligned}$$

If the first angle measures 30°, then the second angle measures $3 \cdot 30°$, or 90°, and the third angle measures 30° + 30°, or 60°.

Check The second angle has a measure of 90°, which is three times the measure of the first angle, 30°. The third angle measures 60°, which is 30° more than the first angle. The sum of the measures of the three angles is 30° + 90° + 60°, or 180°. These results check.

State. The angles measure 30°, 90°, and 60°, respectively.

32. ***Familiarize.*** Let x = the measure of the first angle, in degrees. Then the measure of the second angle is $4x$ degrees, and the third angle measures $x+4x-45$ degrees. Recall that the sum of the measures of the angles of any triangle is 180°.

Translate.

$$\underbrace{\text{The sum of the measures of the three angles}}_{x+4x+(x+4x-45)} \quad \underbrace{\text{is}}_{=} \quad \underbrace{\text{180 degrees.}}_{180}$$

Carry out. We solve the equation.

$$\begin{aligned} x+4x+(x+4x-45) &= 180 \\ 10x-45 &= 180 \quad \text{Combining like terms} \\ 10x &= 225 \quad \text{Adding 45} \\ x &= 22.5 \quad \text{Dividing by 10} \end{aligned}$$

If the first angle measures 22.5°, then the second angle measures $4 \cdot 22.5°$, or 90°, and the third angle measures 22.5° + 90° – 45°, or 67.5°.

Check The second angle has a measure of 90°, which is four times the measure of the first angle, 22.5°. The third angle measures 67.5°, which is 45° less than the sum of the first and second angle. The sum of the measures of the three angles is 22.5° + 90° + 67.5°, or 180°. These results check.

State. The angles measure 22.5°, 90°, and 67.5°, respectively.

33. ***Familiarize.*** Let x = the measure of the first angle, in degrees. Then the measure of the second angle is $3x$ degrees, and the third angle measures $x+3x+10$ degrees. Recall that the sum of the measures of the angles of any triangle is 180°.

Translate.

$$\underbrace{\text{The sum of the measures of the three angles}}_{x+3x+(x+3x+10)} \quad \underbrace{\text{is}}_{=} \quad \underbrace{\text{180 degrees.}}_{180}$$

Carry out. We solve the equation.

$$\begin{aligned} x+3x+(x+3x+10) &= 180 \\ 8x+10 &= 180 \quad \text{Combining like terms} \\ 8x &= 170 \quad \text{Subtracting 10} \\ x &= 21.25 \quad \text{Dividing by 8} \end{aligned}$$

If the first angle measures 21.25°, then the second angle measures $3 \cdot 21.25$, or 63.75°, and the third angle measures 21.25° + 63. 75° + 10°, or 95°.

Check The measure of the second angle, 63.75°, is three times the measure of the first angle, 21.25°. The third angle has a measure of 95°, which is 10° more than the sum of the first and second angles, 21.25° + 63.75°. The sum of the measures of the three angles is 21.25° + 63.75° + 95° = 180°. These results check.

State. The angles measure 21.25°, 63.75°, and 95°, respectively.

34. ***Familiarize.*** Let x = the measure of the first angle, in degrees. Then the measure of the second angle is $4x$ degrees, and the third angle measures $x+4x+5$ degrees. Recall

that the sum of the measures of the angles of any triangle is 180°.

Translate.

$$\underbrace{\text{The sum of the measures of the three angles}}_{x+4x+(x+4x+5)} \text{ is } 180 \text{ degrees.}$$

$$x+4x+(x+4x+5) \;=\; 180$$

Carry out. We solve the equation.

$$\begin{aligned} x+4x+(x+4x+5) &= 180 \\ 10x+5 &= 180 && \text{Combining like terms} \\ 10x &= 175 && \text{Subtracting 5} \\ x &= 17.5 && \text{Dividing by 10} \end{aligned}$$

If the first angle measures 17.5°, then the second angle measures $4 \cdot 17.5^{\circ}$, or 70°, and the third angle measures 17.5° + 70° + 5°, or 92.5°.

Check The second angle has a measure of 70°, which is four times the measure of the first angle, 17.5°. The third angle measures 92.5°, which is 5° more than the sum of the measures of the first and second angles, 87.5°. The sum of the measures of the three angles is 17.5° + 70° + 92.5°, or 180°. These results check.

State. The angles measure 17.5°, 70°, and 92.5°, respectively.

35. ***Familiarize.*** Let x = the length of bottom section, in ft. Then the top section is $\frac{x}{6}$ ft, and the middle section is $\frac{x}{2}$ ft.

Translate.

$$\underbrace{\text{The sum of the lengths}}_{x+\frac{x}{6}+\frac{x}{2}} \text{ is } 240 \text{ ft.}$$

$$x+\frac{x}{6}+\frac{x}{2} = 240$$

Carry out. We solve the equation.

$$\begin{aligned} x+\frac{x}{6}+\frac{x}{2} &= 240 \\ 6x+x+3x &= 1440 && \text{Multiply by LCD = 6} \\ 10x &= 1440 && \text{Combining like terms} \\ x &= 144 && \text{Dividing by 10} \end{aligned}$$

If the bottom section is 144 ft, the top section is 144 ft / 6, or 24 ft, and the middle section is 144 ft / 2, or 72 ft.

Check The top section is 24 ft, which is one sixth of the bottom section, and the middle section is 72 ft, which is half the length of the bottom section. The sum of the lengths is 24 ft + 72 ft + 144 ft = 240 ft. The result checks.

State. The top section of the rocket is 24 ft, the middle section is 72 ft, and the bottom section is 144 ft.

36. ***Familiarize.*** Let x = the length of Jenny's portion, in inches. Let $\frac{x}{2}$ = the length of Demi's portion, and $\frac{3}{4}x$ = Shaina's portion, in inches.

Translate.

$$\underbrace{\text{The sum of the lengths}}_{x+\frac{x}{2}+\frac{3x}{4}} \text{ is } 18 \text{ in.}$$

$$x+\frac{x}{2}+\frac{3x}{4} = 18$$

Carry out. We solve the equation.

$$\begin{aligned} x+\frac{x}{2}+\frac{3x}{4} &= 18 \\ 4x+2x+3x &= 72 && \text{Multiply by LCD = 4} \\ 9x &= 72 && \text{Combining like terms} \\ x &= 8 && \text{Dividing by 9} \end{aligned}$$

If Jenny gets 8 in., then Demi would get 4 in. and Sarah would get 6 in.

Check Demi's portion, 4 in., is half of Jenny's, and Shaina's portion, 6 in., is three fourths of Jenny's portion. The sum of the lengths is 8 in. + 4 in. + 6 in. = 18 in. These results check.

State. Jenny's portion is 8 in., Demi's portion is 4 in., and Shaina's portion is 6 in.

37. ***Familiarize.*** Let x = the number of miles Debbie can travel. Therefore, the ride will cost \$3.25 + \$1.80x.

Translate.

$$\underbrace{\text{The total cost of the taxi ride}}_{3.25+1.80x} \text{ is } \$19.$$

$$3.25+1.80x = 19$$

Carry out. We solve the equation.

$$3.25+1.80x=19$$
$$1.80x=15.75 \quad \text{Subtract 3.25}$$
$$x=8.75 \quad \text{Dividing by 1.8}$$

Check The total cost of the ride is \$3.25 + \$1.80/mi $\times$ 8.75 mi, or \$19. This results checks.

State. On a \$19 budget, Debbie can travel $8\frac{3}{4}$, or 8.75 mi.

38. ***Familiarize.*** Let x = the number of miles Oscar can travel. Therefore, the ride will cost him \$2.50 + \$2.00x.

Translate.

$$\underbrace{\text{The total cost of the taxi ride}}_{2.50+2.00x} \ \underbrace{\text{is}}_{=} \ \underbrace{\$17.50.}_{17.50}$$

Carry out. We solve the equation.

$$2.50+2.00x=17.50$$
$$2.00x=15 \quad \text{Subtract 2.50}$$
$$x=7.5 \quad \text{Dividing by 2}$$

Check The total cost of the ride is \$2.50 + \$2.00/mi $\times$ 7.5 mi, or \$17.50. This result checks.

State. For \$17.50, Oscar can travel $7\frac{1}{2}$, or 7.5 mi.

39. ***Familiarize.*** Let x = the number of miles Concert Productions can travel. The total of their rental will be \$49.95 + \$0.39x.

Translate.

$$\underbrace{\text{The total cost of the rental}}_{49.95+0.39x} \ \underbrace{\text{is}}_{=} \ \underbrace{\$100.}_{100}$$

Carry out. We solve the equation.

$$49.95+0.39x=100$$
$$0.39x=50.05 \quad \text{Subtract 49.95}$$
$$x=128\tfrac{1}{3} \quad \text{Dividing by 0.39}$$

Check The total amount for the rental will be \$49.95 + \$0.39/mi $\times$ $128\frac{1}{3}$ mi, or \$100. This results checks.

State. Concert Productions can travel a total of $128\frac{1}{3}$ mi on their \$100 budget.

40. ***Familiarize.*** Let x = the number of miles Judy can travel. The total of the rental will be \$42 + \$0.35x.

Translate.

$$\underbrace{\text{The total cost of the rental}}_{42+0.35x} \ \underbrace{\text{is}}_{=} \ \underbrace{\$70.}_{70}$$

Carry out. We solve the equation.

$$42+0.35x=70$$
$$0.35x=28 \quad \text{Subtract 42}$$
$$x=80 \quad \text{Dividing by 0.35}$$

Check The total amount for the rental will be \$42 + \$0.35/mi $\times$ 80 mi, or \$70. This results checks.

State. Judy can travel a total of 80 mi on her \$70 budget.

41. ***Familiarize.*** Let x = the measure of the first angle, in degrees. Then the complement of the first angle is 90° – x.

Translate.

$$\underbrace{\text{The measure of an angle}}_{x} \ \underbrace{\text{is}}_{=} \ \underbrace{15^\circ}_{15} \ \underbrace{\text{more than}}_{+} \ \underbrace{\text{twice the measure of its complement.}}_{2(90-x)}$$

Carry out. We solve the equation.

$$x=15+2(90-x)$$
$$x=15+180-2x \quad \text{Distributive Law}$$
$$x=195-2x \quad \text{Combining like terms}$$
$$3x=195 \quad \text{Adding } 2x$$
$$x=65 \quad \text{Dividing by 3}$$

Check If the angle measures 65°, then its complement measures 90° – 65°, or 25°. Twice the measure of the complement is $2\cdot 25^\circ$, or 50°. The original angle's measure of 65° is 15° more than 50°. These results check.

State. The angle measures 65°, and its complement measures 25°.

42. ***Familiarize.*** Let x = the measure of the first angle, in degrees. Then the supplement of the first angle is $180° – x$.
Translate.

$$\underbrace{\text{The measure of an angle}}\ \text{is}\ \underbrace{45^\circ\ \text{less than twice the measure of its supplement.}}$$
$$\downarrow \qquad \downarrow \qquad \downarrow$$
$$x \qquad = \qquad 2(180-x)-45$$

Carry out. We solve the equation.

$x = 2(180-x)-45$
$x = 360-2x-45$ Distributive Law
$x = 315-2x$ Combining like terms
$3x = 315$ Adding $2x$
$x = 105$ Dividing by 3

Check If the angle measures 105°, then its supplement measures 180° – 105°, or 75°. Twice the measure of the supplement is $2\cdot 75^\circ$, or 150°. The original angle's measure of 105° is 45° less than 150°. These results check.
State. The angle measures 105°, and its supplement measures 75°.

43. ***Familiarize.*** Let l = the length of the paper, in cm. Then the width is l – 6.3 cm. Recall that the perimeter of a rectangle is calculated using the formula $P = 2w+2l$.
Translate.

$$\underbrace{\text{The perimeter of the paper}}\ \text{is 99 cm.}$$
$$\downarrow \qquad\qquad \downarrow\ \downarrow$$
$$2(l-6.3)+2l \qquad = 99$$

Carry out. We solve the equation.

$2(l-6.3)+2l = 99$
$2l-12.6+2l = 99$ Distributive Law
$4l-12.6 = 99$ Combining like terms
$4l = 111.6$ Adding 12.6
$l = 27.9$ Dividing by 4

Check If the length of the paper is 27.9 cm, then the width is 27.9 cm – 6.3 cm, or 21.6 cm. Therefore the perimeter is $2\cdot 21.6$ cm + $2\cdot 27.9$ cm, or 99 cm.
State. The width is the paper is 21.6 cm, and the length is 27.9 cm.

44. ***Familiarize.*** Let x = the amount Sarah invested in stock, in dollars. Her investment increased by 28%, or by $0.28x$.
Translate.

$$\text{Investment plus}\ \underbrace{\text{28\% of the investment}}\ \text{is \$448.}$$
$$\downarrow \qquad \downarrow \qquad \downarrow \qquad \downarrow\ \downarrow$$
$$x \qquad + \qquad 0.28x \qquad = \ 448$$

Carry out. We solve the equation.

$x+0.28x = 448$
$1.28x = 448$ Combining like terms
$x = 350$ Dividing by 1.28

Check If Sarah invested \$350, then her investment would have grown by 28%(\$350), or \$98. Thus her investment would have grown to \$350 + \$98, or \$448. These results check.
State. Sarah's original investment would have been \$350.

45. ***Familiarize.*** Let x = the amount Amber invested in her savings account, in dollars. Her investment increased by 6%, or by $0.06x$.
Translate.

$$\text{Investment plus}\ \underbrace{\text{6\% of the investment}}\ \text{is \$6996.}$$
$$\downarrow \qquad \downarrow \qquad \downarrow \qquad \downarrow\ \downarrow$$
$$x \qquad + \qquad 0.06x \qquad = \ 6996$$

Carry out. We solve the equation.

$x+0.06x = 6996$
$1.06x = 6996$ Combining like terms
$x = 6600$ Dividing by 1.06

Check If Amber invested \$6600, then her investment would have grown by 6%(\$6600), or \$396. Thus her investment would have grown to \$6600 + \$396, or \$6996. These results check.
State. Amber 's original investment would have been \$6600.

46. ***Familiarize.*** Let x = the balance in Will's account at the beginning of the month. If he is charged 2% interest, his balance would have grown by $0.02x$ during the month.
Translate.

$$\underbrace{\text{Original balance}}\ \text{plus}\ \underbrace{\text{2\% of the balance}}\ \text{is \$870.}$$
$$\downarrow \qquad \downarrow \qquad \downarrow \qquad \downarrow\ \downarrow$$
$$x \qquad + \qquad 0.02x \qquad = \ 870$$

Carry out. We solve the equation.

$x + 0.02x = 870$

$1.02x = 870$ Combining like terms

$x = 852.94$ Dividing by 1.02 and rounding

Check If Will's beginning-of-the-month balance was \$852.94, then he would have been charged 2%(\$852.94), or \$17.06 (rounded), resulting in a balance of \$852.94 + \$17.06 = \$870. These results check.

State. Will's beginning balance would have been \$852.94.

47. ***Familiarize.*** Let x = the losing score. If the margin of victory was 323 points, then the winning score would have been x + 323 points.

Translate.

$$\underbrace{\text{Sum of the winning and losing scores}} \text{ is } 1127 \text{ points.}$$

$$x + (x + 323) = 1127$$

Carry out. We solve the equation.

$x + (x + 323) = 1127$

$2x + 323 = 1127$ Combining like terms

$2x = 804$ Subtracting 323

$x = 402$ Dividing by 2

Check If the losing score was 402, then the winning score, assuming a margin of victory of 323 points, would have been 402 + 323, or 725 points. The sum of the winning and losing scores is 725 + 402, or 1127 points. These results check.

State. The winning score was 725 points.

48. ***Familiarize.*** Let c = the number of brochures that can be printed for \$5000. If it costs \$200 per month to lease the printer and it is rented for 2 months, then the cost is 2(\$200), or \$400. The cost per brochure is 21.5¢ per copy, resulting in an additional cost of \$0.215c.

Translate.

$$\underbrace{\text{Monthly cost}} \text{ plus } \underbrace{\text{ink and paper cost}} \text{ is } \$5000.$$

$$2(200) + 0.215c = 5000$$

Carry out. We solve the equation.

$2(200) + 0.215c = 5000$

$400 + 0.215c = 5000$

$0.215c = 4600$ Subtracting 400

$c = 21,395$ Dividing by 0.215 and rounding

Check If 21,395 brochures are printed, it will cost 21,365(\$0.215/brochure), or \$4600 (rounding), plus 2(\$200), or \$400, for a total of \$5000. These results check.

State. On a budget of \$5000, 21,395 brochures can be printed.

49. ***Familiarize.*** Let x = the final bid. Let $0.08x$ = the seller's premium on the final bid.

Translate.

$$\underbrace{\text{Final bid minus seller's premium of 8\%}} \text{ is } \underbrace{\text{the amount left}}$$

$$x - 0.08x = 1150$$

Carry out. We solve the equation.

$x - 0.08x = 1150$

$0.92x = 1150$ Combine like terms

$x = 1250$ Dividing by 0.92

Check If the final bid was \$1250, the 8% of \$1250 is 0.08(1250) = \$100. So, \$1250 – \$100 = \$1150. This result checks.

State. The final bid is \$1250.

50. ***Familiarize.*** Let x = the original estimate of The Big Dig. Let $4.84x$ = the actual cost of The Big Dig.

Translate.

$$\underbrace{\text{The cost of The Big Dig}} \text{ is } \$14.6 \text{ billion.}$$

$$4.84x = 14.6$$

Carry out. We solve the equation.

$4.84x = 14.6$

$x \approx 3.02$ Dividing by 4.84

Check If the original estimate was \$3.02 billion, then 484% of \$3.02 is 4.84(3.02) ≈ 14.6, or \$14.6 billion. This result checks.

State. The original estimate of The Big Dig was about \$3.02 billion.

51. ***Familiarize.*** Let N = the number of times the cricket chirps per minute. Let T = the corresponding Fahrenheit temperature.
Translate.
We are already given the equation relating Fahrenheit temperature T, in degrees, and the number of times a cricket chirps per minute N. We are to determine the number of chips corresponding to 80°F.

$$\underbrace{\text{Temperature}}_{\substack{\downarrow\\ T}} \quad \underbrace{\text{is}}_{\substack{\downarrow\\ =}} \quad \underbrace{\text{40 more than one fourth the number of chirps.}}_{\substack{\downarrow\\ \frac{1}{4}N+40}}$$

Carry out. We substitute 80 for T and solve the equation for N.

$T = \frac{1}{4}N + 40$

$80 = \frac{1}{4}N + 40$ Substituting 80 for T

$40 = \frac{1}{4}N$ Subtracting 40

$160 = N$ Multiplying by 4

Check If a cricket chirps 160 times per minute, then the Fahrenheit temperature would be $\frac{1}{4}(160)+40$, or 40 + 40, or 80°F. This result checks.
State. The number of chirps per minute corresponding to 80°F is 160.

52. ***Familiarize.*** Let t = the number of years since 1920. Let R = the number of seconds to complete the 200-m dash.
Translate.
We are already given the equation relating the number of seconds required R to complete the 200-m dash and time t, the number of years after 1920.

$$\underbrace{\text{Time to run the 100-m dash}}_{\substack{\downarrow\\ R}} \quad \underbrace{\text{is}}_{\substack{\downarrow\\ =}} \quad \underbrace{\text{20.8 more than } -0.28 \text{ times the number of years after 1920.}}_{\substack{\downarrow\\ -0.028t+20.8}}$$

Carry out. We substitute 18.0 for R and solve the equation for t.

$R = -0.028t + 20.8$

$18.0 = -0.028t + 20.8$ Substituting 18.0 for R

$-2.8 = -0.028t$ Subtracting 20.8

$t = 100$ Dividing by -0.028

Check If the number of years after 1920 is 100, then the time required to complete the 200-m dash is $-0.028(100)+20.8$, or 18 sec. This result checks.
State. The number of years after 1920 is 100, or $1920+100=2020$.

53. ***Familiarize.*** We examine the table to determine the size of aquarium and the recommended stocking density. We notice that:
$100 = 20 \times 5$
$120 = 24 \times 5$
$200 = 40 \times 5$
$250 = 50 \times 5$
This leads us to conclude that size of aquarium is 5 times the stocking density. We let x = the stocking density and we let S = the size of the aquarium.
Translate.

$$\underbrace{\text{Size of Aquarium}}_{\substack{\downarrow\\ S}} \quad \underbrace{\text{is}}_{\substack{\downarrow\\ =}} \; \underbrace{\text{5}}_{\substack{\downarrow\\ 5}} \; \underbrace{\text{times}}_{\substack{\downarrow\\ \cdot}} \quad \underbrace{\text{the stocking density.}}_{\substack{\downarrow\\ x}}$$

Carry out. We substitute 30 in. for x and solve for S.

$S = 5x$

$S = 5(30)$ Substituting 30 for x

$S = 150$ Simplify

Check. If the aquarium is 150 gallons, then the recommended stocking density $150 \div 5$, or 30 inches. This result checks.
State. The aquarium size for 30 in. of fish is 150 gallons.

54. ***Familiarize.*** We examine the table to determine the relationship between the cost of an order before shipping and the cost including shipping. Examining each row in the table, we see that the cost including shipping can be determined by adding \$5.49 to the cost before shipping:
\$15.50 + \$5.49 = \$20.99
. . . . .
\$45.65 + \$5.49 = \$51.14
We let T = the cost including shipping and let c = the cost before shipping.
Translate.

$$\underbrace{\text{Cost including shipping}}_{\substack{\downarrow\\ T}} \quad \underbrace{\text{is}}_{\substack{\downarrow\\ =}} \quad \underbrace{\text{cost of the order before shipping plus \$5.49.}}_{\substack{\downarrow\\ c+5.49}}$$

Carry out. We substitute \$25.68 for T and solve for c.

$$T = c + 5.49$$

$$25.68 = c + 5.49 \quad \text{Substituting 25.68 for } T$$

$$20.19 = c \quad \text{Subtracting 5.49}$$

Check. If the cost of an order before shipping is \$20.19, then the cost including shipping would be \$20.19 + \$5.49, or \$25.68. This result checks.

State. The cost of the order before shipping was \$20.19.

55. ***Familiarize.*** We examine the table to determine the relationship between the day in August and weight, in pounds, of the pumpkin. Observe that the pumpkin's weight increases by 30 pounds each day:
From Aug. 1 to Aug. 2: 410 – 380 = 30 lb
From Aug. 2 to Aug. 3: 440 – 410 = 30 lb
From Aug. 3 to Aug. 4: 470 – 440 = 30 lb
From Aug. 4 to Aug. 11 (11 – 4, or 7 days): $680 - 470 = 210 = 7 \cdot 30$ lb.
From Aug. 11 to Aug. 25 (25 – 11, or 14 days): $1100 - 680 = 420 = 14 \cdot 30$ lb.
Let d = the number of days after August 1 on which the pumpkin weighed 920 pounds.

Translate.

$$\underbrace{\text{Weight on August 1}}_{380} \;\; \underset{+}{\text{plus}} \;\; \underset{30}{\text{30}} \;\; \underset{\cdot}{\text{times}} \;\; \underbrace{\text{number of days after August 1}}_{d} \;\; \underset{=}{\text{is}} \;\; \underbrace{\text{920 pounds.}}_{920}$$

Carry out. We solve the equation.

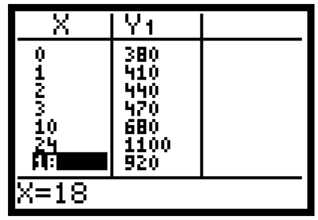
$$380 + 30 \cdot d = 920$$

$$30d = 920 - 380 \quad \text{Subtracting 380}$$

$$30d = 540 \quad \text{Collecting like terms}$$

$$d = 18 \quad \text{Dividing by 30}$$

Check. We use a table to check. Enter $y = 380 + 30x$ in a graphing calculator and set up a table in Ask mode. Enter the x-values as the number of days after August 1: 0, 1, 2, 3, 10, 24, and 18. We see that we get the values given in the statement of the problem for the first 6 x-values and the x-value 18 gives a weight of 920 pounds. The answer checks.



State. The pumpkin weighed 920 pounds 18 days after August 1, or on August 19.

56. ***Familiarize.*** We examine the table and observe that, beginning with a rate of \$60 for 1000 square feet, each increase of 100 square feet corresponds to a \$5 increase in the cleaning rate:
1100 – 1000 = 100 and \$65 - \$60 = \$5;
$1200 - 1000 = 200 = 2 \cdot 100$ and \$70 - \$60 = $\$10 = 2 \cdot \$5$;
$2000 - 1000 = 1000 = 10 \cdot 100$ and \$110 – 60 = $\$50 = 10 \cdot \$5$;
$3000 - 1000 = 2000 = 20 \cdot 100$ and \$160 - \$60 = $\$100 = 20 \cdot \$5$.
Let h = the house size, in square feet, and let C = the total cost to clean the house.

Translate.

$$\underbrace{\text{Cleaning cost}}_{C} \;\; \underset{=}{\text{is}} \;\; \underset{60}{\text{\$60}} \;\; \underset{+}{\text{plus}} \;\; \underbrace{\text{\$5 per every hundred square feet in excess of 1000 square feet.}}_{5\left(\frac{h-1000}{100}\right)}$$

Carry out. We substitute \$145 for C and solve for h.

$$C = 60 + 5\left(\frac{h-1000}{100}\right)$$

$$145 = 60 + 5\left(\frac{h-1000}{100}\right)$$

$$145 \cdot 100 = 6000 + 5(h - 1000)$$

$$14500 = 6000 + 5h - 5000$$

$$14500 = 1000 + 5h$$

$$13500 = 5h$$

$$2700 = h$$

Check. If the house has 2700 ft^2, then the cost to clean would be

$\$60+\$5\left(\frac{2700-1000}{100}\right)$, or \$145. This result checks.

State. The house has a total area of 2700 ft^2.

57. ***Familiarize.*** Let w = the walking speed, in feet per minute. Then $w + 250$ = the running speed, in feet per minute. Since $d = rt$, the walking distance is $w\cdot 10$, or $10w$, and the running distance is $(w+250)\cdot 20$, or $20(w+250)$.

Translate.
We are given that Samantha ran and walked a total of 15,500 feet.

$$\underbrace{\text{running distance}} \text{ plus } \underbrace{\text{walking distance}} \text{ is } 15{,}500.$$
$$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$$
$$20(w+250) \quad + \quad 10w \quad = \quad 15{,}500$$

Carry out. We solve the equation for w.

$$\begin{aligned} 20(w+250)+10w &= 15{,}500 & \\ 20w+5000+10w &= 15{,}500 & \text{Distributive Law} \\ 30w+5000 &= 15{,}500 & \text{Combine like terms} \\ 30w &= 10{,}500 & \text{Subtracting by 5000} \\ w &= 350 & \text{Dividing by 30} \end{aligned}$$

Check If the walking speed is 350 feet per minute, the running speed is $350 + 250 =$ 600 feet per minute. The total distance is: $20\cdot 600+10\cdot 350=12{,}000+3500=15{,}500$. This result checks.

State. Samantha ran at 600 feet per minute.

58. ***Familiarize.*** Let w = the walking speed, in feet per minute. Then $2w$ = the jogging speed, in feet per minute. Since $d = rt$, the walking distance is $w\cdot 5$, or $5w$, and the jogging distance is $2w\cdot 40$, or $80w$.

Translate.
We are given the Stephanie jogged and walked a total of 21,250 feet.

$$\underbrace{\text{jogging distance}} \text{ plus } \underbrace{\text{walking distance}} \text{ is } 21{,}250$$
$$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$$
$$80w \quad + \quad 5w \quad = \quad 21{,}250$$

Carry out. We solve the equation for w.

$$\begin{aligned} 80w+5w &= 21{,}250 & \\ 85w &= 21{,}250 & \text{Combine like terms} \\ w &= 250 & \text{Dividing by 85} \end{aligned}$$

Check If the walking speed is 250 feet per minute, the running speed is $2\cdot 250=500$ feet per minute. The total distance is: $80\cdot 250+5\cdot 250=20{,}000+1250=21{,}250$. This result checks.

State. Stephanie jogged at 500 feet per minute.

59. ***Familiarize.*** Let c = the driving speed in clear weather, in mph. Let $\frac{1}{2}c$ = the driving speed in the snowstorm, in mph. Since $d = rt$, the clear weather driving distance is $c\cdot 5$, or $5c$, and the snowstorm driving distance is $\frac{1}{2}c\cdot 2$, or c.

Translate.
We are given the Anthony drove 240 more miles in clear weather than the snowstorm.

$$\underbrace{\text{distance in clear weather}} \text{ is } \underbrace{\text{distance in snowstorm}} \text{ plus } 240$$
$$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$$
$$5c \quad = \quad c \quad + \quad 240$$

Carry out. We solve the equation for c.

$$\begin{aligned} 5c &= c+240 & \\ 4c &= 240 & \text{Subtracting by } c \\ c &= 60 & \text{Dividing by 4} \end{aligned}$$

Check If the driving speed in clear weather was 60 mph, the driving speed in the snowstorm was $\frac{1}{2}\cdot 60=30$ mph. The distance equation is: $5\cdot 60=60+240$. This result checks.

State. Anthony drove 30 mph in the snow.

60. ***Familiarize.*** Let d = the driving speed on level highway, in mph. Let $d-20$ = the driving speed in the mountains, in mph. Since $d = rt$, the driving distance on level highway is $d\cdot 6$, or $6d$, and the driving distance in the mountains is $2(d-20)$.

Translate.
We are given the Robert drove 300 more miles on level highway.

$$\underbrace{\text{distance on level highway}} \text{ is } \underbrace{\text{distance in mountains}} \text{ plus } 300$$
$$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$$
$$6d \quad = \quad 2(d-20) \quad + \quad 300$$

Carry out. We solve the equation for d.

$$\begin{aligned} 6d &= 2(d-20)+300 \\ 6d &= 2d-40+300 && \text{Distributive Law} \\ 6d &= 2d+260 && \text{Simplify} \\ 4d &= 260 && \text{Subtracting by } 2d \\ d &= 65 && \text{Dividing by 4} \end{aligned}$$

Check If the driving speed on level highway was 65 mph, the driving speed in the mountians was $65-20=45$ mph. The distance equation is: $6\cdot 65 = 2(45)+300$. This result checks.

State. Robert drove 45 mph in the mountains.

61. ***Familiarize.*** Let t = the time spend bicycling at a slower rate of 10 mph *in hours*. Then t + 30 = the time *in minutes* spent bicycling at 15 mph. Converting this to time into hours gives $t+\frac{1}{2}$. Since $d = rt$, the distance at a slower rate is $10t$, and the distance at a faster rate is $15\left(t+\frac{1}{2}\right)$.

Translate.
We are given the total distance bicycled of 25 miles.

$$\begin{array}{ccccc} \underbrace{\text{distance at faster rate}} & \text{plus} & \underbrace{\text{distance at slower rate}} & \text{is} & 25. \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 15\left(t+\frac{1}{2}\right) & + & 10t & = & 25 \end{array}$$

Carry out. We solve the equation for w.

$$\begin{aligned} 15\left(t+\tfrac{1}{2}\right)+10t &= 25 \\ 15t+7.5+10t &= 25 && \text{Distributive Law} \\ 25t+7.5 &= 25 && \text{Combine like terms} \\ 25t &= 17.5 && \text{Subtracting by 7.5} \\ t &= 0.7 && \text{Dividing by 25} \end{aligned}$$

Check The time spend bicycling at a slower rate is 0.7 hours, or $0.7\cdot 60 = 42$ minutes. So the time spent bicycling at a faster rate is 42 + 30 = 72 minutes, or 0.7 + 0.5 = 1.2 hours. The total distance is: $15\cdot 1.2+10\cdot 0.7 = 18+7 = 25$. This result checks.

State. Justin rode for 1.2 hours, or 72 minutes, at a faster speed.

62. ***Familiarize.*** Let t = the time spend going to school *in hours*. Then t + 4 = the time *in minutes* spent going to the library. Converting this to time into hours gives $t+\frac{1}{15}$ because $\frac{4}{60}=\frac{1}{15}$. Since $d = rt$, the distance to the library is $25\left(t+\frac{1}{15}\right)$, and the distance to school is $15t$.

Translate.
We are given the total distance of 15 miles.

$$\begin{array}{ccccc} \underbrace{\text{distance to library}} & \text{plus} & \underbrace{\text{distance to school}} & \text{is} & 15. \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 25\left(t+\frac{1}{15}\right) & + & 15t & = & 15 \end{array}$$

Carry out. We solve the equation for t.

$$\begin{aligned} 25\left(t+\tfrac{1}{15}\right)+15t &= 15 \\ 25t+\tfrac{5}{3}+15t &= 15 && \text{Distributive Law} \\ 40t+\tfrac{5}{3} &= 15 && \text{Combine like terms} \\ 40t &= \tfrac{40}{3} && \text{Subtracting by } \tfrac{5}{3} \\ t &= \tfrac{1}{3} && \text{Dividing by 40} \end{aligned}$$

Check The time spend going to school is $\frac{1}{3}$ hours, or $\frac{1}{3}\cdot 60 = 20$ minutes. So the time spent going to the library is 20 + 4 = 24 minutes, or $24\div 60 = 0.4$ hours. The total distance is: $25\cdot 0.4+15\cdot\frac{1}{3} = 10+5 = 15$. This result checks.

State. Courtney rode her scooter to the library for 0.4 hours, or 24 minutes.

63. *Thinking and Writing Exercise.* Although many of the problems in this section might be solved by guessing, using the five-step problem-solving process to solve them would give Ethan practice in using a technique that can be used to solve other problems whose answers are not so readily guessed.

64. *Thinking and Writing Exercise.* Either approach will work. Some might prefer to let a represent the bride's age because the groom's age is given in terms of the bride's age. When choosing a variable it is important to specify what it represents.

65. Since –9 is to the left of 5 on the number line, we have $-9<5$.

66. Since 1 is to the left of 3 on the number line, we have $1<3$.

67. Since –4 is to the left of 7 on the number line, we have $-4<7$.

68. Since –9 is to the right of –12 on the number line, we have $-9 > -12$.

69. Simply exchange the numbers and change the inequality symbol; $-4 \le x$.

70. Simply exchange the numbers and change the inequality symbol; $5 > x$.

71. Simply exchange the numbers and change the inequality symbol; $y < 5$.

72. Simply exchange the numbers and change the inequality symbol; $t \ge -10$.

73. *Thinking and Writing Exercise.* Answers may vary.
The sum of three consecutive odd integers is 375. What are the integers?

74. *Thinking and Writing Exercise.* Answers may vary.
Acme Rentals rents a 12-foot truck at a rate of $35 plus 20¢ per mile. Audrey has a truck-rental budget of $45 for her move to a new apartment. How many miles can she drive the rental truck without exceeding her budget?

75. ***Familiarize.*** Let c = the amount the meal originally cost. The 15% tip is calculated on the original cost of the meal, so the tip is $0.15c$.
Translate.

$$\underbrace{\text{Original cost}}_{\displaystyle\downarrow \atop \displaystyle c} \quad \underset{\displaystyle + }{\text{plus}} \quad \underset{\displaystyle 0.15c}{\text{tip}} \quad \underset{\displaystyle -}{\text{less}} \quad \underset{\displaystyle 10}{\$10} \quad \underset{\displaystyle =}{\text{is}} \quad \underset{\displaystyle 32.55}{\$32.55.}$$

Carry out. We solve the equation.

$$\begin{aligned} c + 0.15c - 10 &= 32.55 \\ 1.15c - 10 &= 32.55 \\ 1.15c &= 42.55 \\ c &= 37 \end{aligned}$$

Check. If the meal originally cost $37, the tip was 15% of $37, or 0.15($37), or $5.55. Since $37 + $5.55 – $10 = $32.55, the answer checks.
State. The meal originally cost $37.

76. ***Familiarize.*** Let m = the number of multiple-choice questions Pam got right. Note that she got 4 – 1, or 3 fill-ins right.
Translate.

$$\underbrace{\text{Fill-in points}}_{\displaystyle\downarrow \atop \displaystyle 7\cdot 3} \quad \underset{\displaystyle +}{\text{plus}} \quad \underbrace{\text{multiple-choice points}}_{\displaystyle\downarrow \atop \displaystyle 3m} \quad \underset{\displaystyle =}{\text{total}} \quad \underbrace{\text{78 points.}}_{\displaystyle\downarrow \atop \displaystyle 78}$$

Carry out. We solve the equation.

$$\begin{aligned} 7\cdot 3 + 3m &= 78 \\ 21 + 3m &= 78 \\ 3m &= 57 \\ m &= 19 \end{aligned}$$

Check. Pam got 3 fill-ins right and received 7 points for each of them, for a total of $7\cdot 3 = 21$ points. She also got 19 multiple-choice right and received 3 points for each of them, for a total of $3\cdot 19 = 57$ points. So she had a grand total of 21 + 57, or 78 points. This result checks.
State. Pam got 19 multiple-choice questions right.

77. ***Familiarize.*** Let x = a score. Lincoln referred to "four score and seven,", which can be expressed as $4x + 7$. The Gettysburg Address was given in 1863, and Lincoln refers to 1776, a total of 87 years prior.
Translate.

$$\underbrace{\text{Four score and seven years}}_{\displaystyle\downarrow \atop \displaystyle 4x+7} \quad \underset{\displaystyle =}{\text{is}} \quad \underbrace{\text{87 years}}_{\displaystyle\downarrow \atop \displaystyle 87}.$$

Carry out. We solve the equation.

$$\begin{aligned} 4x + 7 &= 87 \\ 4x &= 80 \\ x &= 20 \end{aligned}$$

Check. If a score is 20 years, then four score and seven is $4\cdot 20 + 7$, or 87. If 87 is added to the year 1776, we have $1776 + 87$, or 1863. This results checks.
State. A score is 20 years.

78. ***Familiarize.*** Let x = the larger number. Then 25% of x, or $0.25x$ is the smaller number.
Translate.

$$\underbrace{\text{The larger number}}_{\displaystyle\downarrow \atop \displaystyle x} \quad \underset{\displaystyle =}{\text{is}} \quad \underset{\displaystyle 12}{12} \quad \underbrace{\text{more than}}_{\displaystyle\downarrow \atop \displaystyle +} \quad \underbrace{\text{the smaller number.}}_{\displaystyle\downarrow \atop \displaystyle 0.25x}$$

Carry out. We solve the equation.

$$x = 12 + 0.25x$$
$$0.75x = 12$$
$$x = 16$$

Check. If 16 is the larger number, then 25% of 16, or 0.24(16) = 4 is the smaller number. The larger number, 16, is 12 more than the smaller number, 4. This results checks.
State. The numbers are 4 and 16.

79. ***Familiarize.*** Let x = the number of half-dollars. Then $2x$ would represent the number of quarters, $2(2x)$, or $4x$ would represent the number of dimes, and $3(4x)$, or $12x$ would represent the number of nickels. Furthermore, the value of the half-dollars, in cents, is represented by $50x$, the value of the quarters, in cents, is represented by $25(2x)$, or $50x$, the value of the dimes is represented by $10(4x)$, or $40x$, and the value of the nickels, in cents is represented by $5(12x)$, or $60x$.
Translate.

$$\underbrace{\text{Total value of the change, in cents,}}_{50x+50x+40x+60x} \ \underbrace{\text{is}}_{=} \ \underbrace{1000.}_{1000}$$

Carry out. We solve the equation.

$$50x + 50x + 40x + 60x = 1000$$
$$200x = 1000$$
$$x = 5$$

If $x = 5$, then there are 5 half-dollars; there are 10 quarters, there are 20 dimes, and there are 60 nickels.
Check. The total value of the change is: 5(50¢) + 10(25¢) + 20(10¢) + 60(5¢), or 250¢ + 250¢ + 200¢ + 300¢ = 1000¢, or $10.00. These results check.
State. There are 5 half-dollars, 10 quarters, 20 dimes, and 60 nickels.

80. ***Familiarize.*** Let x = the length of the rectangle, in cm. Then the width can be represented by $\frac{3}{4}x$, in cm. If the dimensions are increased by 2 cm, the length is $x+2$ and the width is $\frac{3}{4}x+2$. Recall that the formula for the perimeter of a rectangle is $P = 2w + 2l$.

Translate.

$$\underbrace{\text{Perimeter of the rectangle when length and width are increased by 2 cm}}_{2\left(\frac{3}{4}x+2\right)+2(x+2)} \ \underbrace{\text{is}}_{=} \ \underbrace{\text{50 cm.}}_{50}$$

Carry out. We solve the equation.

$$2\left(\tfrac{3}{4}x+2\right)+2(x+2)=50$$
$$\tfrac{3}{2}x+4+2x+4=50$$
$$\tfrac{7}{2}x+8=50$$
$$\tfrac{7}{2}x=42$$
$$\tfrac{2}{7}\left(\tfrac{7}{2}x\right)=\tfrac{2}{7}(42)$$
$$x=12$$

If $x = 12$, then the length is 12 and the width is $\frac{3}{4}(12)$, or 9.
Check. If the length is increased by 2 cm, then the new length is 12 + 2, or 14 cm. If the width is increased by 2 cm, then the new width is 9 + 2, or 11 cm. The perimeter of the new rectangle would be 2(11cm) + 2(14 cm), or 22 cm + 28 cm, or 50 cm. These results check.
State. The original rectangle had a length of 12 cm and a width of 9 cm.

81. ***Familiarize.*** Let x = the original price of the camera before the two discounts. Julio's credit account agreement gives him a 10% discount; so, he would pay 90% of the original price, or $0.9x$. His coupon give him an additional 10% discount off of the reduced price; so, he would pay 90% of $0.9x$, or $0.9(0.9x)$, or $0.81x$.
Translate.

$$\underbrace{\text{Final discounted price of the camera}}_{0.81x} \ \underbrace{\text{is}}_{=} \ \underbrace{\$77.75.}_{77.75}$$

Carry out. We solve the equation.

$$0.81x = 77.75$$
$$x = 95.99 \quad \text{(Rounded)}$$

Check. If the original price of the camera was $95.99, then after the credit account discount is applied, Julio will owe 90% of $95.99, or $86.39. After applying the coupon discount of 10%, he will owe 90% of the first

discounted price, or 90% of \$86.39, or \$77.75 (rounded). These results check.
State. The original price of the camera was \$95.99.

82. ***Familiarize.*** Let x = the original number of apples in the basket. Then $\frac{1}{3}x$, $\frac{1}{4}x$, $\frac{1}{8}x$, and $\frac{1}{5}x$ of the apples go to the first, second, third, and fourth person, respectively. The fifth person gets 10 apples, and the sixth person gets 1 apple.
Translate.

$$\underbrace{\text{The number of apples distributed}}_{\displaystyle \frac{1}{3}x+\frac{1}{4}x+\frac{1}{8}x+\frac{1}{5}x+10+1} \quad \underset{=}{\text{is}} \quad \underbrace{\text{the number in the basket.}}_{\displaystyle x}$$

Carry out. We solve the equation.

$$\frac{1}{3}x+\frac{1}{4}x+\frac{1}{8}x+\frac{1}{5}x+10+1=x$$

Multiply both sides by the LCD = 120.

$$120\left(\frac{1}{3}x+\frac{1}{4}x+\frac{1}{8}x+\frac{1}{5}x+10+1\right)=120x$$
$$40x+30x+15x+24x+1200+120=120x$$
$$109x+1320=120x$$
$$1320=11x$$
$$120=x$$

Check. If there were 120 apples in the basket to start with, then the first person received $\frac{1}{3}(120)=40$ apples; the second received $\frac{1}{4}(120)=30$ apples, the third received $\frac{1}{8}(120)=15$ apples, the fourth received $\frac{1}{5}(120)=24$ apples; the fifth received (we are told) 10 apples, and the sixth received (we are told) 1 apple. This makes a total of 40 + 30 + 15 + 24 + 10 + 1, or 120 apples. These results check.
State. There were 120 apples in the basket.

83. ***Familiarize.*** Let x = the number of additional games they must play. Then the total number of games they will win is $\frac{1}{2}x+15$, and the total number of games they will play, including the additional games, is $x+20$.
Translate.

$$\underbrace{\text{The total number of games they win}}_{\displaystyle \frac{1}{2}x+15} \quad \underset{= 0.6 \;\cdot}{\text{is 60\% of}} \quad \underbrace{\text{the number of games played.}}_{\displaystyle (x+20)}$$

Carry out. We solve the equation.

$$\frac{1}{2}x+15=0.6(x+20)$$
$$0.5x+15=0.6x+12$$
$$3=0.1x$$
$$30=x$$

Check. If they play 30 additional games, then they will have played 20 + 30, or 50 games. If they win 60% of all the games they play, they will win 60% of 50, or 0.6(50), or 30 games. They have already won 15 games, and if they win half of the additional ones, or $\frac{1}{2}(30)=15$, they will have won 15 + 15, or 30 games. These results check.
State. They must play a additional 30 games.

84. ***Familiarize.*** Let x = the number of DVDs purchased. .
First DVD: \$9.99 + \$3 shipping = \$12.99
Second DVD: \$6.99 + \$1.50 shipping = \$8.49
Additional DVDs: \$6.99 + \$1 shipping = \$7.99
Therefore, the cost of each additional DVD after the first two is $7.99(x-2)$.
Translate.
The total cost of the shipment was \$45.45.

$$\underbrace{\text{cost of 1st \& 2nd DVDs}}_{\displaystyle 12.99+8.49} \quad \underset{+}{\text{plus}} \quad \underbrace{\text{additional DVDs}}_{\displaystyle 7.99(x-2)} \quad \underset{=}{\text{is}} \quad \underset{45.45}{\$45.45.}$$

Carry out. We solve the equation.

$$12.99+8.49+7.99(x-2)=45.45$$
$$12.99+8.49+7.99x-15.98=45.45$$
$$7.99x-5.5=45.45$$
$$7.99x=39.95$$
$$x=5$$

Check. The total cost for 5 DVDs is: $12.99+8.49+7.99(3)=45.45$. The results check.
State. There were 5 DVDs in the shipment.

85. ***Familiarize.*** Let x = the score on the third test. If the average on the first two exams was 85, then it follows that the total of her exam percentages on the first two exams was 170 $(170 \div 2 = 85)$.

Translate.

$$\underbrace{\text{Average of the three exams}}_{\downarrow} \text{ is 82.}$$

$$\frac{170+x}{3} \qquad = 82$$

Carry out. We solve the equation.

$$\frac{170+x}{3} = 82$$
$$3\left(\frac{170+x}{3}\right) = 3 \cdot 82$$
$$170 + x = 246$$
$$x = 76$$

Check. If Elsa got an average of 85 on her first two exams, then she must have received a total of 170 points on the two exams since $170 \div 2 = 85$. If she received a score of 76 on her third exam, then her total exam points would be 170 + 76, or 246. The average on all three exams would be $246 \div 3 = 82$. This result checks.

State. The score on the third exam must have been 76.

86. ***Familiarize.*** Let x = the number of miles Glenda rode in the taxi. If a 10-min drive took 20 min, then 10 min was spent stopped in traffic. Since there is a charge of 20¢ per min stopped in traffic, she would have been charged \$0.20(10), or \$2 for being stopped in traffic. Note there are 5 one-fifth miles per mile.

Translate.

$$\underbrace{\text{\$2.50 plus 40¢ per } \tfrac{1}{5} \text{ mile}}_{\downarrow} \text{ plus } \underbrace{\text{charge for being stopped}}_{\downarrow} \text{ is \$16.50.}$$

$$2.50 + 0.4(5x) \quad + \quad 2.00 \quad = \quad 16.50$$

Carry out. We solve the equation.

$$2.50 + 0.4(5x) + 2 = 16.50$$
$$2.5 + 2x + 2 = 16.50$$
$$4.5 + 2x = 16.50$$
$$2x = 12$$
$$x = 6$$

Check. The cab charges \$2.50, plus \$0.40 per $\frac{1}{5}$ mile. If the trip was 6 miles, there were 30 $\frac{1}{5}$-miles covered, for a charge of \$0.40(30), or \$12. In addition the cab sat in traffic 10 min for an additional charge of \$0.20(10), or \$2. So the total bill would have been \$2.50 + \$12 + \$2, or \$16.50. This result checks.

State. The trip consisted of 6 miles.

87. *Thinking and Writing Exercise.* If the school can invest the \$2000 so that it earns at least 7.5% and thus grows to at least \$2150 by the end of the year, the second option should be selected. If not, the first option is preferable.

88. *Thinking and Writing Exercise.* Yes; the page numbers must be consecutive integers. The only consecutive integers whose sum is 191 are 95 and 96. These cannot be the numbers of facing pages, however, because the left-hand page of a book is even-numbered.

89. ***Familiarize.*** Let x = the width of the rectangle, in cm. Then the length is $x + 4.25$ cm. Recall that the perimeter is $P = 2w + 2l$.

Translate.

$$\underbrace{\text{The perimeter of the rectangle}}_{\downarrow} \text{ is 101.74.}$$

$$2x + 2(x + 4.25) \qquad = 101.74$$

Carry out. We solve the equation.

$$2x + 2(x + 4.25) = 101.74$$
$$2x + 2x + 8.5 = 101.74$$
$$4x + 8.5 = 101.74$$
$$4x = 93.24$$
$$x = 23.31$$

Check. If the width is 23.32 cm, then the length is 23.31 + 4.25, or 27.56 cm. The perimeter is 2(23.31 cm) + 2(27.56 cm), or 101.74 cm. These results check.

State. The width is 23.31 cm and the length is 27.56 cm.

90. ***Familiarize.*** Let x = the length of the first side of the triangle, in cm. Then the second side is $x+3.25$ cm, and the third side is $(x+3.25)+4.35$, or 7.6 cm. The perimeter of a triangle is given by $P=a+b+c$, where a, b, and c represent the lengths of the sides of the triangle.
Translate.

$$\underbrace{\text{Perimeter of the triangle}}\ \text{is}\ 26.87.$$
$$\downarrow \qquad \downarrow \quad \downarrow$$
$$x+(x+3.25)+(x+7.6)=26.87$$

Carry out. We solve the equation.

$$\begin{aligned} x+(x+3.25)+(x+7.6)&=26.87\\ 3x+10.85&=26.87\\ 3x&=16.02\\ x&=5.34 \end{aligned}$$

If the first side is 5.34 cm, then the second side is 5.34 + 3.25, or 8.59 cm and the third side is 5.34 + 7.6 cm, or 12.94 cm. The perimeter is 5.34 cm + 8.59 cm + 12.94 cm, or 26.87 cm. These results check.
State. The sides are 5.34 cm, 8.59 cm, and 12.94 cm.

Exercise Set 2.6

1. $\geq$

2. $\leq$

3. $<$

4. $>$

5. Equivalent

6. Equivalent

7. Equivalent

8. Not equivalent

9. $x>-2$
   a) Since $5>-2$ is true, 5 is a solution.
   b) Since $0>-2$ is true, 0 is a solution.
   c) Since $-3>-2$ is false, –3 is not a solution.

10. $y<5$
    a) Since $0<5$ is true, 0 is a solution.
    b) Since $5<5$ is false, 5 is not a solution.
    c) Since $-13<5$, –13 is a solution.

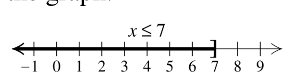
11. $y\leq 19$
    a) Since $18.99\leq 19$ is true, 18.99 is a solution.
    b) Since $19.01\leq 19$ is false, 19.01 is not a solution.
    c) Since $19\leq 19$ is true, 19 is a solution.

12. $x\geq 11$
    a) Since $11\geq 11$ is true, 11 is a solution.
    b) Since $11\frac{1}{2}\geq 11$ is true, $11\frac{1}{2}$ is a solution.
    c) Since $10\frac{2}{3}\geq 11$ is false, $10\frac{2}{3}$ is not a solution.

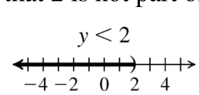
13. $a\geq -6$
    a) Since $-6\geq -6$ is true, –6 is a solution.
    b) Since $-6.1\geq -6$ is false, –6.1 is not a solution.
    c) Since $-5.9\geq -6$ is true, –5.9 is a solution.

14. $c\leq -10$
    a) Since $0\leq -10$ is false, 0 is not a solution.
    b) Since $-10\leq -10$ is true, –10 is a solution.
    c) Since $-10.1\leq -10$ is false, –10.1 is not a solution.

15. The solutions of $x\leq 7$ are shown by using a bracket at the point 7 and shading all points to the left of 7. The bracket indicates that 7 is part of the graph.

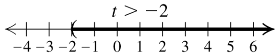


16. The solutions of $y<2$ are shown by using a parenthesis at the point 2 and shading all points to the left of 2. The parenthesis indicates that 2 is not part of the graph.



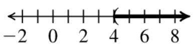
17. The solutions of $t > -2$ are shown by using a parenthesis at the point –2 and shading all points to the right of –2. The parenthesis indicates that –2 is not part of the graph.

$t > -2$



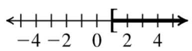
18. The solutions of $y > 4$ are shown by using a parenthesis at the point 4 and shading all points to the right of 4. The parenthesis indicates that 4 is not part of the graph.

$y > 4$



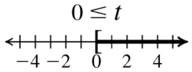
19. The solutions of $1 \le m$ are shown by using a bracket at the point 1 and shading all points to the right of 1. The bracket indicates that 1 is part of the graph.

$1 \le m$



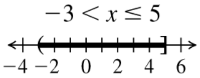
20. The solutions of $0 \le t$ are shown by using a bracket at the point 0 and shading all points to the right of 0. The bracket indicates that 0 is part of the graph.

$0 \le t$



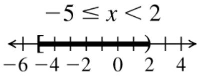
21. In order to be the solution of the inequality $-3 < x \le 5$, a number must be a solution of both $-3 < x$ and $x \le 5$. The solution set is graphed as follows:

$-3 < x \le 5$



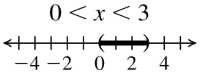
22. In order to be the solution of the inequality $-5 \le x < 2$, a number must be a solution of both $-5 \le x$ and $x < 2$. The solution set is graphed as follows:

$-5 \le x < 2$



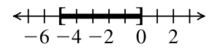
23. In order to be the solution of the inequality $0 < x < 3$, a number must be a solution of both $0 < x$ and $x < 3$. The solution set is graphed as follows:

$0 < x < 3$

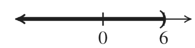


24. In order to be the solution of the inequality $-5 \le x \le 0$, a number must be a solution of both $-5 \le x$ and $x \le 0$. The solution set is graphed as follows:

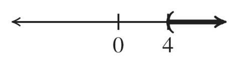
$-5 \le x \le 0$



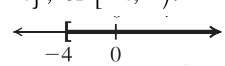
25. The solutions of $y < 6$ are shown by using a parenthesis at the point 6 and shading all points to the left of 6. The parenthesis indicates that 6 is not part of the graph. The solution set is $\{y \mid y < 6\}$, or $(-\infty, 6)$.,



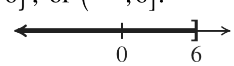
26. The solutions of $x > 4$ are shown by using parenthesis at the point 4 and shading all points to the right of 4. The parenthesis indicates that 4 is not part of the graph. The solution set is $\{x \mid x > 4\}$, or $(4, \infty)$.



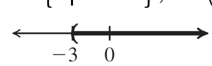
27. The solutions of $x \ge -4$ are shown by using a bracket at the point -4 and shading all points to the right of -4. The bracket indicates that -4 is part of the graph. The solution set is $\{x \mid x \ge -4\}$, or $[-4, \infty)$.



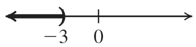
28. The solutions of $t \le 6$ are shown by using a bracket at the point 6 and shading all points to the left of 6. The bracket indicates that 6 is part of the graph. The solution set is $\{x \mid t \le 6\}$, or $(-\infty, 6]$.



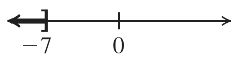
29. The solutions of $t > -3$ are shown by using parenthesis at the point -3 and shading all points to the right of -3. The parenthesis indicates that -3 is not part of the graph. The solution set is $\{t \mid t > -3\}$, or $(-3, \infty)$.



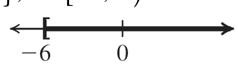
30. The solutions of $y < -3$ are shown by using a parenthesis at the point -3 and shading all points to the left of -3. The parenthesis indicates that -3 is not part of the graph. The solution set is $\{y \mid y < -3\}$, or $(-\infty, -3)$.



31. The solutions of $x \le -7$ are shown by using a bracket at the point –7 and shading all points to the left of –7. The bracket indicates that –7 is part of the graph. The solution set is $\{x \mid t \le -7\}$, or $(-\infty, -7]$.



32. The solutions of $x \ge -6$ are shown by using a bracket at the point -6 and shading all points to the right of -6. The bracket indicates that -6 is part of the graph. The solution set is $\{x \mid x \ge -6\}$, or $[-6, \infty)$.



33. All the points to the right of –4 are shaded. The parenthesis at –4 indicates that –4 is not part of the graph. We have $\{x \mid x > -4\}$, or $(-4, \infty)$.

34. All the points to the left of 3 are shaded. The parenthesis at 3 indicates that 3 is not part of the graph. We have $\{x \mid x < 3\}$, or $(-\infty, 3)$.

35. All the points to the left of 2 are shaded. The bracket at 2 indicates that 2 is part of the graph. We have $\{x \mid x \le 2\}$, or $(-\infty, 2]$.

36. All the points to the right of –2 are shaded. The bracket at –2 indicates that –2 is part of the graph. We have $\{x \mid x \ge -2\}$, or $[-2, \infty)$.

37. All the points to the left of –1 are shaded. The parenthesis at –1 indicates that –1 is not part of the graph. We have $\{x \mid x < -1\}$, or $(-\infty, -1)$.

38. All the points to the right of 1 are shaded. The parenthesis at 1 indicates that 1 is not part of the graph. We have $\{x \mid x > 1\}$, or $(1, \infty)$.

39. All the points to the right of 0 are shaded. The bracket at 0 indicates that 0 is part of the graph. We have $\{x \mid x \ge 0\}$, or $[0, \infty)$.

40. All the points to the left of 0 are shaded. The bracket at 0 indicates that 0 is part of the graph. We have $\{x \mid x \le 0\}$, or $(-\infty, 0]$.

41. $y + 2 > 9$

$y + 2 - 2 > 9 - 2$ Adding -2 to both sides

$y > 7$ Simplifying

The solution set is $\{y \mid y > 7\}$, or $(7, \infty)$.

The graph is as follows:

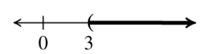
42. $y + 6 > 9$

$y + 6 - 6 > 9 - 6$ Adding -6 to both sides

$y > 3$ Simplifying

The solution set is $\{y \mid y > 3\}$, or $(3, \infty)$.

The graph is as follows:

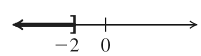


43. $x - 8 \le -10$

$x - 8 + 8 \le -10 + 8$ Adding 8 to both sides

$x \le -2$ Simplifying

The solution set is $\{x \mid x \le -2\}$, or $(-\infty, -2]$. The graph is as follows:



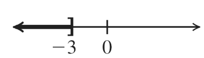
44. $x - 9 \le -12$

$x - 9 + 9 \le -12 + 9$ Adding 9 to both sides

$x \le -3$ Simplifying

The solution set is $\{x \mid x \le -3\}$, or $(-\infty, -3]$.

The graph is as follows:

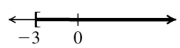


45. $5 \le t + 8$

$5 - 8 \le t + 8 - 8$ Adding -8 to both sides

$-3 \le t$ Simplifying

The solution set is $\{t \mid -3 \le t\}$, or $\{t \mid t \ge -3\}$, or $[-3, \infty)$. The graph is as follows:

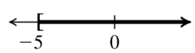


46. $4 \le t + 9$

$4 - 9 \le t + 9 - 9$ Adding -9 to both sides

$-5 \le t$ Simplifying

The solution set is $\{t \mid -5 \le t\}$, or $\{t \mid t \ge -5\}$, or $[-5, \infty)$. The graph is as follows:



47. $2x + 4 \le x + 9$

$2x + 4 - 4 \le x + 9 - 4$ Adding -4 to both sides

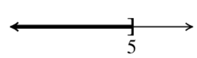
$2x \le x + 5$ Simplifying

$2x - x \le x + 5 - x$ Adding $-x$

$x \le 5$ Simplifying

The solution set is $\{x \mid x \le 5\}$, or $(-\infty, 5]$.

The graph is as follows:



48. $2x + 4 \le x + 1$

$2x + 4 - 4 \le x + 1 - 4$ Adding -4 to both sides

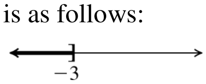
$2x \le x - 3$ Simplifying

$2x - x \le x - 3 - x$ Adding $-x$

$x \le -3$ Simplifying

The solution set is $\{x \mid x \le -3\}$, or $(-\infty, -3]$.

The graph is as follows:



49. $y + \frac{1}{3} \le \frac{5}{6}$

$y + \frac{1}{3} - \frac{1}{3} \le \frac{5}{6} - \frac{1}{3}$

$y \le \frac{5}{6} - \frac{2}{6}$

$y \le \frac{3}{6}$

$y \le \frac{1}{2}$

The solution set is $\left\{y \middle| y \le \frac{1}{2}\right\}$, or $\left(-\infty, \frac{1}{2}\right]$.

50. $x + \frac{1}{4} \le \frac{1}{2}$

$x + \frac{1}{4} - \frac{1}{4} \le \frac{1}{2} - \frac{1}{4}$

$x \le \frac{1}{4}$

The solution set is $\left\{x \middle| x \le \frac{1}{4}\right\}$, or $\left(-\infty, \frac{1}{4}\right]$.

51. $t - \frac{1}{8} > \frac{1}{2}$

$t - \frac{1}{8} + \frac{1}{8} > \frac{1}{2} + \frac{1}{8}$

$t > \frac{4}{8} + \frac{1}{8}$

$t > \frac{5}{8}$

The solution set is $\left\{t \middle| t > \frac{5}{8}\right\}$, or $\left(\frac{5}{8}, \infty\right)$.

52. $y - \frac{1}{3} > \frac{1}{4}$

$y - \frac{1}{3} + \frac{1}{3} > \frac{1}{4} + \frac{1}{3}$

$y > \frac{3}{12} + \frac{4}{12}$

$y > \frac{7}{12}$

The solution set is $\left\{y \middle| y > \frac{7}{12}\right\}$, or $\left(\frac{7}{12}, \infty\right)$.

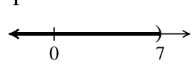
53. $$-9x+17>17-8x$$
$$-9x+17-17>17-8x-17$$
$$-9x>-8x$$
$$-9x+9x>-8x+9x$$
$$0>x$$
The solution set is $\{x\,|\,0>x\}$, or $\{x\,|\,x<0\}$, or $(-\infty,0)$.

54. $$-8n+12>12-7n$$
$$-8n>-7n$$
$$0>n$$
The solution set is $\{n\,|\,n<0\}$, or $(-\infty,0)$.

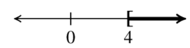
55. $-23<-t$
The inequality states that the opposite of 23 is less than the opposite of t. Thus, t must be less than 23, so the solution set is $\{t\,|\,t<23\}$.
To solve this inequality using the addition principle, we would proceed as follows:
$$-23<-t$$
$$-23+t<-t+t$$
$$-23+t<0$$
$$-23+t+23<0+23$$
$$t<23$$
The solution set is $\{t\,|\,t<23\}$, or $(-\infty,23)$.

56. $$19<-x$$
$$19+x<-x+x$$
$$19+x<0$$
$$19+x-19<0-19$$
$$x<-19$$
The solution set is $\{x\,|\,x<-19\}$, or $(-\infty,-19)$.

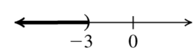
57. $$5x<35$$
$$\frac{1}{5}\cdot 5x<\frac{1}{5}\cdot 35 \qquad \text{Multiplying by } \frac{1}{5}$$
$$x<7$$
The solution set is $\{x\,|\,x<7\}$, or $(-\infty,7)$.
The graph is as follows:



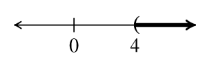
58. $$8x\ge 32$$
$$\frac{1}{8}\cdot 8x\ge\frac{1}{8}\cdot 32 \qquad \text{Multiplying by } \frac{1}{8}$$
$$x\ge 4$$
The solution set is $\{x\,|\,x\ge 4\}$, or $[4,\infty)$.
The graph is as follows:



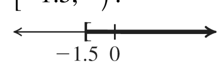
59. $$-24>8t$$
$$\frac{1}{8}\cdot(-24)>\frac{1}{8}\cdot 8t \qquad \text{Multiplying by } \frac{1}{8}$$
$$-3>t \qquad \text{Simplifying}$$
The solution set is $\{t\,|\,-3>t\}$, or $\{t\,|\,t<-3\}$, or $(-\infty,-3)$. The graph is as follows:



60. $$-16x<-64$$
$$-\frac{1}{16}\cdot(-16x)<-\frac{1}{16}(-64) \qquad \text{Multiplying by } -\frac{1}{16}$$
$$\uparrow \qquad \text{The symbol has to be reversed.}$$
$$x>4 \qquad \text{Simplifying}$$
The solution set is $\{x\,|\,x>4\}$, or $(4,\infty)$. The graph is as follows:



61. $$1.8\ge -1.2n$$
$$\frac{1.8}{-1.2}\le\frac{-1.2n}{-1.2} \qquad \text{Dividing by } -1.2$$
$$\uparrow \qquad \text{The symbol has to be reversed}$$
$$-1.5\le n$$
The solution set is $\{n|n\ge -1.5\}$, or $[-1.5,\infty)$.



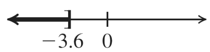
62. $9 \le -2.5a$

$\frac{9}{-2.5} \ge \frac{-2.5a}{-2.5}$ Dividing by -2.5

$\uparrow$ The symbol has to be reversed

$-3.6 \ge a$

The solution set is $\{a|a \le -3.6\}$, or $(-\infty, -3.6]$.



63. $-2y \le \frac{1}{5}$

$-\frac{1}{2} \cdot (-2y) \ge -\frac{1}{2} \cdot \frac{1}{5}$ Multiplying by $-\frac{1}{2}$

$\uparrow$ The symbol has to be reversed

$y \ge -\frac{1}{10}$

The solution set is $\left\{y \middle| y \ge -\frac{1}{10}\right\}$, or $\left[-\frac{1}{10}, \infty\right)$.

64. $-2x \ge \frac{1}{5}$

$-\frac{1}{2} \cdot (-2x) \le -\frac{1}{2} \cdot \frac{1}{5}$ Multiplying by $-\frac{1}{2}$

$\uparrow$ The symbol has to be reversed.

$x \le -\frac{1}{10}$

The solution set is $\left\{x \middle| x \le -\frac{1}{10}\right\}$, or $\left(-\infty, -\frac{1}{10}\right]$.

65. $-\frac{8}{5} > -2x$

$-\frac{1}{2} \cdot \left(-\frac{8}{5}\right) < -\frac{1}{2} \cdot (-2x)$ Multiplying by $-\frac{1}{2}$

$\uparrow$ The symbol has to be reversed.

$\frac{8}{10} < x$

$\frac{4}{5} < x$, or $x > \frac{4}{5}$

The solution set is $\left\{x \middle| \frac{4}{5} < x\right\}$, or $\left\{x \middle| x > \frac{4}{5}\right\}$, or $\left(\frac{4}{5}, \infty\right)$.

66. $-\frac{5}{8} < -10y$

$-\frac{1}{10}\left(-\frac{5}{8}\right) > -\frac{1}{10} \cdot (-10y)$ Multiplying by $-\frac{1}{10}$ and reversing the symbol

$\uparrow$

$\frac{5}{80} > y$

$\frac{1}{16} > y$

The solution set is $\left\{y \middle| y < \frac{1}{16}\right\}$, or $\left(-\infty, \frac{1}{16}\right)$.

67. $7 + 3x < 34$

$7 + 3x - 7 < 34 - 7$ Adding -7

$3x < 27$ Simplifying

$x < 9$ Multiplying both sides by $\frac{1}{3}$

The solution set is $\{x \mid x < 9\}$, or $(-\infty, 9)$.

68. $5 + 4y < 37$

$5 + 4y - 5 < 37 - 5$ Adding -5

$4y < 32$ Simplifying

$y < 8$ Multiplying both sides by $\frac{1}{4}$

The solution set is $\{y \mid y < 8\}$, or $(-\infty, 8)$.

69. $4t-5\le 23$

$4t-5+5\le 23+5$ Adding 5

$4t\le 28$ Simplifying

$t\le 7$ Multiplying both sides by $\frac{1}{4}$

The solution set is $\{t\mid t\le 7\}$, or $(-\infty,7]$.

70. $13x-7<-46$

$13x-7+7<-46+7$ Adding 7

$13x<-39$ Simplifying

$x<-3$ Multiplying both sides by $\frac{1}{13}$

The solution set is $\{x\mid x<-3\}$, or $(-\infty,-3)$.

71. $16<4-a$

$16-4<4-a-4$ Adding -4

$12<-a$ Simplifying

$-12>a$ Multiplying both sides by -1 and reversing the inequality symbol

The solution set is $\{a\mid -12>a\}$, or $\{a\mid a<-12\}$, or $(-\infty,-12)$.

72. $22<6-n$

$22-6<6-n-6$ Adding -6

$16<-n$ Simplifying

$-16>n$ Multiplying both sides by -1 and reversing the inequality symbol

The solution set is $\{n\mid -16>n\}$, or $\{n\mid n<-16\}$, or $(-\infty,-16)$.

73. $5-7y\ge 5$

$5-7y-5\ge 5-5$ Subtracting 5

$-7y\ge 0$ Simplifying

$y\le 0$ Multiplying both sides by $-\frac{1}{7}$ and reversing the inequality symbol

The solution set is $\{y\mid y\le 0\}$, or $(-\infty,0]$.

74. $8-2y\ge 14$

$8-2y-8\ge 14-8$ Adding -8

$-2y\ge 6$ Simplifying

$y\le -3$ Multiplying both sides by $-\frac{1}{2}$ and reversing the inequality symbol

The solution set is $\{y\mid y\le -3\}$, or $(-\infty,-3]$.

75. $-3<8x+7-7x$

$-3<x+7$ Simplifying

$-3-7<x+7-7$ Adding -7

$-10<x$ Simplifying

The solution set is $\{x\mid -10<x\}$, or $\{x\mid x>-10\}$, or $(-10,\infty)$.

76. $-5<9x+8-8x$

$-5<x+8$ Simplifying

$-5-8<x+8-8$ Adding -8

$-13<x$ Simplifying

The solution set is $\{x\mid -13<x\}$, or $\{x\mid x>-13\}$, or $(-13,\infty)$.

77. $6-4y>4-3y$

$6-4y-4>4-3y-4$ Adding -4

$-4y+2>-3y$ Simplifying

$-4y+2+4y>-3y+4y$ Adding $4y$

$2>y$ Simplifying

The solution set is $\{y\mid 2>y\}$, or $\{y\mid y<2\}$, or $(-\infty,2)$.

78. $7-8y>5-7y$

$7-8y-5>5-7y-5$ Adding -5

$2-8y>-7y$ Simplifying

$2-8y+8y>-7y+8y$ Adding $8y$

$2>y$ Simplifying

The solution set is $\{y\mid 2>y\}$, or $\{y\mid y<2\}$, or $(-\infty,2)$.

79.
$$\begin{aligned} 7-9y &\le 4-8y \\ 7-9y-4 &\le 4-8y-4 && \text{Adding } -4 \\ 3-9y &\le -8y && \text{Simplifying} \\ 3-9y+9y &\le -8y+9y && \text{Adding } 9y \\ 3 &\le y && \text{Simplifying} \end{aligned}$$

The solution set is $\{y\,|\,3\le y\}$, or $\{y\,|\,y\ge 3\}$, or $[3,\infty)$.

80.
$$\begin{aligned} 6-13y &\le 4-12y \\ 6-13y+12y &\le 4-12y+12y && \text{Adding } 12y \\ 6-y &\le 4 && \text{Simplifying} \\ 6-y-6 &\le 4-6 && \text{Subtracting 6} \\ -y &\le -2 && \text{Simplifying} \\ y &\ge 2 && \text{Multiplying both sides by } -1 \text{ and reversing the inequality symbol} \end{aligned}$$

The solution set is $\{y|y\ge 2\}$, or $[2,\infty)$.

81.
$$\begin{aligned} 2.1x+43.2 &> 1.2-8.4x \\ 2.1x+43.2-43.2 &> 1.2-8.4x-43.2 && \text{Adding } -43.2 \\ 2.1x &> -8.4x-42 && \text{Simplifying} \\ 2.1x+8.4x &> -8.4x-42+8.4x && \text{Adding } 8.4x \\ 10.5x &> -42 && \text{Simplifying} \\ x &> -4 && \text{Multiplying by } \frac{1}{10.5} \end{aligned}$$

The solution set is $\{x|x>-4\}$, or $(-4,\infty)$.

82.
$$\begin{aligned} 0.96y-0.79 &\le 0.21y+0.46 \\ 0.96y-0.79+0.79 &\le 0.21y+0.46+0.79 && \text{Adding 0.79} \\ 0.96y &\le 0.21y+1.25 && \text{Simplifying} \\ 0.96y-0.21y &\le 0.21y+1.25-0.21y && \text{Adding } -0.21y \\ 0.75y &\le 1.25 && \text{Simplifying} \\ y &\le \frac{1.25}{0.75} && \text{Multiplying by } \frac{1}{0.75} \\ y &\le \frac{5}{3} && \text{Simplifying} \end{aligned}$$

The solution set is $\left\{y\middle|y\le\frac{5}{3}\right\}$, or $\left(-\infty,\frac{5}{3}\right]$.

83.
$$\begin{aligned} 0.7n-15+n &\ge 2n-8-0.4n \\ 1.7n-15 &\ge 1.6n-8 && \text{Simplifying} \\ 1.7n-15-1.6n &\ge 1.6n-8-1.6n && \text{Adding } -1.6n \\ 0.1n-15 &\ge -8 && \text{Simplifying} \\ 0.1n-15+15 &\ge -8+15 && \text{Adding 15} \\ 0.1n &\ge 7 && \text{Simplifying} \\ n &\ge 70 && \text{Multiplying by } \frac{1}{0.1} \end{aligned}$$

The solution set is $\{n\,|\,n\ge 70\}$, or $[70,\infty)$.

84.
$$\begin{aligned} 1.7t+8-1.62t &< 0.4t-0.32+8 \\ 0.08t+8 &< 0.4t+7.68 && \text{Simplifying} \\ 0.08t+8-7.68 &< 0.4t+7.68-7.68 && \text{Adding } -7.68 \\ 0.08t+0.32 &< 0.4t && \text{Simplifying} \\ 0.08t+0.32-0.08t &< 0.4t-0.08t && \text{Adding } -0.08t \\ 0.32 &< 0.32t && \text{Simplifying} \\ 1 &< t && \text{Multiplying by } +\frac{1}{0.32} \end{aligned}$$

The solution set is $\{t\,|\,1<t\}$, or $\{t\,|\,t>1\}$, or $(1,\infty)$.

85.
$$\begin{aligned} \frac{x}{3}-4 &\le 1 \\ \frac{x}{3}-4+4 &\le 1+4 && \text{Adding 4} \\ \frac{x}{3} &\le 5 && \text{Simplifying} \\ 3\left(\frac{x}{3}\right) &\le 3\cdot 5 && \text{Multiplying by 3} \\ x &\le 15 && \text{Simplifying} \end{aligned}$$

The solution set is $\{x\,|\,x\le 15\}$, or $(-\infty,15]$.

86. $\frac{2}{3}-\frac{x}{5}<\frac{4}{15}$

$15\left(\frac{2}{3}-\frac{x}{5}\right)<15\left(\frac{4}{15}\right)$ Multiplying by 15

$10-3x<4$ Simplifying

$10-3x-10<4-10$ Adding -10

$-3x<-6$ Simplifying

$\left(-\frac{1}{3}\right)(-3x)<\left(-\frac{1}{3}\right)(-6)$ Multiplying by $-\frac{1}{3}$ and reversing the inequality symbol

$x>2$

The solution set is $\{x\,|\,x>2\}$, or $(2,\infty)$.

87. $3<5-\frac{t}{7}$

$7\cdot 3<7\left(5-\frac{t}{7}\right)$ Multiplying by 7

$21<35-t$ Simplifying

$21-21<35-t-21$ Adding -21

$0<14-t$ Simplifying

$0+t<14-t+t$ Adding t

$t<14$ Simplifying

The solution set is $\{t\,|\,t<14\}$ or $(-\infty,14)$.

88. $2>9-\frac{x}{5}$

$5\cdot 2>5\left(9-\frac{x}{5}\right)$ Multiplying by 5

$10>45-x$ Simplifying

$10-10>45-x-10$ Adding -10

$0>35-x$ Simplifying

$0+x>35-x+x$ Adding x

$x>35$ Simplifying

The solution set is $\{x\,|\,x>35\}$, or $(35,\infty)$.

89. $4(2y-3)\le -44$

$8y-12\le -44$ Distributive Law

$8y-12+12\le -44+12$ Adding 12

$8y\le -32$ Simplifying

$y\le -4$ Multiplying by $\frac{1}{8}$

The solution set is $\{y\,|\,y\le -4\}$, or $(-\infty,-4]$.

90. $3(2y-3)\ge 21$

$6y-9\ge 21$ Distributive Law

$6y-9+9\ge 21+9$ Adding 9

$6y\ge 30$ Simplifying

$y\ge 5$ Multiplying by $\frac{1}{6}$

The solution set is $\{y\,|\,y\ge 5\}$, or $[5,\infty)$.

91. $3(t-2)\ge 9(t+2)$

$3t-6\ge 9t+18$ Distributive Law

$3t-6+6\ge 9t+18+6$ Adding 6

$3t\ge 9t+24$ Simplifying

$3t-9t\ge 9t+24-9t$ Adding $-9t$

$-6t\ge 24$ Simplifying

$t\le -4$ Multiplying by $-\frac{1}{6}$ and reversing the inequality symbol

The solution set is $\{t\,|\,t\le -4\}$, or $(-\infty,-4]$.

92. $8(2t+1)>4(7t+7)$

$16t+8>28t+28$ Distributive Law

$16t+8-28>28t+28-28$ Adding -28

$16t-20>28t$ Simplifying

$16t-20-16t>28t-16t$ Adding $-16t$

$-20>12t$ Simplifying

$-\frac{20}{12}>t$ Multiplying by $\frac{1}{12}$

$-\frac{5}{3}>t$ Simplifying

The solution set is $\left\{t\,\middle|\,-\frac{5}{3}>t\right\}$, or

$\left\{t\,\middle|\,t<-\frac{5}{3}\right\}$, or $\left(-\infty,-\frac{5}{3}\right)$.

93. $3(r-6)+2<4(r+2)-21$

$3r-18+2<4r+8-21$ Distributive Law

$3r-16<4r-13$ Simplifying

$3r-16+13<4r-13+13$ Adding 13

$3r-3<4r$ Simplifying

$3r-3-3r<4r-3r$ Adding $-3r$

$-3<r$ Simplifying

The solution set is $\{r \mid -3 < r\}$, or $\{r \mid r > -3\}$, or $(-3, \infty)$.

94. $5(t+3)+9 > 3(t-2)+6$

$5t+15+9 > 3t-6+6$ Distributive Law

$5t+24 > 3t$ Simplifying

$5t+24-24 > 3t-24$ Adding -24

$5t > 3t-24$ Simplifying

$5t-3t > 3t-24-3t$ Adding $-3t$

$2t > -24$ Simplifying

$t > -12$ Multiplying by $\frac{1}{2}$

The solution set is $\{t \mid t > -12\}$, or $(-12, \infty)$.

95. $\frac{2}{3}(2x-1) \geq 10$

$\frac{3}{2}\left[\frac{2}{3}(2x-1)\right] \geq \frac{3}{2} \cdot 10$ Multiplying by $\frac{3}{2}$

$2x-1 \geq 15$ Simplifying

$2x-1+1 \geq 15+1$ Adding 1

$2x \geq 16$ Simplifying

$x \geq 8$ Multiplying by $\frac{1}{2}$

The solution set is $\{x \mid x \geq 8\}$, or $[8, \infty)$.

96. $\frac{4}{5}(3x+4) \leq 20$

$\frac{5}{4}\left[\frac{4}{5}(3x+4)\right] \leq \frac{5}{4} \cdot 20$ Multiplying by $\frac{5}{4}$

$3x+4 \leq 25$ Simplifying

$3x+4-4 \leq 25-4$ Adding -4

$3x \leq 21$ Simplifying

$x \leq 7$ Multiplying by $\frac{1}{3}$

The solution set is $\{x \mid x \leq 7\}$, or $(-\infty, 7]$.

97. $\frac{3}{4}\left(3x-\frac{1}{2}\right)-\frac{2}{3} < \frac{1}{3}$

$12\left[\frac{3}{4}\left(3x-\frac{1}{2}\right)-\frac{2}{3}\right] < 12 \cdot \frac{1}{3}$ Multiplying by 12

$9\left(3x-\frac{1}{2}\right)-8 < 4$ Simplifying

$27x-4.5-8 < 4$ Distributive Law

$27x-12.5 < 4$ Simplifying

$27x-12.5+12.5 < 4+12.5$ Adding 12.5

$27x < 16.5$ Simplifying

$270x < 165$ Multiplying by 10

$x < \frac{165}{270}$ Multiplying by $\frac{1}{270}$

$x < \frac{11}{18}$ Simplifying

The solution set is $\left\{x \middle| x < \frac{11}{18}\right\}$, or $\left(-\infty, \frac{11}{18}\right)$.

98. $\frac{2}{3}\left(\frac{7}{8}-4x\right)-\frac{5}{8} < \frac{3}{8}$

$24\left[\frac{2}{3}\left(\frac{7}{8}-4x\right)-\frac{5}{8}\right] < 24 \cdot \frac{3}{8}$ Multiplying by 24

$16\left(\frac{7}{8}-4x\right)-15 < 9$ Distributive Law

$14-64x-15 < 9$ Distributive Law

$-64x-1 < 9$ Simplifying

$-64x-1+1 < 9+1$ Adding 1

$-64x < 10$ Simplifying

$x > -\frac{10}{64}$ Multiplying by $-\frac{1}{64}$ and reversing the inequality symbol

$x > -\frac{5}{32}$ Simplifying

The solution set is $\left\{x \middle| x > -\frac{5}{32}\right\}$, or $\left(-\frac{5}{32}, \infty\right)$.

99. *Thinking and Writing Exercise.* No, because the inequality $x > -3$ also includes all x-values greater than -3 that are less than -2.

100. *Thinking and Writing Exercise.* The solution set of the first inequality is $\{t \mid t > -7\}$ and the solution set of the second inequality is $\{t \mid t < -7\}$. Since the inequalities have different solution sets, they are not equivalent.

101. $$\begin{aligned} 4-x &= 8-5x \\ 4-x-4 &= 8-5x-4 && \text{Subtracting 4} \\ -x &= 4-5x && \text{Simplifying} \\ -x+5x &= 4-5x+5x && \text{Adding } 5x \\ 4x &= 4 && \text{Simplifying} \\ x &= 1 && \text{Multiplying by } \tfrac{1}{4} \end{aligned}$$

The solution is $x=1$.

102. $$\begin{aligned} 4-x &> 8-5x \\ 4-x-4 &> 8-5x-4 && \text{Adding } -4 \\ -x &> 4-5x && \text{Simplifying} \\ -x+5x &> 4-5x+5x && \text{Adding } 5x \\ 4x &> 4 && \text{Simplifying} \\ x &> 1 && \text{Multiplying by } \tfrac{1}{4} \end{aligned}$$

The solution set is $\{x \mid x>1\}$, or $(1,\infty)$.

103. $$\begin{aligned} 2(5-x) &= \tfrac{1}{2}(x+1) \\ 2\left[2(5-x)\right] &= 2\left[\tfrac{1}{2}(x+1)\right] && \text{Multiplying by 2} \\ 4(5-x) &= x+1 && \text{Simplifying} \\ 20-4x &= x+1 && \text{Distributive Law} \\ 20-4x-1 &= x+1-1 && \text{Adding } -1 \\ 19-4x &= x && \text{Simplifying} \\ 19-4x+4x &= x+4x && \text{Adding } 4x \\ 19 &= 5x && \text{Simplifying} \\ \frac{19}{5} &= x && \text{Multiplying by } \frac{1}{5} \end{aligned}$$

The solution is $x=\frac{19}{5}$.

104. $$\begin{aligned} 2(5-x) &\le \tfrac{1}{2}(x+1) \\ 2\left[2(5-x)\right] &\le 2\left[\tfrac{1}{2}(x+1)\right] && \text{Multiplying by 2} \\ 4(5-x) &\le x+1 && \text{Simplifying} \\ 20-4x &\le x+1 && \text{Distributive Law} \\ 20-4x-1 &\le x+1-1 && \text{Adding } -1 \\ 19-4x &\le x && \text{Simplifying} \\ 19-4x+4x &\le x+4x && \text{Adding } 4x \\ 19 &\le 5x && \text{Simplifying} \\ \frac{19}{5} &\le x && \text{Multiplying by } \frac{1}{5} \end{aligned}$$

The solution set is $\left\{x \mid x \ge \frac{19}{5}\right\}$, or $\left[\frac{19}{5},\infty\right)$.

105. *Thinking and Writing Exercise.* The graph of an inequality of the form $a \le x \le a$ consists of just one number, a.

106. *Thinking and Writing Exercise.* For any pair of numbers their relative position on the number line is reversed when both are multiplied by the same negative number. For example, –3 is to the left of 5 on the number line, but 12 is to the right of –20. That is, $-3<5$, but $-3(-4)>5(-4)$.

107. One more than some number x, or $x+1$ is always going to be larger than x for any x, so the solution set is $\{x \mid x \text{ is a real number}\}$, or $(-\infty,\infty)$. We could have also solved this inequality as follows:

$$\begin{aligned} x &< x+1 \\ x-x &< x+1-x && \text{Adding } -x \\ 0 &< 1 && \text{Simplifying} \end{aligned}$$

Since $0<1$ is a true statement, x can be any real number.

108. $6\left[4-2(6+3t)\right]>5\left[3(7-t)-4(8+2t)\right]-20$

$6[4-12-6t]>5[21-3t-32-8t]-20$	Distributive Law
$6[-8-6t]>5[-11-11t]-20$	Simplifying
$-48-36t>-55-55t-20$	Distributive Law
$-48-36t+48>-75-55t+48$	Adding 48
$-36t>-27-55t$	Simplifying
$-36t+55t>-27-55t+55t$	Adding $55t$
$19t>-27$	Simplifying
$t>-\frac{27}{19}$	Multiplying by $\frac{1}{19}$

The solution set is $\left\{t\middle|t>-\frac{27}{19}\right\}$, or $\left(-\frac{27}{9},\infty\right)$.

109. $27-4\left[2(4x-3)+7\right]\geq 2\left[4-2(3-x)\right]-3$

$27-4[8x-6+7]\geq 2[4-6+2x]-3$	Distributive Law
$27-4(8x+1)\geq 2(-2+2x)-3$	Simplifying
$27-32x-4\geq -4+4x-3$	Distributive Law
$23-32x\geq -7+4x$	Simplifying
$23-32x-23\geq -7+4x-23$	Adding -23
$-32x\geq -30+4x$	Simplifying
$-32x-4x\geq -30+4x-4x$	Adding $-4x$
$-36x\geq -30$	Simplifying
$x\leq \frac{30}{36}$	Multiplying by $-\frac{1}{36}$ and reversing the inequality symbol
$x\leq \frac{5}{6}$	Simplifying

The solution set is $\left\{x\middle|x\leq\frac{5}{6}\right\}$, or $\left(-\infty,\frac{5}{6}\right)$.

110. $-(x+5)\geq 4a-5$

$-x-5\geq 4a-5$	Distributive Law
$-x-5+5\geq 4a-5+5$	Adding 5
$-x\geq 4a$	Simplifying
$x\leq -4a$	Multiplying by -1

The solution set is $\{x\,|\,x\leq -4a\}$, or $(-\infty,-4a)$.

111. $\frac{1}{2}(2x+2b)>\frac{1}{3}(21+3b)$

$x+b>7+b$	Distributive Law
$x+b-b>7+b-b$	Subtracting b
$x>7$	Simplifying

The solution set is $\{x\,|\,x>7\}$, or $(7,\infty)$.

112. $y<ax+b$

$y-b<ax+b-b$	Adding $-b$
$y-b<ax$	Simplifying
$\frac{y-b}{a}<x$	Multiplying by $\frac{1}{\text{a}}$

The solution set is $\left\{x\middle|\frac{y-b}{a}<x\right\}$, or

$\left\{x\middle|x>\frac{y-b}{a}\right\}$, or $\left(\frac{y-b}{a},\infty\right)$.

113. $$\begin{aligned} y &< ax+b \\ y-b &< ax+b-b && \text{Adding } -b \\ y-b &< ax && \text{Simplifying} \\ \frac{y-b}{a} &> x && \text{Multiplying by } \frac{1}{a} \end{aligned}$$

The solution set is $\left\{x \middle| \frac{y-b}{a} > x\right\}$, or

$\left\{x \middle| x < \frac{y-b}{a}\right\}$, or $\left(-\infty, \frac{y-b}{a}\right)$.

114. $|x| < 3$

This inequality says that the distance from x to the origin is less than 3 units. So the solution set is $\{x \mid -3 < x < 3\}$, or $(-3,3)$.

115. $|x| > -3$

The absolute value of any real number is greater than or equal to 0, so the solution set is $\{x \mid x \text{ is a real number}\}$, or $(-\infty,\infty)$.

116. $|x| < 0$

The absolute value of any real number is greater than or equal to 0, so the solution set is $\varnothing$.

Exercise Set 2.7

1. $b \le a$

2. $b < a$

3. $a \le b$

4. $a < b$

5. $b \le a$

6. $a \le b$

7. $b < a$

8. $a < b$

9. Let n represent the number. Then we have $n < 10$.

10. Let n represent the number. Then we have $n \ge 4$.

11. Let t represent the temperature. Then we have $t \le -3$.

12. Let d represent the average credit-card debt. Then we have $d \ge 2000$.

13. Let a represent the age of the Mayan altar. Then we have $a > 1200$.

14. Let t represent the time of the test. Then we have $45 < t < 55$.

15. Let d represent the distance to Normandale Community College. Then we have $d \le 15$.

16. Let h represent Angenita's hourly wage. Then $h \ge 12$.

17. Let d represent the number of years of driving experience. Then we have $d \ge 5$.

18. Let f represent the amount of exposure to formaldehyde. Then we have $f \le 2$.

19. Let c represent the cost of production. Then we have $c \le 12{,}500$.

20. Let c represent the cost of gasoline. Then we have $c \le 4$.

21. ***Familiarize.*** Let h = the number of hours RJ worked. The cost of an emergency call is \$55 plus \$40 times the number of hours, or $\$40h$.

Translate.

$$\begin{array}{ccccc} \underbrace{\text{Emergency fee}} & \text{plus} & \underbrace{\text{hourly fee}} & \underbrace{\text{is more than}} & \$100. \\ \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 55 & + & 40h & > & 100 \end{array}$$

Carry out. We solve the inequality.

$$\begin{aligned} 55+40h &> 100 \\ 40h &> 45 \\ h &> \tfrac{9}{8} \text{ or } 1.125 \end{aligned}$$

Check. As a partial check, we can determine how much the bill would have been if the plumber had worked 1 hour. The bill would have been $\$55+\$40(1) = \$95$. From this calculation, it would appear that $h > 1.125$ is correct.

State. The plumber worked more than 1.125 hours.

22. ***Familiarize.*** Let c = the number of courses Karen can take. Her total tuition is the $35 registration fee plus $375 times the number of courses for which she registers, or $\$375c$.

Translate.

Registration fee	plus	fee for courses	cannot exceed	$1000.
↓	↓	↓	↓	↓
35	+	$375c$	$\le$	1000

Carry out. We solve the inequality.

$$\begin{aligned} 35 + 375c &\le 1000 \\ 375c &\le 965 \\ c &\le 2.57\overline{3} \end{aligned}$$

Check. Although the solution set of the inequality is all numbers less than or equal to $2.75\overline{3}$, since c represents the number of courses for which Karen registers, we round down to 2. If she registers for 2 courses, her tuition is $\$35 + \$375 \cdot 2$, or $785 which does not exceed $1000. If she registers for 3 courses, her tuition is $\$35 + \$375 \cdot 3$, or $1160 which exceeds $1000.

State. Karen can register for at most 2 courses.

23. ***Familiarize.*** Let n = Chloe's grade point average. An unconditional acceptance is given to students whose GMAT score plus 200 times the undergraduate grade point average is at least 950

Translate.

GMAT score	plus	200 times the undergrad GPA	at least	950
↓	↓	↓	↓	↓
500	+	$200n$	$\ge$	950

Carry out. We solve the inequality.

$$\begin{aligned} 500 + 200n &\ge 950 \\ 200n &\ge 450 \\ n &\ge 2.25 \end{aligned}$$

Check. As a partial check, we can determine the score for a grade point average of 2. $500 + 200(2) = 500 + 400 = 900$. 900 is less than the 950 score required, so it appears that $n \ge 2.25$ is correct.

State. Chloe must earn at least a 2.25 grade points average to an unconditional acceptance into the Master of Business Administration (MBA) program at Arkansas State University.

24. ***Familiarize.*** Let c = Oliver's monthly car payment. Debt payment should be less than 8% of a consumer's monthly gross income. Oliver makes $54,000 per year or $54,000 \div 12 = 4500$ per month.

Translate.

student-loan pay	plus	car payment	less than	8% of monthly gross income
↓	↓	↓	↓	↓
100	+	c	$<$	$0.08(4500)$

Carry out. We solve the inequality.

$$\begin{aligned} 100 + c &< 0.08(4500) \\ 100 + c &< 360 \\ c &< 260 \end{aligned}$$

Check. As a partial check, we can find the monthly debt payment and divide it by 8% to find the monthly income. 100 + 260 = $360, and $360 \div 0.08 = 4500$. Because 4500 times 12 is 54,000, the monthly car payment of $c < 260$ is correct.

State. Oliver's monthly car payment must be less than $260.

25. ***Familiarize.*** The average of the five scores is their sum divided by the number of quizzes, 5. We let s represent Rod's score on the last quiz.

Translate.

The average of the four scores is given by

$$\frac{73 + 75 + 89 + 91 + s}{5}.$$

Since this average must be at least 85, this means that it must be greater than or equal to 85. Thus, we can translate the problem to the inequality

$$\frac{73 + 75 + 89 + 91 + s}{5} \ge 85.$$

Carry out. We first multiply by 5 to clear the fraction.

$$5\left(\frac{73+75+89+91+s}{5}\right)\ge 5\cdot 85$$
$$73+75+89+91+s\ge 425$$
$$328+s\ge 425$$
$$s\ge 97$$

Check. As a partial check, we show that Rod can get a score of 97 on the fourth test and have an average of at least 85:

$$\frac{73+75+89+91+97}{5}=\frac{425}{5}=85$$

State. Scores of 97 and higher will earn Rod at least an 85.

26. ***Familiarize.*** The average of the seven days is their sum of their servings divided by the number of days, 7. We let s represent the number of servings on Saturday.
Translate.
The average of the 7 servings is given by

$$\frac{4+6+7+4+6+4+s}{7}.$$

Since this average must be at least 5, this means that it must be greater than or equal to 5. Thus, we can translate the problem to the inequality

$$\frac{4+6+7+4+6+4+s}{7}\ge 5.$$

Carry out. We first multiply by 5 to clear the fraction.

$$7\left(\frac{4+6+7+4+6+4+s}{7}\right)\ge 7\cdot 5$$
$$4+6+7+4+6+4+s\ge 35$$
$$31+s\ge 35$$
$$s\ge 4$$

Check. As a partial check, we show that Dale can eat 4 servings of fruits or vegetables on Saturday and have an average of at least 5:

$$\frac{4+6+7+4+6+4+4}{7}=\frac{35}{7}=5$$

State. Servings of 4 or more will result in an average of at least 5.

27. ***Familiarize.*** The average of the credits for the four quarters is their sum divided by the number of quarters, 4. We let c represent the number of credits for the fourth quarter.
Translate.
The average of the credits for the four quarters is given by

$$\frac{5+7+8+c}{4}.$$

Since this average must be at least 7, this means that it must be greater than or equal to 7. Thus, we can translate the problem to the inequality

$$\frac{5+7+8+c}{4}\ge 7.$$

Carry out. We first multiply by 4 to clear the fraction.

$$4\left(\frac{5+7+8+c}{4}\right)\ge 4\cdot 7$$
$$5+7+8+c\ge 28$$
$$20+c\ge 28$$
$$c\ge 8$$

Check. As a partial check, we show that Millie can complete 8 credits during the fourth quarter and have an average of at least 7 credits:

$$\frac{5+7+8+8}{4}=\frac{28}{4}=7$$

State. Millie can average 7 credits per quarter per year if she takes 8 credits or more in the fourth quarter.

28. ***Familiarize.*** Let m represent the number of minutes Monroe practices on the seventh day.

Translate.

$$\underbrace{\text{Average practice time}}\quad\underbrace{\text{is at least}}\quad 20\text{ min.}$$
$$\downarrow\qquad\downarrow\qquad\downarrow$$
$$\frac{15+28+30+0+15+25+m}{7}\ \ge\ 20$$

Carry out. We solve the inequality.

$$\frac{15+28+30+0+15+25+m}{7}\ge 20$$
$$7\left(\frac{15+28+30+0+15+25+m}{7}\right)\ge 7\cdot 20$$
$$15+28+30+0+15+25+m\ge 140$$
$$113+m\ge 140$$
$$m\ge 27$$

Check. As a partial check, we show that if Monroe practices 27 min on the seventh day he meets expectations.

$$\frac{15+28+30+0+15+25+27}{7}=\frac{140}{7}=20$$

State. Monroe must practice 27 min or more on the seventh day in order to meet expectations.

29. ***Familiarize.*** Let b represent the plate appearances in the tenth game. The average plate appearances per game must be at least 3.1 to qualify for a batting title.

Translate.

$$\underbrace{\text{Average plate appearances}}_{\downarrow} \quad \underbrace{\text{is at least}}_{\downarrow} \quad \underset{\downarrow}{3.1.}$$

$$\frac{5+1+4+2+3+4+4+3+2+b}{10} \geq 3.1$$

Carry out. We solve the inequality.

$$\frac{5+1+4+2+3+4+4+3+2+b}{10}\geq 3.1$$

$$10\left(\frac{5+1+4+2+3+4+4+3+2+b}{10}\right)\geq 3.1$$

$$5+1+4+2+3+4+4+3+2+b\geq 31$$

$$28+b\geq 31$$

$$b\geq 3$$

Check. As a partial check, we show that if 3 plate appearances occur in the tenth game,

$$\frac{5+1+4+2+3+4+4+3+2+3}{10}=\frac{31}{10}=3.1$$

and the answer checks.

State. The player must have at least 3 plate appearances in the tenth game in order to qualify for a batting title.

30. ***Familiarize.*** Let d represent the Friday school day in hours. The standard school day is at least $5\frac{1}{2}$ hours.

Translate.

$$\underbrace{\text{Average school day}}_{\downarrow} \quad \underbrace{\text{is at least}}_{\downarrow} \quad \underset{\downarrow}{5\tfrac{1}{2}\text{ hr.}}$$

$$\frac{4+6\frac{1}{2}+3\frac{1}{2}+6\frac{1}{2}+d}{5} \geq 5\tfrac{1}{2}$$

Carry out. We solve the inequality.

$$\frac{4+6\frac{1}{2}+3\frac{1}{2}+6\frac{1}{2}+d}{5} \geq 5\tfrac{1}{2}$$

$$5\left(\frac{4+6\frac{1}{2}+3\frac{1}{2}+6\frac{1}{2}+d}{5}\right)\geq 5\tfrac{1}{2}$$

$$4+6\tfrac{1}{2}+3\tfrac{1}{2}+6\tfrac{1}{2}+d\geq 25+\tfrac{5}{2}$$

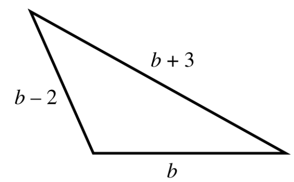
$$20\tfrac{1}{2}+d\geq 27\tfrac{1}{2}$$

$$d\geq 7$$

Check. As a partial check, we show that if Friday is 7 hours (excluding meal breaks), then $\frac{4+6\frac{1}{2}+3\frac{1}{2}+6\frac{1}{2}+7}{5}=\frac{27\frac{1}{2}}{5}=5\frac{1}{2}$, and the answer checks.

State. The school day on Friday must be at least 7 hours.

31. We first make a drawing. Let b = the length of the base, in cm. The one side is $b-2$ and the other side is $b+3$.



Translate.

$$\underbrace{\text{The perimeter}}_{\downarrow} \quad \underbrace{\text{is greater than}}_{\downarrow} \quad \underset{\downarrow}{19\text{ cm.}}$$

$$b+(b-2)+(b+3) \quad > \quad 19$$

Carry out.

$$b+(b-2)+(b+3)>19$$

$$3b+1>19$$

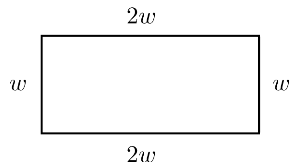
$$3b>18$$

$$b>6$$

Check. We check to see if the solution seems reasonable. If $b=5$ cm, the perimeter is $5+(5-2)+(5+3)$, or 16 cm. If $b=6$ cm, the perimeter is $6+(6-2)+(6+3)$, or 19 cm. If $b=7$ cm, the perimeter is $7+(7-2)+(7+3)$, or 22 cm.

State. If the base is greater than 6 cm, then the perimeter of the triangle will be greater than 19 cm.

32. ***Familiarize.*** We first make a drawing. Let w = the width, in feet. Then $2w$ = the length.



The perimeter is $P = 2l + 2w$
$= 2\cdot 2w + 2w = 4w + 2w = 6w$.

Translate.

$$\underbrace{\text{The perimeter}}\quad \underbrace{\text{cannot exceed}}\quad \underbrace{70\ \text{ft.}}$$
$$\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow$$
$$6w \qquad\qquad \le \qquad\qquad 70$$

Carry out. We solve the inequality.

$6w \le 70$

$w \le \frac{35}{3}$, or $11\frac{2}{3}$

Check. As a partial check, we show that the perimeter is 70 ft when the width is $\frac{35}{3}$ ft and the length is $2\cdot\frac{35}{3}$, or $\frac{70}{3}$ ft.

$$P = 2\cdot\frac{70}{3} + 2\cdot\frac{35}{3} = \frac{140}{3} + \frac{70}{3} = \frac{210}{3} = 70$$

State. Widths less than or equal to $11\frac{2}{3}$ ft will meet the given conditions.

33. ***Familiarize.*** Let d = the depth of the well. Under the "pay-as-you-go" plan, the charge is \$500 + \$8d. Under the "guaranteed-water" plan, the charge is \$4000.

Translate.

$$\underbrace{\text{Pay-as-you -go plan}}\quad \underbrace{\text{is less than}}\quad \underbrace{\text{the guaranteed -water plan.}}$$
$$\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow$$
$$500 + 8d \qquad\qquad < \qquad\qquad 4000$$

Carry out. We solve the inequality.

$500 + 8d < 4000$

$8d < 3500$

$d < 437.50$

Check. We compute the cost of the well under the "pay-as-you-go" plan for various depths. If $d = 437$ ft, the cost is $\$500 + \$8\cdot 437 =$ \$3996. If $d = 438$ ft, the cost is $\$500 + \$8\cdot 438 =$ \$4004.

State. The "pay-as-you-go" plan is cheaper if the depth is less than 437.5 ft.

34. ***Familiarize.*** Let t = the number of 15-min units of time for a road call. Rick's Automotive charges \$50 + $\$15\cdot t$ for a road call, and Twin City Repair charges \$70 + $\$10\cdot t$.

Translate

$$\underbrace{\text{Rick's charge}}\quad \underbrace{\text{is less than}}\quad \underbrace{\text{Twin City's charge.}}$$
$$\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow$$
$$50 + 15t \qquad\qquad < \qquad\qquad 70 + 10t$$

Carry out. We solve the inequality.

$50 + 15t < 70 + 10t$

$15t < 20 + 10t$

$5t < 20$

$t < 4$

Check. We check to see if the solution seems reasonable. When $t = 3$, Rick's charges $\$50 + \$15\cdot 3$, or \$95, and Twin City charges $\$70 + \$10\cdot 3$, or \$100. When $t = 4$, Rick's charges $\$50 + \$15\cdot 4$, or \$110, and Twin City charges $\$70 + \$10\cdot 4$, or \$110. When $t = 5$, Rick's charges $\$50 + \$15\cdot 5$, or \$125, and Twin City charges $\$70 + \$10\cdot 5$, or \$120. From these calculations, it appears that the solution is correct.

State. It would be more economical to call Rick's for a service call of less than 4 15-min time units, or of less than 1 hr.

35. ***Familiarize.*** Let b = the blue-book value of Michelle's car. The car was repaired rather than being replaced.

Translate.

$$\underbrace{\text{Cost of the repair}}\quad \underbrace{\text{did not exceed}}\quad \underbrace{\text{80\% of the blue-book value.}}$$
$$\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow$$
$$8500 \qquad\qquad \le \qquad\qquad 0.8b$$

Carry out. We solve the inequality.

$8500 \le 0.8b$

$10{,}625 \le b$

Check. If the blue-book value of the vehicle is \$10,625, then 80% of that amount would be $\$10{,}625\cdot 0.8 = \$8500$. Since the repairs, \$8500, did not exceed this amount, the car would have been repaired rather than being replaced.

State. The blue-book value of the vehicle was at least $10,625.

36. ***Familiarize.*** Let c = the cost of the repairs.
Translate.

$$\underbrace{\text{The cost of the repairs}}_{c} \quad \underbrace{\text{exceeded}}_{>} \quad \underbrace{\text{80\% of the blue-book value.}}_{0.8\cdot(21,000)}$$

Carry out. We solve the inequality.

$$c > 0.8(21,000)$$
$$c > 16,800$$

Check. The blue-book value was $21,000. The pickup was replaced rather than being repaired, so the cost had to exceed 80% of $21,000, or $16,800.
State. The cost of the repairs had to exceed $16,800.

37. ***Familiarize.*** Let L = the length of the envelope.
Translate.
The area of the envelop is $A = L \cdot W$.

$$\underbrace{\text{Area of the envelope}}_{L\cdot\left(3\frac{1}{2}\right)} \quad \underbrace{\text{must be at least}}_{\geq} \quad \underbrace{17\tfrac{1}{2}\ \text{in}^2.}_{17\frac{1}{2}}$$

Carry out. We solve the inequality.

$$L\cdot\left(3\tfrac{1}{2}\right) \geq 17\tfrac{1}{2}$$
$$\frac{7}{2}L \geq \frac{35}{2}$$
$$7L \geq 35$$
$$L \geq 5$$

Check. We can do a partial check by calculating the are when the length is 5 in. The area would be

$$3\tfrac{1}{2}\cdot 5 = \frac{7}{2}\cdot 5 = \frac{35}{2} = 17\tfrac{1}{2}\ \text{in}^2.$$

State. The envelopes used must have lengths greater than or equal to 5 in.

38. ***Familiarize.*** Let l = the length of the package, in inches. The girth of the package is 29 in. and the sum of the length and girth, $l + 29$ in., is less than 84 inches.
Translate.

$$\underbrace{\text{Length and girth}}_{l+29} \quad \underbrace{\text{less than}}_{\leq} \quad \underbrace{\text{84 in.}}_{84}$$

Carry out. We solve the inequality.

$$l + 29 \leq 84$$
$$l \leq 55$$

Check. As a partial check, we can determine the combined length and girth of a package. We are told that the package has a girth of 29 in., so the combined length and girth would be 55 in. + 29 in., or 84 in. As long as the box had a length less than or equal to 84 inches, it would meet the requirements of being a package.
State. The length of the package must be less than or equal to 55 in.

39. ***Familiarize.*** We let C = the body temperature of the person, in degrees Celsius and let F = the body temperature of the person, in degrees Fahrenheit. We will use the formula $F = \frac{9}{5}C + 32$.
Translate.

$$\underbrace{\text{Fahrenheit temperature}}_{F} \quad \underbrace{\text{is above}}_{>} \quad \underbrace{98.6^{\circ}.}_{98.6}$$

Substituting $\frac{9}{5}C + 32$ for F, we have

$$\frac{9}{5}C + 32 > 98.6.$$

Carry out. We solve the inequality.

$$\frac{9}{5}C + 32 > 98.6$$
$$\frac{9}{5}C > 66.6$$
$$C > \frac{333}{9}$$
$$C > 37$$

Check. We check to see if the solution seems reasonable.

When $C = 36$, $\frac{9}{5}\cdot 36 + 32 = 96.8$.

When $C = 37$, $\frac{9}{5}\cdot 37 + 32 = 98.6$.

When $C = 38$, $\frac{9}{5}\cdot 38 + 32 = 100.4$.

It would appear that the solution is correct, considering that rounding occurred.
State. The human body is feverish for Celsius temperatures greater than 37°C.

40. ***Familiarize.*** Let C = the Celsius temperatures for which gold stays solid. Let F = those Fahrenheit temperatures for which gold stays solid. We will use the formula $F = \frac{9}{5}C + 32$.
Translate.

$$\underbrace{\text{Fahrenheit temperature}}_{\substack{\downarrow \\ F}}\ \underbrace{\text{is below}}_{\substack{\downarrow \\ <}}\ \underset{\substack{\downarrow \\ 1945.4}}{1945.4^\circ.}$$

Substituting $\frac{9}{5}C + 32$ for F, we have

$\frac{9}{5}C + 32 < 1945.4$.

Carry out. We solve the inequality.

$$\frac{9}{5}C + 32 < 1945.4$$
$$\frac{9}{5}C < 1913.4$$
$$C < \frac{9567}{9}$$
$$C < 1063$$

Check. We check to see if the solution seems reasonable.

When $C = 1062$, $\frac{9}{5} \cdot 1062 + 32 = 1943.6$.

When $C = 1063$, $\frac{9}{5} \cdot 1063 + 32 = 1945.4$.

When $C = 1064$, $\frac{9}{5} \cdot 1064 + 32 = 1947.2$.

It would appear that the solution is correct, considering that rounding occurred.
State. Gold stays solid for temperatures less than 1063°C.

41. ***Familiarize.*** Let h = the height of the triangular flag, in ft. The base of the flag is $1\frac{1}{2}$ ft. We will use the formula for the area of a triangle, $A = \frac{1}{2}bh$, where b = the base and h = the height.
Translate.

$$\underbrace{\text{Area of the flag}}_{\substack{\downarrow \\ \frac{1}{2}\cdot\left(1\frac{1}{2}\right)\cdot h}}\ \underbrace{\text{is at least}}_{\substack{\downarrow \\ \geq}}\ \underset{\substack{\downarrow \\ 3}}{3\text{ ft}^2.}$$

Carry out. We solve the inequality.

$$\tfrac{1}{2}\cdot\left(1\tfrac{1}{2}\right)\cdot h \geq 3$$
$$\tfrac{1}{2}\left(\tfrac{3}{2}\right)h \geq 3$$
$$\tfrac{3}{4}h \geq 3$$
$$h \geq 4$$

Check. As a partial check we compute the area of the flag with a height of 4 ft to be $\frac{1}{2}\left(1\frac{1}{2}\right)(4) = \frac{1}{2}\left(\frac{3}{2}\right)(4) = 3$ ft^2. Any increase in the height would result in an area greater than 3 ft^2.
State. The height of the flag must be greater than or equal to 4 ft.

42. ***Familiarize.*** Let h = the height of the triangular sign, in ft. The base of the sign is 8 ft. We will use the formula for the area of a triangle, $A = \frac{1}{2}bh$, where b = the base and h = the height.
Translate.

$$\underbrace{\text{Area of the flag}}_{\substack{\downarrow \\ \frac{1}{2}\cdot 8\cdot h}}\ \underbrace{\text{cannot exceed}}_{\substack{\downarrow \\ \leq}}\ \underset{\substack{\downarrow \\ 12}}{12\text{ ft}^2.}$$

Carry out. We solve the inequality.

$$\tfrac{1}{2}\cdot 8\cdot h \leq 12$$
$$4h \leq 12$$
$$h \leq 3$$

Check. As a partial check we compute the area of the sign 3 ft tall to be $\frac{1}{2}(8)(3) = 12$ ft^2. Any increase in the height would result in an area greater than 12 ft^2.
State. The sign can be no more than 3 ft tall.

43. ***Familiarize.*** Let r = the number of grams of fat in a serving of regular Oreo® cookies. Reduced fat Oreo® cookies have 4.5 g of fat per serving. If reduced fat Oreo® cookies contains at least 25% less fat than regular Oreo® cookies , then reduced fat Oreo® cookies contains at most 75% as much fat as the regular Oreo® cookies .
Translate.

$$\underbrace{\text{4.5 g of fat}} \quad \underbrace{\text{is at most}} \quad \text{75\% of} \quad \underbrace{\text{the amount of fat in regular Oreo® cookies}}$$
$$\downarrow \qquad \downarrow \quad \downarrow \quad \downarrow \qquad \downarrow$$
$$4.5 \qquad \le \quad 0.75 \quad \cdot \qquad r$$

Carry out. We solve the inequality.
$4.5 \le 0.75r$
$6 \le r$
Check. As a partial check, we show that 4.5 g of fat does not exceed 75% of 6 g of fat:
$0.75(6) = 4.5$
State. Regular Oreo® cookies contain at least 6 g of fat per serving.

44. ***Familiarize.*** Let r = the number of grams of fat in a serving of regular Sargento® colby cheese. Reduced Fat Sargento® colby cheese contains 6 g of fat per serving. If Reduced Fat Sargento® colby cheese contains at least 25% less fat than Sargento® colby cheese, then Reduced Fat Sargento® colby cheese contains at most 75% as much fat as the regular Sargento® colby cheese .
Translate.

$$\underbrace{\text{6 g of fat}} \quad \underbrace{\text{is at most}} \quad \text{75\% of} \quad \underbrace{\text{the amount of fat in regular Sargento® colby cheese}}$$
$$\downarrow \qquad \downarrow \quad \downarrow \ \downarrow \qquad \downarrow$$
$$6 \qquad \le \quad 0.75 \cdot \qquad r$$

Carry out. We solve the inequality.
$6 \le 0.75r$
$8 \le r$
Check. As a partial check, we show that 6 g of fat does not exceed 75% of 8 g of fat:
$0.75(8) = 6$
State. Regular Sargento® colby cheese contains at least 8 g of fat per serving.

45. ***Familiarize.*** Let d = the number of days after September 5. Then d days after September 5, Charlotte's pumpkin will weigh 532 + 26d.
Translate.

$$\underbrace{\text{The weight of Charlotte's pumpkin}} \quad \underbrace{\text{will exceed}} \quad \text{818 lb.}$$
$$\downarrow \qquad \downarrow \qquad \downarrow$$
$$532 + 26d \qquad > \qquad 818$$

Carry out. We solve the inequality.
$532 + 26d > 818$
$26d > 286$
$d > 11$
Check. As a partial check, we calculate the weight of Charlotte's pumpkin on different days.
If $d = 10$, the weight is $532 + 26 \cdot 10 = 792$.
If $d = 11$, the weight is $532 + 26 \cdot 11 = 818$.
If $d = 12$, the weight is $532 + 26 \cdot 12 = 844$.
State. Charlotte's pumpkin will weigh more than 818 lb more than 11 days after September 5, or for dates after September 16.

46. ***Familiarize.*** Let w = the number of weeks after July 1. Then w weeks after July 1, the water level will be $25 - \frac{2}{3}d$ ft.
Translate.

$$\underbrace{\text{The water level}} \quad \underbrace{\text{will not exceed}} \quad \text{21 ft.}$$
$$\downarrow \qquad \downarrow \qquad \downarrow$$
$$25 - \tfrac{2}{3}w \qquad \le \qquad 21$$

Carry out. We solve the inequality.
$25 - \frac{2}{3}w \le 21$
$-\frac{2}{3}w \le -4$
$w \ge 6$
Check. As a partial check, we determine the water level for different dates.
If $w = 5$, the water level is $25 - \frac{2}{3}(5) = 21\frac{2}{3}$.
If $w = 6$, the water level is $25 - \frac{2}{3}(6) = 21$.
If $w = 7$, the water level is $25 - \frac{2}{3}(7) = 20\frac{1}{3}$.
It is apparent that for 6 or more weeks after July1, the water level is below 21 ft.
State. Six weeks after July 1, or later, the water level will not exceed 21 ft. Six weeks is $6 \cdot 7 = 42$ days. After July 1, there are 30 days left with 12 remaining, so on August 12 or later the water level will be below 21 ft.

47. ***Familiarize.*** Let n = the number of text messages sent or received. The monthly fee of \$39.95 plus taxes of \$6.65 is \$46.60. The cost per text message is $0.1n$, and Braden's budget is \$60 per month.

Translate.

$$\underbrace{\text{Cost of monthly fees and text messages}} \quad \underbrace{\text{cannot exceed}} \quad \$60.$$
$$\downarrow \qquad\qquad \downarrow \qquad \downarrow$$
$$46.60 + 0.1n \qquad \le \qquad 60$$

Carry out. We solve the inequality.

$$46.60 + 0.1n \le 60$$
$$0.1n \le 13.40$$
$$n \le 134$$

Check. As a partial check, if 314 text messages are sent or received, the monthly bill will be $\$46.60 + \$0.1 \cdot 134 = \$46.60 + \$13.40 = \$60$.

State. Braden can send or receive no more than 134 text messages.

48. ***Familiarize.*** Let n = the number of people who can attend the banquet. Then the total cost of the banquet will be $\$40 + \$16n$.

Translate.

$$\underbrace{\text{Total cost of the banquet}} \quad \underbrace{\text{cannot exceed}} \quad \$450.$$
$$\downarrow \qquad\qquad \downarrow \qquad \downarrow$$
$$40 + 16n \qquad \le \qquad 450$$

Carry out. We solve the inequality.

$$40 + 16n \le 450$$
$$16n \le 410$$
$$n \le 25.625$$

Since it is impossible for a fractional person to attend, we round down and obtain $n \le 25$.

Check. As a partial check, if 25 people attend, the cost will be $\$40 + \$16 \cdot 25 = \$440$. If 26 people attend, the cost will be $\$40 + \$16 \cdot 26 = \$456$.

State. No more than 25 people can attend the banquet.

49. ***Familiarize.*** Let t = the number of years after 1900 for which the world record will be less than 3.6 min. We use the equation $R = -0.0065t + 4.3259$ where R = the world record, in minutes.

Translate.

$$\underbrace{\text{The world record}} \quad \underbrace{\text{is less than}} \quad 3.6 \text{ min.}$$
$$\downarrow \qquad\qquad \downarrow \qquad \downarrow$$
$$R \qquad < \qquad 3.6$$

We substitute $-0.0065t + 4.3259$ for R to get the inequality $-0.0065t + 4.3259 < 3.6$.

Carry out. We solve the inequality.

$$-0.0065t + 4.3259 < 3.6$$
$$-0.0065t < -0.7259$$
$$t > 111.67692308$$

Check. As a partial check, we calculate the record time for different values of t. If $t = 112$, the time would be $-0.0065(112) + 4.3259$, or 3.5979 min. If $t = 111$, the time would be $-0.0065(111) + 4.3259$, or 3.6044.

State. The record time will be less than 3.6 min for years greater than 112 years after 1900, or years after 2012.

50. ***Familiarize.*** Let t = the number of years after 1900 for which the world record will be less than 3.8 min. We use the equation $R = -0.0026t + 4.0807$ where R = the world record, in minutes.

Translate.

$$\underbrace{\text{The world record}} \quad \underbrace{\text{is less than}} \quad 3.8 \text{ min.}$$
$$\downarrow \qquad\qquad \downarrow \qquad \downarrow$$
$$R \qquad < \qquad 3.8$$

We substitute $-0.0026t + 4.0807$ for R to get the inequality $-0.0026t + 4.0807 < 3.8$.

Carry out. We solve the inequality.

$$-0.0026t + 4.0807 < 3.8$$
$$-0.0026t < -0.2807$$
$$t > 107.961538$$

Check. As a partial check, we calculate the record time for t after 108 years, or 1900 + 108 = 2008. When $t = 108$, the time would be $-0.0026(108) + 4.0807 = 3.7999$, or 3.8 min.

State. The record time will be under 3.8 min for years after 2008.

51. ***Familiarize.*** Let x = the number of miles driven and let y = the cost of driving on the toll road, in dollars. We will use the equation

$$y = 0.06x + 0.50 .$$

Translate.

$$\begin{array}{ccc} \underbrace{\begin{matrix}\text{The cost of driving}\\ \text{on the toll road}\end{matrix}} & \underbrace{\text{is at most}} & \$14. \\ \downarrow & \downarrow & \downarrow \\ y & \le & 14 \end{array}$$

Carry out. We substitute $0.06x + 0.50$ for y to obtain the inequality $0.06x + 0.50 \le 14$. We then solve this inequality.

$$\begin{aligned} 0.06x + 0.50 &\le 14 \\ 0.06x &\le 13.50 \\ x &\le 225 \end{aligned}$$

Check. As a partial check we determine the toll cost if 225 miles are driven to be $0.06(226) + 0.50 = 13.50 + 0.50$, or \$14.

State. If the toll is at most \$14, the number of miles driven must be less than or equal to 225 miles.

52. ***Familiarize.*** Let Y = the year and let P = the average price per movie ticket, in dollars. We will use the equation $P = 0.169Y - 333.04$.

Translate.

$$\begin{array}{ccc} \underbrace{\begin{matrix}\text{The average price}\\ \text{of a movie ticket}\end{matrix}} & \underbrace{\text{is at least}} & \$7. \\ \downarrow & \downarrow & \downarrow \\ P & \ge & 7 \end{array}$$

We substitute $0.169Y - 333.04$ for P and solve the inequality.

Carry out. We solve the inequality.

$$\begin{aligned} 0.169Y - 333.04 &\ge 7 \\ 0.169Y &\ge 340.04 \\ Y &\ge 2012.071006 \end{aligned}$$

Check. As a partial check we can calculate the average price of a ticket for different years. If $Y = 2011$, the average price is $0.169(2011) - 333.04$, or about \$6.82. If $Y = 2012$, the average price is $0.169(2012) - 333.04$, or about \$6.99. So sometime during the year 2012, ticket prices reached exactly \$7.

State. The average price of a ticket will be \$7 for years 2012 and beyond.

53. ***Familiarize.*** Let n = the number of checks written. For the Anywhere plan, the total cost for checks would be \$0.20n, and for the Acu-checking plan, the total cost for checks would be \$2 + \$0.12n.

Translate.

$$\begin{array}{ccc} \underbrace{\begin{matrix}\text{Cost of the Acu}\\ \text{-checking plan}\end{matrix}} & \underbrace{\begin{matrix}\text{is less}\\ \text{than}\end{matrix}} & \underbrace{\begin{matrix}\text{the cost of the}\\ \text{Anywhere}\\ \text{checking plan.}\end{matrix}} \\ \downarrow & \downarrow & \downarrow \\ 2 + 0.12n & < & 0.20n \end{array}$$

Carry out. We solve the inequality.

$$\begin{aligned} 2 + 0.12n &< 0.20n \\ 2 &< 0.08n \\ 25 &< n \end{aligned}$$

Check. As a partial check, we can calculate the costs of each plan for different numbers of checks.

No.	Acu-checking	Any-where
24	\$2 + \$0.12(24) = \$4.88	\$0.20(24) = \$4.80
25	\$2 + \$0.12(25) = \$5	\$0.20(25) = \$5
26	\$2+\$0.12(26) = \$5.12	\$0.20(26) = \$5.20

State. The Acu-checking plan costs less if more than 25 checks are written.

54. ***Familiarize.*** Let h = the number of hours required to move items across town. Musclebound Movers charges $\$85 + \$40h$, and Champion charges \$60h.

Translate.

$$\begin{array}{ccc} \underbrace{\begin{matrix}\text{Champion}\\ \text{Moving charge}\end{matrix}} & \underbrace{\begin{matrix}\text{is greater}\\ \text{than}\end{matrix}} & \underbrace{\begin{matrix}\text{Musclebound}\\ \text{Moving charge.}\end{matrix}} \\ \downarrow & \downarrow & \downarrow \\ 60h & > & 85 + 40h \end{array}$$

Carry out. We solve the inequality.

$$\begin{aligned} 60h &> 85 + 40h \\ 20h &> 85 \\ h &> 4.25 \end{aligned}$$

Check. As a partial check, we can calculate the cost of moving for each mover for different times.

Hrs.	Champion	Muscle
4	\$60(4) = \$240	\$85 + \$40(4) = \$245
4.25	\$60(4.25) = \$255	\$85 + \$40(4.25) = \$255
5	\$60(5) = \$300	\$85 + \$40(5) = \$285

State. If the move requires more than 4.25 hours, Champion Moving is more expensive than Musclebound Moving.

55. ***Familiarize.*** We list the given information in a table. Let s = gross sales.

Plan A: Monthly Income	Plan B: Monthly Income
\$400 salary 8% of sales Total: 400 + 8% of sales	\$610 5% of sales Total: 610 + 5% of sales

Translate.

$$\underbrace{\text{Income from plan A}}_{400+0.08s}\ \underbrace{\text{is greater than}}_{>}\ \underbrace{\text{income from plan B.}}_{610+0.05s}$$

Carry out. We solve the inequality.

$$400+0.08s > 610+0.05s$$
$$400+0.03s > 610$$
$$0.03s > 210$$
$$s > 7000$$

Check. For s = \$7000, the income from plan A is \$400 + 0.08(\$7000), or \$960, and the income from plan B is \$610 + 0.05(\$7000), or \$960. This shows that for sales of \$7000 Toni's income is the same from each plan. For s = \$6990, the income from plan A is \$400 + 0.08(\$6990), or \$959.20, and the income from plan B is \$610 + 0.05(\$6990), or \$959.50. For $s = \$7010$, the income from plan A is \$400 + 0.08(\$7010), or \$960.80, and the income from plan B is \$610 + 0.05(\$7010), or \$960.50.

State. For gross sales greater than \$7000, plan A provides Toni with the greater income.

56. ***Familiarize.*** We list the given information in a table. Let n = the number of hours required to do the job..

Plan A:	Plan B:
\$300 + \$9n	\$12.50n

Translate

$$\underbrace{\text{Pay for plan B}}_{12.50h}\ \underbrace{\text{is greater than}}_{>}\ \underbrace{\text{pay for plan A}}_{300+9.00h}.$$

Carry out. We solve the inequality.

$$12.50h > 300+9.00h$$
$$3.50h > 300$$
$$h > 85\tfrac{5}{7}$$

Check. As a partial check, we compute the pay under both plans for different numbers of hours.

Hrs.	Plan A	Plan B
85	\$300 + \$9(85) = \$1065	\$12.50(85) = \$1062.50
$85\frac{5}{7}$	$\$300 + \$9\left(85\frac{5}{7}\right)$ $\approx$ \$1071.43	$\$12.50\left(85\frac{5}{7}\right)$ $\approx$ \$1071.43
86	\$300 + \$9(86) = \$1074	\$12.50(86) = \$1075

State. Plan B is better when the job requires more than $85\frac{5}{7}$ hr.

57. ***Familiarize.*** Let g = the number of gallons of gasoline used. If Abriana chooses the first option, paying for an entire tank of gasoline, she would pay \$3.099(14), or \$43.386. If she chooses the second option, paying for only the gasoline required to fill the tank, she would pay \$6.34g.

Translate.

$$\underbrace{\text{Paying for only the gallons used}}_{6.34g}\ \underbrace{\text{is less than}}_{<}\ \underbrace{\text{paying for an entire tank.}}_{43.386}$$

Carry out. We solve the inequality.

$$6.34g < 43.386$$
$$g < 6.843217666$$

Check. As a partial check, we can calculate the cost under both options if 6.8 gallons of gas was used. Paying for only the gas used,

Abriana would owe \$6.34(6.8), or about \$43.11.
State. Abriana should use the second plan, paying for only the gas used, if she uses about 6.8 gallons of gasoline or less.

58. For the first option to be more economical, Abriana would have to use more than 6.8 gallons of gas. If the car gets 30 mph, this amounts to driving the car $6.8 \text{ gal}\left(30 \text{ mph}\right)$, or 204 miles. So Abriana would have to drive more than 204 miles.

59. *Thinking and Writing Exercise.* Answers may vary. Three more than Walt's age is less than Fran's age.

60. *Thinking and Writing Exercise.* Let *n* represent "a number." Then "five more than a number" translates to $n+5$, or $5+n$, and "five is more than a number" translates to $5>n$.

61. $-2+(-5)-7=-7-7=-14$

62. $\dfrac{1}{2}\div\left(-\dfrac{3}{4}\right)=\dfrac{1}{2}\cdot\left(-\dfrac{4}{3}\right)=-\dfrac{4}{6}=-\dfrac{2}{3}$

63. $$\begin{aligned}3\cdot(-10)\cdot(-1)\cdot(-2)&=-30\cdot(-1)\cdot(-2)\\&=30\cdot(-2)=-60\end{aligned}$$

64. $-6.3+(-4.8)=-11.1$

65. $(3-7)-(4-8)=-4-(-4)=-4+4=0$

66. $$\begin{aligned}3-2+5\cdot10\div5^2\cdot2&=3-2+5\cdot10\div25\cdot2\\&=1+(50\div25)\cdot2\\&=1+2\cdot2=5\end{aligned}$$

67. $\dfrac{-2-(-6)}{8-10}=\dfrac{4}{-2}=-2$

68. $\dfrac{1-(-7)}{-3-5}=\dfrac{8}{-8}=-1$

69. *Thinking and Writing Exercise.* Answers may vary.
Acme rents a truck at a daily rate of \$40 plus \$0.50 per mile. The Rothmans want a one-day truck rental, but they must stay within an \$85 budget. What mileage will allow them to stay within their budget? Round to the nearest mile.

70. *Thinking and Writing Exercise.* Answers may vary.
A boat has a capacity of 2700 lb. How many passengers can go on the boat if each passenger is considered to weigh 150 lb?

71. ***Familiarize.*** Let *n* = the number of wedding guests. For plan A, the cost for the guests would be \$30*n*. For plan B, the cost for the guests would be \$1300 + \$20(*n* – 25), assuming that more than 25 guests attend.
Translate.

$$\underbrace{\text{The cost for plan B}}\ \underbrace{\text{is less than}}\ \underbrace{\text{the cost for plan A.}}$$
$$\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow$$
$$1300+20(n-25)\quad<\quad 30n$$

Carry out. We solve the inequality.
$$\begin{aligned}1300+20(n-25)&<30n\\1300+20n-500&<30n\\800&<10n\\80&<n\end{aligned}$$
Check. As a partial check, we calculate the cost for the guests under both plans for different numbers of guests.

No	Plan A	Plan B
79	\$30(79) = \$2370	\$1300 + \$20(79 – 25) = \$2380
80	\$30(80) = \$2400	\$1300 + \$20(80 – 25) = \$2400
81	\$30(81) = \$2430	\$1300 + \$20(81 – 25) = \$2420

State. Plan B is cheaper if there are more than 80 guests attending the wedding.

72. ***Familiarize.*** Let *b* = the amount of Giselle's medical bills. Under plan A, Giselle would pay \$50 + 0.2(*b* – 50). Under plan B, Giselle would pay \$250 + 0.1(*b* – 250). We assume the bills exceed \$250.
Translate.

$$\underbrace{\text{Medical cost under plan B}}\ \underbrace{\text{is less than}}\ \underbrace{\text{medical cost under plan A.}}$$
$$\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow$$
$$250+0.1(b-250)\quad<\quad 50+0.2(b-50)$$

Carry out. We solve the inequality.

$$250+0.1(b-250)<50+0.2(b-50)$$
$$250+0.1b-25<50+0.2b-10$$
$$225+0.1b<40+0.2b$$
$$185<0.1b$$
$$1850<b$$

Check. As a partial check, we compute the cost to Giselle under plans A and B for different medical bills.

Bill	Plan A	Plan B
\$1849	\$50 + 0.2(\$1849 – \$50) = \$409.80	\$250 + 0.1(\$1849 – 250) = \$409.90
\$1850	\$50 + 0.2(1850 – 50) = \$410	\$250 + 0.1(\$1850 – 250) = \$410
\$1851	\$50 + \$0.2(\$1851 – 50) = \$410.20	\$250 + 0.1(\$1851 – 250) = \$410.10

State. Plan B is the cheapest if Giselle's medical bills are more than \$1850.

73. ***Familiarize.*** Let h = the number of hours the car was parked. The cost to park the car can be expressed as \$4 + \$2.50(h – 1), assuming the car was parked at least one hour.
Translate.

$$\underbrace{\text{The charge to park the car}}_{\downarrow\atop 4+2.5(h-1)}\ \underbrace{\text{exceeds}}_{\downarrow\atop >}\ \underbrace{\$16.50.}_{\downarrow\atop 16.50}$$

Carry out. We solve the inequality.

$$4+2.5(h-1)>16.50$$
$$4+2.5h-2.5>16.50$$
$$2.5h+1.5>16.50$$
$$2.5h>15$$
$$h>6$$

Check. As a partial check, we can calculate the cost to park the car for 6 hours. The cost would be \$4 + \$2.5(6 – 1), or \$4 + \$2.5(5), or \$16.50.
State. The car must have been parked more than 6 hours.

74. ***Familiarize.*** Let C = the Celsius temperatures for which Green ski was works best. Let F = the Fahrenheit temperature for which Green ski works best. We will use the formula $F=\frac{9}{5}C+32$.

Translate.

$$\underbrace{\text{Fahrenheit temperature is between } 5^\circ \text{ and } 15^\circ.}_{\downarrow\atop 5<F<15}$$

Carry out. We substitute $\frac{9}{5}C+32$ for F and solve the inequality.

$$5<\frac{9}{5}C+32<15$$
$$5-32<\frac{9}{5}C+32-32<15-32$$
$$-27<\frac{9}{5}C<-17$$
$$\frac{5}{9}(-27)<\frac{5}{9}\left(\frac{9}{5}C\right)<\frac{5}{9}(-17)$$
$$-15<C-\frac{85}{9}$$
$$-15<C<-9\tfrac{4}{9}$$

Check. The above steps indicate that the Celsius temperature is greater than –15°, which is $\frac{9}{5}(-15)+32$, or 5° F, and the Celsius temperature is less than $-9\frac{4}{9}$° F, which is $\frac{9}{5}\left(-9\frac{4}{9}\right)+32=\ \frac{9}{5}\left(-\frac{85}{9}\right)+32$, or –17 + 32, or 15° F.

State. Green ski was works best between –15° C and $-9\frac{4}{9}$° C.

75. ***Familiarize.*** Let s = the length of the side of the square, in cm. The area of the square would be s^2 cm^2.
Translate.

$$\underbrace{\text{The area of a square}}_{\downarrow\atop s^2}\ \underbrace{\text{can be no more than}}_{\downarrow\atop \le}\ \underbrace{64\text{ cm}^2.}_{\downarrow\atop 64}$$

Carry out. We solve the inequality.

$$s^2\le 64$$
$$s\le 8$$

Check. As a partial check, we find the area of a square having length of side equal to 8. The area is $8^2=64$.
State. The length can be less than or equal to 8 cm.

76. ***Familiarize.*** Let x = the first odd integer and let $x+2$ equal the second odd integer.
Translate.

$$\underbrace{\text{The sum of the two consecutive odd integers}}\quad \underbrace{\text{is less than}}\quad 100.$$
$$\downarrow \qquad\qquad \downarrow \qquad \downarrow$$
$$x+(x+2) \qquad < \qquad 100$$

Carry out. We solve the inequality.

$$x+(x+2)<100$$
$$2x+2<100$$
$$2x<98$$
$$x<49$$

The first odd integer less than 49 is 47. The next odd integer would be 49.
Check. Both 47 and 49 are odd integers, and they are consecutive odd integers. As a partial check, we calculate their sum, 47 + 49, or 96, which is less than 100.
State. The integers are 47 and 49.

77. ***Familiarize.*** Let x = the amount of fat in a serving of nacho cheese tortilla chips, in grams. If reduced fat Tortilla Pops contain 60% less fat than regular nacho cheese tortilla chips, then they must contain 40% of the fat in regular nacho cheese tortilla chips, or $0.4x$ g.
Translate.

$$\underbrace{\text{Reduced fat Tortilla Pops}}\quad \underbrace{\text{contain at least}}\quad \underbrace{\text{3 g of fat.}}$$
$$\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow$$
$$0.4x \qquad\quad \geq \qquad\quad 3$$

Carry out. We solve the inequality.

$$0.4x\geq 3$$
$$x\geq 7.5$$

Check. As a partial check, if a serving of nacho cheese tortilla chips have 7.5 g of fat, then a serving of reduced fat Tortilla Pops must contain 60% less fat, or 40% of the fat in nacho cheese tortilla chips, or 0.4(7.5), or 3 g of fat. In order to be labeled "lowfat," the reduced fat Tortilla Pops would have to contain less than 3 of fat.
State. A serving of nacho cheese tortilla chips contain at least 7.5 g of fat.

78. ***Familiarize.*** Let h = the number of hours the car was parked. The cost to park the care can be expressed as \$4 + \$2.50(h – 1), assuming the car was parked at least one hour.
Translate.

$$\underbrace{\text{The cost to park was between \$14 and \$24.}}$$
$$\downarrow$$
$$14<4+2.5(h-1)<24$$

Carry out. We solve the inequality.

$$14<4+2.5(h-1)<24$$
$$14<4+2.5h-2.5<24$$
$$14<2.5h+1.5<24$$
$$14-1.5<2.5h+1.5-1.5<24-1.5$$
$$12.5<2.5h<22.5$$
$$5<h<9$$

Check. As a partial check, if the car was parked 5 hours, then the cost would have been more than \$4 + \$2.5(5 – 1), or \$4 + \$2.5(4), or \$14. If the car was parked 9 hours, then the cost would have been less than \$4 + \$2.5(9 – 1), or \$4 + \$2.5(8), or \$24.
State. The car was parked between 5 and 9 hours.

79. ***Familiarize.*** Let p = the price of Neoma's tenth book. If the average price of each of the first 9 books is \$12, then the total price of the 9 books is $9\cdot\$12$, or \$108. The average price of the first 10 books will be $\dfrac{\$108+p}{10}$.
Translate.

$$\underbrace{\text{The average price of 10 books}}\quad \underbrace{\text{is at least}}\quad \$15.$$
$$\downarrow \qquad\qquad \downarrow \qquad \downarrow$$
$$\frac{108+p}{10} \qquad \geq \qquad 15$$

Carry out. We solve the inequality.

$$\frac{108+p}{10}\geq 15$$
$$108+p\geq 150$$
$$p\geq 42$$

Check. As a partial check, we show that the average price of the 10 books is \$15 when the price of the tenth book is \$42.

$$\frac{\$108+\$42}{10}=\frac{150}{10}=\$15$$

State. Neoma's tenth book should cost at least \$42 if she wants to select a \$15 book for her free book.

80. *Thinking and Writing Exercise.* Let s = Blythe's score on the tenth quiz. We determine the score required to improve her average at least 2 points. Solving $\frac{9\cdot 84+s}{10}\geq 86$, we get $s\geq 104$. Since the maximum possible score is 100, Blythe cannot improve her average two points with the next quiz.

81. *Thinking and Writing Exercise.* Let p = the total other purchases for the year. Solving $10\%p>25$, we get $p>250$. Thus, when a customer's other purchases are more than \$250 for the year, the customer saves money by purchasing a card. Or, let p = the total hardcover bestseller purchases for the year. Solving $40\%p>25$, we get $p>62.50$. Thus, when a customer's hardcover bestseller purchases are more than \$62.50 for the year, the customer saves money by buying a card.

Chapter 2 Study Summary

1.
$$\begin{aligned} x-8&=-3 \\ x-8+8&=-3+8 &&\text{Adding 8} \\ x&=5 &&\text{Simpifying} \end{aligned}$$
The solution is 5.

2.
$$\begin{aligned} \frac{1}{4}x&=1.2 \\ 4\left(\frac{1}{4}x\right)&=4(1.2) &&\text{Multiplying by 4} \\ x&=4.8 &&\text{Simplifying} \end{aligned}$$
The solution is 4.8.

3.
$$\begin{aligned} 4-3x&=7 \\ 4-3x+(-4)&=7+(-4) &&\text{Adding } -4 \\ -3x&=3 &&\text{Simplifying} \\ \frac{-3x}{-3}&=\frac{3}{-3} &&\text{Dividing by } -3 \\ x&=-1 &&\text{Simplifying} \end{aligned}$$
The solution is –1.

4.
$$\begin{aligned} \frac{1}{6}t-\frac{3}{4}&=t-\frac{2}{3} \\ 12\left(\frac{1}{6}t-\frac{3}{4}\right)&=12\left(t-\frac{2}{3}\right) &&\text{Multiplying by 12} \\ 12\cdot\frac{1}{6}t-12\cdot\frac{3}{4}&=12\cdot t-12\cdot\frac{2}{3} &&\text{Distributive Law} \\ 2t-9&=12t-8 &&\text{Simplifying} \\ 2t-9+9&=12t-8+9 &&\text{Adding 9} \\ 2t&=12t+1 &&\text{Simplifying} \\ 2t-12t&=12t+1-12t &&\text{Adding } -12t \\ -10t&=1 &&\text{Simplifying} \\ \frac{-10t}{-10}&=\frac{1}{-10} &&\text{Dividing by } -10 \\ t&=-\frac{1}{10} &&\text{Simplifying} \end{aligned}$$
The solution is $-\frac{1}{10}$.

5.
$$\begin{aligned} ac-bc&=d \\ c(a-b)&=d &&\text{Factoring out } c \\ \frac{c(a-b)}{(a-b)}&=\frac{d}{(a-b)} &&\text{Dividing by } a-b \\ c&=\frac{d}{(a-b)} &&\text{Simplifying} \end{aligned}$$

6. 12 is 15% of $\underbrace{\text{what number}}$?
$$\begin{array}{ccccc} \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 12 & = & 0.15 & \cdot & y \end{array}$$
We solve the equation.
$$\begin{aligned} 12&=0.15\cdot y \\ \frac{12}{0.15}&=y \\ 80&=y \end{aligned}$$
The answer is 80.

7. ***Familiarize.*** Let x = the length of the shorter bicycle tour, in miles. Then $x+25$ is the length of the longer tour, in miles.
Translate.
$$\begin{array}{ccc} \underbrace{\text{Length of two bicycle tours}} & \text{was a total of} & \text{120 miles.} \\ \downarrow & \downarrow & \downarrow \\ x+(x+25) & = & 120 \end{array}$$
Carry out. We solve the equation.

$$x+(x+25)=120$$
$$2x+25=120$$
$$2x=95$$
$$x=47\tfrac{1}{2}$$

Check. If the short tour was $47\frac{1}{2}$, then the total length is:
$47\frac{1}{2}+\left(47\frac{1}{2}+25\right)=47\frac{1}{2}+72\frac{1}{2}=120$ miles.
This checks.

State. The length of tours were $47\frac{1}{2}$ miles and $72\frac{1}{2}$ miles.

8. $\{x\mid x\le 0\}$ in interval notation is $(-\infty,0]$

9. $x-11>-4$
   $x-11+11>-4+11$ Adding 11
   $x>7$ Simplifying
   The solution set is $\{x|x>7\}$, or $(7,\infty)$.

10. $-8x\le 2$
    $\dfrac{-8x}{-8}\ge\dfrac{2}{-8}$ Dividing by -8
    $x\ge-\dfrac{1}{4}$ Simplifying
    The solution set is $\{x\mid x\ge-\frac{1}{4}\}$, or $\left[-\frac{1}{4},\infty\right)$.

11. Let d represent the distance Luke runs, in miles. If Luke runs no less than 3 mi per day, then $d\ge 3$.

Chapter 2 Review Exercises

1. True
2. False
3. True
4. True
5. True
6. False
7. True
8. True
9. $x+9=-16$
   $x+9-9=-16-9$ Adding -9
   $x=-25$ Simplifying
   The solution is –25.
10. $-8x=-56$
    $\left(-\dfrac{1}{8}\right)(-8x)=\left(-\dfrac{1}{8}\right)(-56)$ Multiplying by $-\dfrac{1}{8}$
    $x=7$ Simplifying
    The solution is 7.
11. $-\dfrac{x}{5}=13$
    $-5\left(-\dfrac{x}{5}\right)=-5(13)$ Multiplying by -5
    $x=-65$ Simplifying
    The solution is –65.
12. $-8=n-11$
    $-8+11=n-11+11$ Adding 11
    $3=n$ Simpifying
    The solution is 3.
13. $\frac{2}{5}t=-8$
    $\frac{5}{2}\left(\frac{2}{5}t\right)=\frac{5}{2}(-8)$ Multiplying by $\dfrac{5}{2}$
    $t=-20$ Simplifying
    The solution is –20.
14. $x-0.1=1.01$
    $x-0.1+0.1=1.01+0.1$ Adding 0.1
    $x=1.11$ Simplifying
    The solution is 1.11.
15. $-\frac{2}{3}+x=-\frac{1}{6}$
    $6\left(-\frac{2}{3}+x\right)=6\left(-\frac{1}{6}\right)$ Multiplying by 6
    $-4+6x=-1$ Simplifying
    $-4+6x+4=-1+4$ Adding 4
    $6x=3$ Simplifying
    $x=\frac{1}{2}$ Multiplying by $\dfrac{1}{6}$
    The solution is $\frac{1}{2}$.

16. $5z+3=41$

$5z+3-3=41-3$ Adding -3

$5z=38$ Simplifying

$z=\frac{38}{5}$ Multiplying by $\frac{1}{5}$

The solution is $\frac{38}{5}$.

17. $5-x=13$

$5-x-5=13-5$ Adding -5

$-x=8$ Simplifying

$x=-8$ Multiplying by -1

The solution is –8.

18. $5t+9=3t-1$

$5t+9-9=3t-1-9$ Adding -9

$5t=3t-10$ Simplifying

$5t-3t=3t-10-3t$ Adding $-3t$

$2t=-10$ Simplifying

$t=-5$ Multiplying by $\frac{1}{2}$

The solution is –5.

19. $7x-6=25x$

$7x-6-7x=25x-7x$ Adding $-7x$

$-6=18x$ Simplifying

$-\frac{1}{3}=x$ Multiplying by $\frac{1}{18}$

The solution is $-\frac{1}{3}$.

20. $\frac{1}{4}a-\frac{5}{8}=\frac{3}{8}$

$8\left(\frac{1}{4}a-\frac{5}{8}\right)=8\left(\frac{3}{8}\right)$ Multiplying by 8

$2a-5=3$ Simplifying

$2a-5+5=3+5$ Adding 5

$2a=8$ Simplifying

$\frac{2a}{2}=\frac{8}{2}$ Dividing by 2

$a=4$ Simplifying

The solution is 4.

21. $14y=23y-17-9y$

$14y=14y-17$ Simplifying

$14y-14y=14y-17-14y$ Adding $-14y$

$0=-17$ Simplifying

This is a false statement. The equation is a contradiction, and has no solution.

22. $0.22y-0.6=0.12y+3-0.8y$

$0.22y-0.6=-0.68y+3$ Simplifying

$0.22y-0.6+0.68y=-0.68y+3+0.68y$ Adding $0.68y$

$0.9y-0.6=3$ Simplifying

$0.9y-0.6+0.6=3+0.6$ Adding 0.6

$0.9y=3.6$ Simplifying

$y=4$ Multiplying by $\frac{1}{0.9}$

The solution is 4.

23. $\frac{1}{4}x-\frac{1}{8}x=3-\frac{1}{16}x$

$16\left(\frac{1}{4}x-\frac{1}{8}x\right)=16\left(3-\frac{1}{16}x\right)$ Multiplying by 16

$4x-2x=48-x$ Distributive Law

$2x=48-x$ Simplifying

$2x+x=48-x+x$ Adding x

$3x=48$ Simplifying

$x=16$ Multiplying by $\frac{1}{3}$

The solution is 16.

24 $3(5-n)=36$

$15-3n=36$ Distributive Law

$15-3n-15=36-15$ Adding -15

$-3n=21$ Simplifying

$x=-7$ Multiplying by $-\frac{1}{3}$

The solution is –7.

25. $4(5x-7)=-56$

$20x-28=-56$ Distributive Law

$20x-28+28=-56+28$ Adding 28

$20x=-28$ Simplifying

$x=-\frac{28}{20}$ Multiplying by $\frac{1}{20}$

$x=-\frac{7}{5}$ Simplifying

The solution is $-\frac{7}{5}$.

26. $8(x-2)=5(x+4)$

$8x-16=5x+20$ Distributive Law

$8x-16+16=5x+20+16$ Adding 16

$8x=5x+36$ Simplifying

$8x-5x=5x+36-5x$ Adding $-5x$

$3x=36$ Simplifying

$x=12$ Multiplying by $\frac{1}{3}$

The solution is 12.

27. $3(x-4)+2=x+2(x-5)$

$$\begin{aligned} 3x-12+2 &= x+2x-10 && \text{Distributive Law} \\ 3x-10 &= 3x-10 && \text{Simplifying} \\ 3x-10-3x &= 3x-10-3x && \text{Subtracting } 3x \\ -10 &= -10 && \text{Simplifying} \end{aligned}$$

Because $-10=-10$ is a true statement, this equation is an identity and the solution is all real numbers.

28.

$$\begin{aligned} C &= \pi d \\ C\left(\frac{1}{\pi}\right) &= \pi d\left(\frac{1}{\pi}\right) && \text{Multipling by } \frac{1}{\pi} \\ \frac{C}{\pi} &= d && \text{Simplifying} \end{aligned}$$

29.

$$\begin{aligned} V &= \frac{1}{3}Bh \\ 3\cdot V &= 3\left(\frac{1}{3}Bh\right) && \text{Multiplying by 3} \\ 3V &= Bh && \text{Simplifying} \\ \frac{1}{h}(3V) &= \frac{1}{h}(Bh) && \text{Multiplying by } \frac{1}{h} \\ \frac{3V}{h} &= B && \text{Simplifying} \end{aligned}$$

30.

$$\begin{aligned} 5x-2y &= 10 \\ 5x-2y-5x &= 10-5x && \text{Subtracting } 5x \\ -2y &= 10-5x && \text{Simplifying} \\ \frac{-2y}{-2} &= \frac{10-5x}{-2} && \text{Dividing by } -2 \\ y &= \frac{5}{2}x-5 && \text{Simplifying} \end{aligned}$$

31.

$$\begin{aligned} tx &= ax+b \\ tx-ax &= ax+b-ax && \text{Subtracting } ax \\ tx-ax &= b && \text{Simplifying} \\ x(t-a) &= b && \text{Factor out } x \\ \frac{x(t-a)}{t-a} &= \frac{b}{t-a} && \text{Dividing by } t-a \\ x &= \frac{b}{t-a} && \text{Simplifying} \end{aligned}$$

32.

$$\begin{aligned} 0.9\% &= 0.9\times 0.01 && \text{Replacing \% by } \times 0.01 \\ &= 0.009 \end{aligned}$$

33. $\frac{11}{25}=\frac{4}{4}\cdot\frac{11}{25}=\frac{44}{100}=0.44$

First, move the decimal point two places to the right; then write a % symbol:

0.44.

44%

The answer is 44%.

34. $\underbrace{\text{What percent}}$ of 60 is 42?

$$\begin{array}{cccccc} \downarrow & & \downarrow & \downarrow & \downarrow & \downarrow \\ y & & \cdot & 60 & = & 42 \end{array}$$

We solve the equation and then convert to percent notation.

$$\begin{aligned} y\cdot 60 &= 42 \\ y &= \frac{42}{60} \\ y &= 0.70 = 70\% \end{aligned}$$

The answer is 70%.

35. 42 is 30% of $\underbrace{\text{what number}}$?

$$\begin{array}{ccccc} \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ 42 & = & 0.30 & \cdot & y \end{array}$$

We solve the equation.

$$\begin{aligned} 42 &= 0.30\cdot y \\ \frac{42}{0.30} &= y \\ 140 &= y \end{aligned}$$

The answer is 140.

36. $x\le -5$

We substitute –3 for x giving $-3\le -5$, which is a false statement since –3 is to the right of –5 on the number line. So –3 is not a solution of the inequality $x\le -5$.

37. $x\le -5$

We substitute –7 for x giving $-7\le -5$, which is a true statement since –7 is to the left of –5 on the number line. So –7 is a solution of the inequality $x\le -5$.

38. $x\le -5$

We substitute 0 for x giving $0\le -5$, which is a false statement since 0 is to the right of –5 on the number line. So 0 is not a solution of the inequality $x\le -5$.

39. $5x-6<2x+3$

$5x-6+6<2x+3+6$ Adding 6

$5x<2x+9$ Simplifying

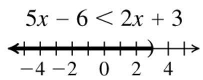
$5x-2x<2x+9-2x$ Adding $-2x$

$3x<9$ Simplifying

$x<3$ Multiplying by $\frac{1}{3}$

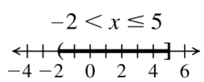
The solution set is $\{x\mid x<3\}$, or $(-\infty,3)$.

The graph is as follows:



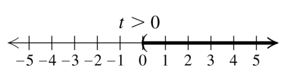
40. $-2<x\le 5$

The solution set is $\{x\mid -2<x\le 5\}$, or $(-2,5]$. The graph is as follows:



41. $t>0$

The solution set is $\{t\mid t>0\}$, or $(0,\infty)$. The graph is as follows:



42. $t+\frac{2}{3}\ge\frac{1}{6}$

$6\left(t+\frac{2}{3}\right)\ge 6\left(\frac{1}{6}\right)$ Multiplying by 6

$6t+4\ge 1$ Simplifying

$6t+4-4\ge 1-4$ Adding -4

$6t\ge -3$ Simplifying

$\frac{1}{6}(6t)\ge\frac{1}{6}(-3)$ Multiplying by $\frac{1}{6}$

$t\ge -\frac{1}{2}$ Simplifying

The solution set is $\left\{t\middle|t\ge -\frac{1}{2}\right\}$, or $\left[-\frac{1}{2},\infty\right)$.

43. $9x\ge 63$

$\frac{1}{9}(9x)\ge\frac{1}{9}\cdot 63$ Multiplying by $\frac{1}{9}$

$x\ge 7$ Simplifying

The solution set is $\{x\mid x\ge 7\}$, or $[7,\infty)$.

44. $2+6y>20$

$2+6y-2>20-2$ Adding -2

$6y>18$ Simplifying

$\frac{1}{6}(6y)>\frac{1}{6}\cdot 18$ Multiplying by $\frac{1}{6}$

$y>3$ Simplifying

The solution set is $\{y\mid y>3\}$, or $(3,\infty)$.

45. $7-3y\ge 27+2y$

$7-3y-7\ge 27+2y-7$ Adding -7

$-3y\ge 20+2y$ Simplifying

$-3y-2y\ge 20+2y-2y$ Adding $-2y$

$-5y\ge 20$ Simplifying

$y\le -4$ Multiplying by $-\frac{1}{5}$ and reversing the inequality symbol

The solution set is $\{y\mid y\le -4\}$, or $(-\infty,-4]$.

46. $3x+5<2x-6$

$3x+5-2x<2x-6-2x$ Adding $-2x$

$x+5<-6$ Simplifying

$x+5-5<-6-5$ Adding -5

$x<-11$ Simplifying

The solution set is $\{x\mid x<-11\}$, or $(-\infty,-11)$.

47. $-4y<28$

$-\frac{1}{4}(-4y)>-\frac{1}{4}\cdot 28$ Multiplying by $-\frac{1}{4}$ and reversing the inequality symbol

$y>-7$ Simplifying

The solution set is $\{y\mid y>-7\}$, or $(-7,\infty)$.

48. $3-4x<27$

$3-4x-3<27-3$ Adding -3

$-4x<24$ Simplifying

$-\frac{1}{4}(-4x)>-\frac{1}{4}\cdot 24$ Multiplying by $-\frac{1}{4}$ and reversing the inequality symbol

$x>-6$ Simplifying

The solution set is $\{x\mid x>-6\}$, or $(-6,\infty)$.

49.
$$
\begin{aligned}
4-8x &< 13+3x \\
4-8x-4 &< 13+3x-4 && \text{Adding } -4 \\
-8x &< 9+3x && \text{Simplifying} \\
-8x-3x &< 9+3x-3x && \text{Adding } -3x \\
-11x &< 9 && \text{Simplifying} \\
-\tfrac{1}{11}(-11x) &> -\tfrac{1}{11}\cdot 9 && \text{Multiplying by } -\tfrac{1}{11} \\
x &> -\tfrac{9}{11} && \text{Simplifying}
\end{aligned}
$$

The solution set is $\left\{x \middle| x > -\frac{9}{11}\right\}$, or $\left(-\frac{9}{11}, \infty\right)$.

50.
$$
\begin{aligned}
13 &\le -\tfrac{2}{3}t+5 \\
13+\tfrac{2}{3}t &\le -\tfrac{2}{3}t+5+\tfrac{2}{3}t && \text{Adding } \tfrac{2}{3}t \\
13+\tfrac{2}{3}t &\le 5 && \text{Simplifying} \\
13+\tfrac{2}{3}t-13 &\le 5-13 && \text{Adding } -13 \\
\tfrac{2}{3}t &\le -8 && \text{Simplifying} \\
\tfrac{3}{2}\left(\tfrac{2}{3}t\right) &\le \tfrac{3}{2}(-8) && \text{Multipying by } \tfrac{3}{2} \\
t &\le -12 && \text{Simplifying}
\end{aligned}
$$

The solution set is $\{t \mid t \le -12\}$, or

$(-\infty, -12]$.

51.
$$
\begin{aligned}
7 &\le 1-\tfrac{3}{4}x \\
7-1 &\le 1-\tfrac{3}{4}x-1 && \text{Adding } -1 \\
6 &\le -\tfrac{3}{4}x && \text{Simplifying} \\
-\tfrac{4}{3}\cdot 6 &\ge -\tfrac{4}{3}\left(-\tfrac{3}{4}x\right) && \text{Multiplying by } -\tfrac{4}{3} \\
-8 &\ge x && \text{Simplifying}
\end{aligned}
$$

The solution set is $\{x \mid -8 \ge x\}$, or

$\{x \mid x \le -8\}$, or $(-\infty, -8]$.

52. ***Familiarize.*** Let x = the amount given to charities in 2008, in dollars.

Translate.

$$
\underset{0.35}{\underset{\downarrow}{35\%}}\ \underset{\cdot}{\underset{\downarrow}{\text{of}}}\ \underset{x}{\underset{\downarrow}{\underbrace{\text{the amount given to charities}}}}\ \underset{=}{\underset{\downarrow}{\text{was}}}\ \underset{106.9}{\underset{\downarrow}{\underbrace{\text{\$106.9 billion.}}}}
$$

Carry out. We solve the equation.

$$
\begin{aligned}
0.35x &= 106.9 \\
x &= \frac{106.9}{0.35} \\
x &\approx 305.4286
\end{aligned}
$$

Check. If about \$305.4 billion was given to charities, then 35% of that amount was given to religious organizations. So $35\% \cdot \$305.4$ billion , or \$106.9.billion was given to religious organizations. This amount checks.

State. The amount given to charities in 2008 was about \$305.4 billion.

53. ***Familiarize.*** Let x = the length of the first piece, in ft. Since the second piece is 2 ft longer than the first piece, it must be $x+2$ ft.

Translate.

$$
\underset{x+(x+2)}{\underset{\downarrow}{\underbrace{\text{The sum of the lengths of the two pieces}}}}\ \underset{=}{\underset{\downarrow}{\text{is}}}\ \underset{32}{\underset{\downarrow}{\text{32 ft.}}}
$$

Carry out. We solve the equation.

$$
\begin{aligned}
x+(x+2) &= 32 \\
2x+2 &= 32 \\
2x &= 30 \\
x &= 15
\end{aligned}
$$

Check. If the first piece is 15 ft long, then the second piece must be 15 + 2, or 17 ft long. The sum of the lengths of the two pieces is 15 ft + 17 ft, or 32 ft. The answer checks.

State. The lengths of the two pieces are 15 ft and 17 ft.

54. ***Familiarize.*** Let x = the first odd integer and let $x+2$ = the next consecutive odd integer.

Translate.

$$
\underset{x+(x+2)}{\underset{\downarrow}{\underbrace{\text{The sum of the two consecutive odd integers}}}}\ \underset{=}{\underset{\downarrow}{\text{is}}}\ \underset{116}{\underset{\downarrow}{\text{116.}}}
$$

Carry out. We solve the equation.

$$
\begin{aligned}
x+(x+2) &= 116 \\
2x+2 &= 116 \\
2x &= 114 \\
x &= 57
\end{aligned}
$$

Check. If the first odd integer is 57, then the next consecutive odd integer would be 57 + 2, or 59. The sum of these two integers is 57 + 59, or 116. This result checks.

State. The integers are 57 and 59.

55. ***Familiarize.*** Let x = the length of the rectangle, in cm. The width of the rectangle is $x-6$ cm. The perimeter of a rectangle is given by $P = 2l + 2w$, where l is the length and w is the width.

Translate.

$$\underbrace{\text{The perimeter of the rectangle}}\ \text{is}\ 56\text{ cm.}$$
$$\downarrow \qquad\qquad\qquad \downarrow\ \downarrow$$
$$2x+2(x-6) \qquad\qquad = 56$$

Carry out. We solve the equation.

$$\begin{aligned} 2x+2(x-6)&=56\\ 2x+2x-12&=56\\ 4x-12&=56\\ 4x&=68\\ x&=17 \end{aligned}$$

Check. If the length is 17 cm, then the width is 17 cm – 6 cm, or 11 cm. The perimeter is $2\cdot 17$ cm + $2\cdot 11$ cm ,or 34 cm + 22 cm, or 56 cm. These results check.

State. The length is 17 cm and the width is 11 cm.

56. ***Familiarize.*** Let x = the regular price of the picnic table. Since the picnic table was reduced by 25%, it actually sold for 75% of its original price.

Translate.

$$75\%\ \text{of}\ \underbrace{\text{the original price}}\ \text{is}\ \$120.$$
$$\downarrow\quad \downarrow \qquad\quad \downarrow \qquad\quad \downarrow\ \downarrow$$
$$0.75 \quad \cdot \qquad\quad x \qquad\quad = \ 120$$

Carry out. We solve the equation.

$$\begin{aligned} 0.75x&=120\\ x&=\frac{120}{0.75}\\ x&=160 \end{aligned}$$

Check. If the original price was \$160 with a 25% discount, then the purchaser would have paid 75% of \$160, or $0.75\cdot \$160$, or \$120. This result checks.

State. The original price was \$160.

57. ***Familiarize.*** Let x = the amount of sleep that infants need. 12 hours is 25% less than x, or 75% of x.

Translate.

$$75\%\ \text{of}\ \underbrace{\begin{array}{c}\text{the hours}\\ \text{infants sleep}\end{array}}\ \text{is}\ \underbrace{12\text{ hours}}.$$
$$\downarrow\quad \downarrow \qquad \downarrow \qquad \downarrow \qquad \downarrow$$
$$0.75 \quad \cdot \qquad x \qquad = \qquad 12$$

Carry out. We solve the equation.

$$\begin{aligned} 0.75x&=12\\ x&=\frac{12}{0.75}\\ x&=16 \end{aligned}$$

Check. If infants sleep 16 hours, then 75% of 16 hours is 12 hours. This result checks.

State. Infants need 16 hours of sleep per day.

58. ***Familiarize.*** Let x = the measure of the first angle. The measure of the second angle is x + 50°, and the measure of the third angle is $2x$ – 10°. The sum of the measures of the angles of a triangle is 180°.

Translate.

$$\underbrace{\begin{array}{c}\text{The sum of the measures}\\ \text{of the angles}\end{array}}\ \text{is}\ 180^{\circ}.$$
$$\downarrow \qquad\qquad\qquad \downarrow\ \downarrow$$
$$x+(x+50)+(2x-10) \quad = \ 180$$

Carry out. We solve the equation.

$$\begin{aligned} x+(x+50)+(2x-10)&=180\\ 4x+40&=180\\ 4x&=140\\ x&=35 \end{aligned}$$

Check. If the measure of the first angle is 35°, then the measure of the second angle is 35° + 50°, or 85°, and the measure of the third angle is $2\cdot 35^{\circ}-10^{\circ}$, or 60°. The sum of the measures of the first, second, and third angles is 35° + 85° + 60°, or 180°. These results check.

State. The measures of the angles are 35°, 85°, and 60°.

59. ***Familiarize.*** We examine the values in the table and determine the relationship between the number of gift subscriptions and the total cost of the subscriptions.

Number of Gift Subscriptions	Total Cost of Subscriptions
1	$1\cdot 10+3=10+3=13$
2	$2\cdot 10+3=20+3=23$
4	$4\cdot 10+3=40+3=43$
10	$10\cdot 10+3=100+3=103$

We note that \$10 times the number of gift subscriptions plus \$3 gives the total cost of the subscriptions. We let x represent the number of gift subscriptions.

Translate.

$$\underbrace{\text{The total cost of gift subscriptions}}\ \text{is}\ \$73.$$
$$\downarrow \qquad\qquad\qquad \downarrow\ \downarrow$$
$$10x+3 \qquad\qquad\qquad = \ 73$$

Carry out. We solve the equation.

$$10x+3=73$$
$$10x=70$$
$$x=7$$

Check. If the number of gift subscriptions is 7, then the total cost of the subscription is $\$10\cdot 7+\$3$, or \$73. This results checks.

State. Tonya purchased 7 gift subscriptions.

60. ***Familiarize.*** Let x = the amounts Caroline can spend during the sixth month.

Translate.

$$\underbrace{\text{The average of the amounts spent for entertainment}}\quad\underbrace{\text{does not exceed}}\quad \$95.$$
$$\downarrow \qquad\qquad \downarrow \qquad \downarrow$$
$$\frac{98+89+110+85+83+x}{6} \quad \le \quad 95$$

Carry out. We solve the inequality.

$$\frac{98+89+110+85+83+x}{6}\le 95$$
$$6\left(\frac{98+89+110+85+83+x}{6}\right)\le 6\cdot 95$$
$$98+89+110+85+83+x\le 570$$
$$465+x\le 570$$
$$465+x-465\le 570-465$$
$$x\le 105$$

Check. As a partial check we calculate the average amount spent on entertainment if Caroline spends \$105 during the sixth month. The average is

$$\frac{\$98+\$89+\$110+\$85+\$83+\$105}{6}$$
$$=\frac{\$570}{6}=\$95.$$

If Caroline spent any less than \$105 during the sixth month, her 6-month average would be less than \$95. These results check.

State. Caroline should spend \$105 or less during the sixth month.

61. ***Familiarize.*** Let x = the widths of the rectangle. The perimeter of a rectangle is given by $P=2l+2w$.

Translate.

$$\underbrace{\text{The perimeter of the rectangle}}\quad\underbrace{\text{is greater than}}\quad 120\text{ cm.}$$
$$\downarrow \qquad\qquad \downarrow \qquad \downarrow$$
$$2\cdot 43+2x \quad > \quad 120$$

Carry out. We solve the inequality.

$$2\cdot 43+2x>120$$
$$86+2x>120$$
$$86+2x-86>120-86$$
$$2x>34$$
$$x>17$$

Check. As a partial check, we calculate the perimeter when the width is 17 cm. The perimeter is $2\cdot 43$ cm + $2\cdot 17$ cm, or 86 cm + 34 cm, or 120 cm. If the width exceeded 17 cm, the perimeter would exceed 120 cm. These results check.

State. The width must be greater than 17 cm.

62. *Thinking and Writing Exercise.* Multiplying both sides of an equation by *any* nonzero number results in an equivalent equation. When multiplying on both sides of an inequality, the sign of the number being multiplied by must be considered. If the number is positive, the direction of the inequality symbol remains unchanged; if the number is negative, the direction of the inequality symbol must be reversed to produce an equivalent inequality.

63. *Thinking and Writing Exercise.* The solutions of an equation can usually each be checked. The solutions of an inequality are normally too numerous to check. Checking a few numbers from the solution set found cannot guarantee that the answer is correct, although if any number does not check, the answer found is incorrect.

64. ***Familiarize.*** Let x = the amount of time that sixth- and seventh-graders spend reading or doing homework each day. 108% more than this is $208\%x$. Note that 3 hr 20 min is equivalent to 200 min.

Translate.

$$208\%\ \text{of}\ \underbrace{\text{the time spent by children on reading or homework}}\ \text{is}\ 200\text{ min.}$$
$$\downarrow \quad \downarrow \qquad \downarrow \qquad \downarrow \quad \downarrow$$
$$2.08 \quad \cdot \quad x \quad = \quad 200$$

Carry out. We solve the equation.

$$2.08x=200$$
$$x=\frac{200}{2.08}$$
$$x\approx 96.153846$$

Check. If children spend 96.153846 minutes reading or doing homework, they spend (2.08)(96.153846) minutes watching TV or playing video games, or about 200 minutes. The result checks.
State. Children spend about 96 minutes, or 1 hour 36 minutes, reading or doing homework each day.

65. ***Familiarize.*** Let x = the length of the Nile River, in miles. Let $x + 65$ represent the length of the Amazon River, in miles.
Translate.

$$\underbrace{\text{The combined length of both rivers}}_{\downarrow} \quad \underset{\downarrow}{\text{is}} \quad \underset{\downarrow}{\text{8385 miles.}}$$
$$x+(x+65) \qquad = 8385$$

Carry out. We solve the equation.
$$x+(x+65)=8385$$
$$2x+65=8385$$
$$2x=8320$$
$$x=4160$$
Check. If the Nile River is 4160 miles long, then the Amazon River is 4160 + 65, or 4225 miles. The combined length of both rivers is then 4160 + 4225, or 8385 miles. These results check.
State. The Nile River is 4160 miles long, and the Amazon River is 4225 miles long.

66. ***Familiarize.*** Let x = the sticker price of the car. The sticker price minus 20% of the sticker price would be $x-0.20x$.
Translate.

$$\underbrace{\text{The sticker price minus 20\% of the sticker price}}_{\downarrow} \quad \underset{\downarrow}{\text{plus}} \quad \underset{\downarrow}{\text{\$200}} \quad \underset{\downarrow}{\text{is}} \quad \underset{\downarrow}{\text{\$15,080.}}$$
$$x-0.20x \qquad + \quad 200 \quad = \quad 15,080$$

Carry out. We solve the equation.
$$x-0.20x+200=15080$$
$$0.80x+200=15,080$$
$$0.80x=14,880$$
$$x=\frac{14,880}{0.80}$$
$$x=18,600$$
Check. If the sticker price is \$18,600, then 20% of the sticker price is $0.20\cdot\$18,600$, or \$3720. The sticker price minus 20% of the sticker price is \$18,600 – \$3720, or \$14,880. Adding \$200, we get \$14,880 + \$200, or \$15,080, which is the purchase price.
State. The sticker price of the car is \$18,600.

67. $$2|n|+4=50$$
$$2|n|=46$$
$$|n|=23$$
The distance from some number n and the origin is 23 units. The solution is n = 23, or n = –23.

68. $|3n|=60$
The distance from some number, $3n$, to the origin is 60 units. So we have:
$$3n=-60 \qquad 3n=60$$
$$n=-20 \qquad n=20$$
The solution is –20 and 20.

69. $$y=2a-ab+3$$
$$y=a(2-b)+3$$
$$y-3=a(2-b)$$
$$\frac{y-3}{2-b}=a$$
The solution is $a=\dfrac{y-3}{2-b}$.

Chapter 2 Test

1. $$t+7=16$$
$$t+7-7=16-7 \quad \text{Adding } -7$$
$$t=9 \quad \text{Simplifying}$$
The solution is 9.

2. $$t-3=12$$
$$t-3+3=12+3 \quad \text{Adding 3}$$
$$t=15 \quad \text{Simplifying}$$
The solution is 15.

3. $$6x=-18$$
$$\tfrac{1}{6}(6x)=\tfrac{1}{6}(-18) \quad \text{Multiplying by } \tfrac{1}{6}$$
$$x=-3 \quad \text{Simplifying}$$
The solution is –3.

4. $-\frac{4}{7}x = -28$

$-\frac{7}{4}\left(-\frac{4}{7}x\right) = -\frac{7}{4}(-28)$ Multiplying by $-\frac{7}{4}$

$x = 49$ Simplifying

The solution is 49.

5. $3t + 7 = 2t - 5$

$3t + 7 - 7 = 2t - 5 - 7$ Adding -7

$3t = 2t - 12$ Simplifying

$3t - 2t = 2t - 12 - 2t$ Adding $-2t$

$t = -12$ Simplifying

The solution is –12.

6. $\frac{1}{2}x - \frac{3}{5} = \frac{2}{5}$

$\frac{1}{2}x - \frac{3}{5} + \frac{3}{5} = \frac{2}{5} + \frac{3}{5}$ Adding $\frac{3}{5}$

$\frac{1}{2}x = \frac{5}{5}$ Simplifying

$\frac{1}{2}x = 1$ Simplifying

$2\left(\frac{1}{2}x\right) = 2 \cdot 1$ Multiplying by 2

$x = 2$ Simplifying

The solution is 2.

7. $8 - y = 16$

$8 - y - 8 = 16 - 8$ Adding -8

$-y = 8$ Simplifying

$y = -8$ Multiply by -1

The solution is –8.

8. $4.2x + 3.5 = 1.2 - 2.5x$

$4.2x + 3.5 - 3.5 = 1.2 - 2.5x - 3.5$ Subtracting 3.5

$4.2x = -2.3 - 2.5x$ Simplifying

$4.2x + 2.5x = -2.3 - 2.5x + 2.5x$ Adding $2.5x$

$6.7x = -2.3$ Simplifying

$\frac{6.7x}{6.7} = \frac{-2.3}{6.7}$ Dividing by 6.7

$x = \frac{-23}{67}$ Simplifying

The solution is $-\frac{23}{67}$.

9. $4(x + 2) = 36$

$4x + 8 = 36$ Distributive Law

$4x + 8 - 8 = 36 - 8$ Adding -8

$4x = 28$ Simplifying

$\frac{1}{4}(4x) = \frac{1}{4}(28)$ Multiplying by $\frac{1}{4}$

$x = 7$ Simplifying

The solution is 7.

10. $9 - 3x = 6(x + 4)$

$9 - 3x = 6x + 24$ Distributive Law

$9 - 3x - 24 = 6x + 24 - 24$ Adding -24

$-3x - 15 = 6x$ Simplifying

$-3x - 15 + 3x = 6x + 3x$ Adding $3x$

$-15 = 9x$ Simplifying

$\frac{1}{9}(-15) = \frac{1}{9}(9x)$ Multiplying by $\frac{1}{9}$

$-\frac{5}{3} = x$ Simplifying

The solution is $-\frac{5}{3}$.

11. $\frac{5}{6}(3x + 1) = 20$

$\frac{6}{5}\left[\frac{5}{6}(3x + 1)\right] = \frac{6}{5} \cdot 20$ Multiplying by $\frac{6}{5}$

$3x + 1 = 24$ Simplifying

$3x + 1 - 1 = 24 - 1$ Adding -1

$3x = 23$ Simplifying

$\frac{1}{3}(3x) = \frac{1}{3}(23)$ Multiplying by $\frac{1}{3}$

$x = \frac{23}{3}$ Simplifying

The solution is $\frac{23}{3}$.

12. $3(2x - 8) = 6(x - 4)$

$6x - 24 = 6x - 24$ Distributive Law

Since this is true for all x, the equation is an identity.

13. $x + 6 > 1$

$x + 6 - 6 > 1 - 6$ Adding -6

$x > -5$ Simplifying

The solution set is $\{x \mid x > -5\}$, or $(-5, \infty)$.

14. $14x + 9 > 13x - 4$

$14x + 9 - 9 > 13x - 4 - 9$ Adding -9

$14x > 13x - 13$ Simplifying

$14x - 13x > 13x - 13 - 13x$ Adding $-13x$

$x > -13$ Simplifing

The solution set is $\{x \mid x > -13\}$, or $(-13, \infty)$.

15. $-2y \le 26$

$-\frac{1}{2}(-2y) \ge -\frac{1}{2}(26)$ Multiplying by $-\frac{1}{2}$ and reversing the inequality symbol

$y \ge -13$ Simplifying

The solution set is $\{y \mid y \ge -13\}$, or $[-13, \infty)$.

16. $4y \le -32$

$\frac{1}{4}(4y) \le \frac{1}{4}(-32)$ Multiplying by $\frac{1}{4}$

$y \le -8$ Simplifying

The solution set is $\{y \mid y \le -8\}$, or $(-\infty, -8]$.

17. $4n + 3 < -17$

$4n + 3 - 3 < -17$ Subtracting 3

$4n < -20$ Simplifying

$\frac{4n}{4} < \frac{-20}{4}$ Dividing by 4

$n < -5$

The solution set is $\{n|n < -5\}$, or $(-\infty, -5)$.

18. $\frac{1}{2}t - \frac{1}{4} \le \frac{3}{4}t$

$4\left(\frac{1}{2}t - \frac{1}{4}\right) \le 4 \cdot \left(\frac{3}{4}t\right)$ Multiplying by 4

$2t - 1 \le 3t$ Simplifying

$2t - 1 + 1 \le 3t + 1$ Adding 1

$2t \le 3t + 1$ Simplifying

$2t - 3t \le 3t + 1 - 3t$ Subtracting $3t$

$-t \le 1$ Simplifying

$t \ge -1$ Multiplying by -1

The solution set is $\{t|t \ge -1\}$, or $[-1, \infty)$.

19. $5 - 9x \ge 19 + 5x$

$5 - 9x - 5 \ge 19 + 5x - 5$ Adding -5

$-9x \ge 14 + 5x$ Simplifying

$-9x - 5x \ge 14 + 5x - 5x$ Adding $-5x$

$-14x \ge 14$ Simplifying

$-\frac{1}{14}(-14x) \le -\frac{1}{14}(14)$ Multiplying by $-\frac{1}{14}$ and reversing the inequality symbol

$x \le -1$ Simplifying

The solution set is $\{x \mid x \le -1\}$, or $(-\infty, -1]$.

20. $A = 2\pi rh$

$\frac{1}{2\pi h} \cdot A = \frac{1}{2\pi h}(2\pi rh)$ Multiplying by $\frac{1}{2\pi h}$

$\frac{A}{2\pi h} = r$ Simplifying

The solution is $r = \frac{A}{2\pi h}$.

21. $w = \frac{P + l}{2}$

$2 \cdot w = 2\left(\frac{P + l}{2}\right)$ Multiplying by 2

$2w = P + l$ Simplifying

$2w - P = P + l - P$ Adding $-P$

$2w - P = l$ Simplifying

The solution is $l = 2w - P$.

22. $230\% = 230 \times 0.01$ Replacing % by $\times 0.01$

$= 2.3$

23. 0.054

First move the decimal point two places to the right; then write a % symbol. The answer is 5.4%.

0.05.4

5.4%

24. ***Translate.***

$\underbrace{\text{What number}}$ is 32% of 50?

$$\begin{array}{ccccc} \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ x & = & 0.32 & \cdot & 50 \end{array}$$

We solve the equation.

$x = 0.32 \cdot 50$

$x = 16$

The solution is 16.

25. ***Translate.***

$\underbrace{\text{What percent}}$ of 75 is 33?

$$\begin{array}{ccccc} \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\ y & \cdot & 75 & = & 33 \end{array}$$

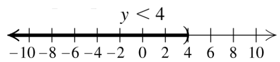
We solve the equation and then convert to percent notation.

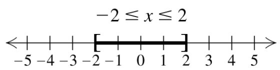
$y \cdot 75 = 33$

$y = \frac{33}{75}$

$y = 0.44 = 44\%$

The solution is 44%.

26. 

27. 

28. ***Familiarize.*** Let w = the width of the calculator, in cm. Then the length is $w+4$, in cm. The perimeter of a rectangle is given by $P = 2l + 2w$.
Translate.

$$\underbrace{\text{The perimeter of the rectangle}}\ \text{is}\ 36.$$

$$2(w+4)+2w \quad = 36$$

Carry out. We solve the equation.

$$\begin{aligned} 2(w+4)+2w &= 36 \\ 2w+8+2w &= 36 \\ 4w+8 &= 36 \\ 4w &= 28 \\ w &= 7 \end{aligned}$$

Check. If the width is 7 cm, then the length is 7 + 4, or 11 cm. The perimeter is then $2 \cdot 11 + 2 \cdot 7$, or 22 + 14, or 36 cm. The results checks.
State. The width is 7 cm and the length is 11 cm.

29. ***Familiarize.*** Let x = the number of miles Kari has already ridden. Then she has $3x$ miles to go.
Translate.

$$\underbrace{\text{The total length of Kari's bicycle trip}}\ \text{is 240 miles.}$$

$$x + 3x \quad = \quad 240$$

Carry out. We solve the equation.

$$\begin{aligned} x+3x &= 240 \\ 4x &= 240 \\ x &= 60 \end{aligned}$$

Check. If Kari has already ridden 60 mi, then she has yet to ride $3 \cdot 60$ mi, or 180 mi. The total length of her ride is 60 mi + 180 mi, or 240 mi. This result checks.
State. Kari has already ridden 60 miles.

30. ***Familiarize.*** Let x = the length of the first side, in mm. Then the length of the second side is $x+2$ mm, and the length of the third side is $x+4$ mm. The perimeter of a triangle is the sum of the lengths of the three sides.
Translate.

$$\underbrace{\text{The perimeter of the triangle}}\ \text{is 249 mm.}$$

$$x+(x+2)+(x+4) \quad = 249$$

Carry out. We solve the equation.

$$\begin{aligned} x+(x+2)+(x+4) &= 249 \\ 3x+6 &= 249 \\ 3x &= 243 \\ x &= 81 \end{aligned}$$

Check. If the length of the first side is 81 mm, then the length of the second side is 81 + 2, or 83 mm, and the length of the third side is 81 + 4, or 85 mm. The perimeter of the triangle is 81 + 83 + 85, or 249 mm. These results check.
State. The lengths of the sides are 81 mm, 83 mm, and 85 mm.

31. ***Familiarize.*** Let x = the electric bill before the temperature of the water heater was lowered. If the bill dropped by 7%, then the Kelly's paid 93% of their original bill.
Translate.

$$93\%\ \text{of}\ \underbrace{\text{the original bill}}\ \text{is}\ \$60.45.$$

$$0.93 \quad \cdot \quad x \quad = \quad 60.45$$

Carry out. We solve the equation.

$$\begin{aligned} 0.93x &= 60.45 \\ x &= \frac{60.45}{0.93} \\ x &= 65 \end{aligned}$$

Check. If the original bill was \$65, and the bill was reduced by 7%, or $0.07 \cdot \$65$, or \$4.55, the new bill would be \$65 – \$4.55, or \$60.45. This result checks.
State. The original bill was \$65.

32. ***Familiarize.*** Let x = the number of miles that will allow the business to stay within budget. The cost for the rental would be \$14.95 + \$0.59x.

Translate.

$$\underbrace{\text{The cost of the rental}}_{14.95+0.59x} \quad \underbrace{\text{must not exceed}}_{\le} \quad \underbrace{\$250.}_{250}$$

Carry out. We solve the inequality.

$$14.95+0.59x \le 250$$
$$0.59x \le 235.05$$
$$x \le \frac{235.05}{0.59}$$
$$x \le 398.3898$$

Check. As a partial check, we let $x = 398.39$ mi and determine the cost of the rental. The rental would be \$14.95 + \$0.59(398.39), or \$250 (rounded to the nearest dollar). If the mileage were less, the rental would be under \$250, so the result checks. If 398.4 miles is used, the result will be slightly more than \$250, so we round down to 398.3 miles to the nearest tenth of a mile.

State. The mileage is less than or equal to 398.3 mi, rounded to the nearest tenth.

33.

$$c = \frac{2cd}{a-d}$$

$$(a-d)c = (a-d)\left(\frac{2cd}{a-d}\right) \quad \text{Multiplying by } a-d$$

$$ac-dc = 2cd \quad \text{Simplifying}$$

$$ac-dc+dc = 2cd+dc \quad \text{Adding dc}$$

$$ac = 3cd \quad \text{Simplifying}$$

$$\frac{1}{3c}(ac) = \frac{1}{3c}(3cd) \quad \text{Multiplying by } \frac{1}{3c}$$

$$\frac{ac}{3c} = d \quad \text{Simplifying}$$

$$\frac{a}{3} = d \quad \text{Simplifying}$$

The solution is $d = \frac{a}{3}$.

34.

$$3|w|-8 = 37$$

$$3|w|-8+8 = 37+8 \quad \text{Adding 8}$$

$$3|w| = 45 \quad \text{Simplifying}$$

$$\tfrac{1}{3}(3|w|) = \tfrac{1}{3}\cdot 45 \quad \text{Multiplying by } \tfrac{1}{3}$$

$$|w| = 15 \quad \text{Simplifying}$$

This tells us that the number w is 15 units from the origin. The solutions are $w = -15$ and $w = 15$.

35. Let h = the number of hours of sun each day. Then at least 4 hr but no more than 6 hr of sun is $4 \le h \le 6$.

36. ***Familiarize.*** Let x = the number of tickets given away. The following shows the distribution of the tickets:

First person received $\frac{1}{3}x$ tickets.

Second person received $\frac{1}{4}x$ tickets.

Third person received $\frac{1}{5}x$ tickets.

Fourth person received 8 tickets.

Fifth person received 5 tickets.

Translate.

$$\underbrace{\text{The number of tickets the five people received}}_{\frac{1}{3}x+\frac{1}{4}x+\frac{1}{5}x+8+5} \quad \underbrace{\text{is}}_{=} \quad \underbrace{\text{the total number of tickets.}}_{x}$$

Carry out. We solve the equation.

$$\tfrac{1}{3}x+\tfrac{1}{4}x+\tfrac{1}{5}x+8+5 = x$$
$$60\left(\tfrac{1}{3}x+\tfrac{1}{4}x+\tfrac{1}{5}x+8+5\right) = 60x$$
$$60\left(\tfrac{1}{3}x+\tfrac{1}{4}x+\tfrac{1}{5}x+13\right) = 60x$$
$$20x+15x+12x+780 = 60x$$
$$47x+780 = 60x$$
$$780 = 13x$$
$$60 = x$$

Check. If the total number of tickets given away was 60, then the first person received $\frac{1}{3}(60)$, or 20 tickets; the second person received $\frac{1}{4}(60)$, or 15 tickets; the third person received $\frac{1}{5}(60)$, or 12 tickets. We are told that the fourth person received 8 tickets, and the fifth person received 5 tickets. The sum of the tickets distributed is 20 + 15 + 12 + 8 + 5, or 60 tickets. These results check.

State. A total of 60 tickets were given away.