

Section 1.6

Check Point Exercises

1. $4x^4 = 12x^2$

$4x^4 - 12x^2 = 0$

$4x^2(x^2 - 3) = 0$

$4x^2 = 0 \quad \text{or} \quad x^2 - 3 = 0$

$x^2 = 0 \quad x^2 = 3$

$x = \pm\sqrt{0} \quad x = \pm\sqrt{3}$

$x = 0 \quad x = \pm\sqrt{3}$

The solution set is $\{-\sqrt{3}, 0, \sqrt{3}\}$.

2. $2x^3 + 3x^2 = 8x + 12$

$x^2(2x + 3) - 4(2x + 3) = 10$

$(2x + 3)(x^2 - 4) = 0$

$2x + 3 = 0 \quad \text{or} \quad x^2 - 4 = 0$

$2x = -3 \quad x^2 = 4$

$x = -\frac{3}{2} \quad x = \pm 2$

The solution set is $\left\{-2, -\frac{3}{2}, 2\right\}$.

3. $\sqrt{x+3} + 3 = x$

$\sqrt{x+3} = x - 3$

$(\sqrt{x+3})^2 = (x-3)^2$

$x + 3 = x^2 - 6x + 9$

$0 = x^2 - 7x + 6$

$0 = (x-6)(x-1)$

$x - 6 = 0 \quad \text{or} \quad x - 1 = 0$

$x = 6 \quad x = 1$

1 does not check and must be rejected.

The solution set is $\{6\}$.

4. $\sqrt{x+5} - \sqrt{x-3} = 2$

$\sqrt{x+5} = 2 + \sqrt{x-3}$

$(\sqrt{x+5})^2 = (2 + \sqrt{x-3})^2$

$x + 5 = (2)^2 + 2(2)(\sqrt{x-3}) + (\sqrt{x-3})^2$

$x + 5 = 4 + 4\sqrt{x-3} + x - 3$

$4 = 4\sqrt{x-3}$

$\frac{4}{4} = \frac{4\sqrt{x-3}}{4}$

$1 = \sqrt{x-3}$

$(1)^2 = (\sqrt{x-3})^2$

$1 = x - 3$

$4 = x$

The check indicates that 4 is a solution.

The solution set is $\{4\}$.

5. a. $5x^{3/2} - 25 = 0$

$5x^{3/2} = 25$

$x^{3/2} = 5$

$(x^{3/2})^{2/3} = (5)^{2/3}$

$x = 5^{2/3} \quad \text{or} \quad \sqrt[3]{25}$

Check:

$5(5^{2/3})^{3/2} - 25 = 0$

$5(5) - 25 = 0$

$25 - 25 = 0$

$0 = 0$

The solution set is $\{5^{2/3}\}$ or $\{\sqrt[3]{25}\}$.

b. $\frac{2}{x^3} - 8 = -4$

$x^{2/3} = 4$

$(x^{2/3})^{3/2} = 4^{3/2} \quad \text{or}$

$x = (2^2)^{3/2}$

$x = 2^3 \quad x = (-2)^3$

$x = 8 \quad x = -8$

The solution set is $\{-8, 8\}$.

6. $x^4 - 5x^2 + 6 = 0$

$$(x^2)^2 - 5x^2 + 6 = 0$$

Let $t = x^2$.

$$t^2 - 5t + 6 = 0$$

$$(t-3)(t-2) = 0$$

$$t-3=0 \quad \text{or} \quad t-2=0$$

$$t=3 \quad \text{or} \quad t=2$$

$$x^2=3 \quad \text{or} \quad x^2=2$$

$$x = \pm\sqrt{3} \quad \text{or} \quad x = \pm\sqrt{2}$$

The solution set is $\{-\sqrt{3}, -\sqrt{2}, \sqrt{2}, \sqrt{3}\}$.

7. $3x^{2/3} - 11x^{1/3} - 4 = 0$

Let $t = x^{1/3}$.

$$3t^2 - 11t - 4 = 0$$

$$(3t+1)(t-4) = 0$$

$$3t+1=0 \quad \text{or} \quad t-4=0$$

$$3t = -1$$

$$t = -\frac{1}{3} \quad t = 4$$

$$x^{1/3} = -\frac{1}{3} \quad x^{1/3} = 4$$

$$x = \left(-\frac{1}{3}\right)^3 \quad x = 4^3$$

$$x = -\frac{1}{27} \quad x = 64$$

The solution set is $\left\{-\frac{1}{27}, 64\right\}$.

8. $|2x-1| = 5$

$$2x-1=5 \quad \text{or} \quad 2x-1=-5$$

$$2x=6 \quad 2x=-4$$

$$x=3 \quad x=-2$$

The solution set is $\{-2, 3\}$.

9. $4|1-2x| - 20 = 0$

$$4|1-2x| = 20$$

$$|1-2x| = 5$$

$$1-2x=5 \quad \text{or} \quad 1-2x=-5$$

$$-2x=4 \quad -2x=-6$$

$$x=-2 \quad x=3$$

The solution set is $\{-2, 3\}$.

10. $H = -2.3\sqrt{I} + 67.6$

$$33.1 = -2.3\sqrt{I} + 67.6$$

$$-34.5 = -2.3\sqrt{I}$$

$$\frac{-34.5}{-2.3} = \frac{-2.3\sqrt{I}}{-2.3}$$

$$15 = \sqrt{I}$$

$$15^2 = (\sqrt{I})^2$$

$$225 = I$$

The model indicates that an annual income of 225 thousand dollars, or \$225,000, corresponds to 33.1 hours per week watching TV.

Concept and Vocabulary Check 1.6

1. subtract $8x$ and subtract 12 from both sides

2. radical

3. extraneous

4. $2x+1$; $x^2+14x+49$

5. $x+2$; $x+8-6\sqrt{x-1}$

6. $\frac{4}{5^3}$

7. $\pm 5^{\frac{3}{2}}$

8. x^2 ; $u^2-13u+36=0$

9. $\frac{1}{x^3}$; $u^2+2u-3=0$

10. c ; $-c$

11. $3x-1=7$; $3x-1=-7$

Exercise Set 1.6

1. $3x^4 - 48x^2 = 0$

$3x^2(x^2 - 16) = 0$

$3x^2(x+4)(x-4) = 0$

$3x^2 = 0 \quad x+4 = 0 \quad x-4 = 0$

$x^2 = 0 \quad x = -4 \quad x = 4$

$x = 0$

The solution set is $\{-4, 0, 4\}$.

2. $5x^4 - 20x^2 = 0$

$5x^2(x^2 - 4) = 0$

$5x^2(x+2)(x-2) = 0$

$5x^2 = 0 \quad x+2 = 0 \quad x-2 = 0$

$x^2 = 0$

$x = 0 \quad x = -2 \quad x = 2$

The solution set is $\{-2, 0, 2\}$.

3. $3x^3 + 2x^2 = 12x + 8$

$3x^3 + 2x^2 - 12x - 8 = 0$

$x^2(3x+2) - 4(3x+2) = 0$

$(3x+2)(x^2 - 4) = 0$

$3x+2 = 0 \quad x^2 - 4 = 0$

$3x = -2 \quad x^2 = 4$

$x = -\frac{2}{3} \quad x = \pm 2$

The solution set is $\left\{-2, -\frac{2}{3}, 2\right\}$.

4. $4x^3 - 12x^2 = 9x - 27$

$4x^3 - 12x^2 - 9x + 27 = 0$

$4x^2(x-3) - 9(x-3) = 0$

$(x-3)(4x^2 - 9) = 0$

$x-3 = 0 \quad 4x^2 - 9 = 0$

$x = 3 \quad 4x^2 = 9$

$x^2 = \frac{9}{4}$

$x = \pm \frac{3}{2}$

The solution set is $\left\{-\frac{3}{2}, \frac{3}{2}, 3\right\}$.

5. $2x - 3 = 8x^3 - 12x^2$

$8x^3 - 12x^2 - 2x + 3 = 0$

$4x^2(2x-3) - (2x-3) = 0$

$(2x-3)(4x^2 - 1) = 0$

$2x-3 = 0 \quad 4x^2 - 1 = 0$

$2x = 3 \quad 4x^2 = 1$

$x^2 = \frac{1}{4}$

$x = \frac{3}{2} \quad x = \pm \frac{1}{2}$

The solution set is $\left\{\frac{3}{2}, \frac{1}{2}, -\frac{1}{2}\right\}$.

6. $x+1 = 9x^3 + 9x^2$

$9x^3 + 9x^2 - x - 1 = 0$

$9x^2(x+1) - (x+1) = 0$

$(x+1)(9x^2 - 1) = 0$

$x+1 = 0 \quad 9x^2 - 1 = 1$

$x = -1 \quad 9x^2 = 1$

$x^2 = \frac{1}{9}$

$x = \pm \frac{1}{3}$

The solution set is $\left\{-1, -\frac{1}{3}, \frac{1}{3}\right\}$.

7. $4y^3 - 2 = y - 8y^2$

$4y^3 + 8y^2 - y - 2 = 0$

$4y^2(y+2) - (y+2) = 0$

$(y+2)(4y^2 - 1) = 0$

$y+2 = 0 \quad 4y^2 - 1 = 0$

$4y^2 = 1$

$y^2 = \frac{1}{4}$

$y = -2 \quad y = \pm \frac{1}{2}$

The solution set is $\left\{-2, \frac{1}{2}, -\frac{1}{2}\right\}$.

8. $9y^3 + 8 = 4y + 18y^2$

$$9y^3 - 18y^2 - 4y + 8 = 0$$

$$9y^2(y-2) - 4(y-2) = 0$$

$$(y-2)(9y^2 - 4) = 0$$

$$y-2=0 \quad 9y^2-4=0$$

$$y=2 \quad 9y^2=4$$

$$y^2 = \frac{4}{9}$$

$$y = \pm \frac{2}{3}$$

The solution set is $\left\{-\frac{2}{3}, \frac{2}{3}, 2\right\}$.

9. $2x^4 = 16x$

$$2x^4 - 16x = 0$$

$$2x(x^3 - 8) = 0$$

$$2x = 0 \quad x^3 - 8 = 0$$

$$x = 0 \quad (x-2)(x^2 + 2x + 2) = 0$$

$$x-2=0 \quad x^2 + 2x + 2 = 0$$

$$x=2 \quad x = \frac{-2 \pm \sqrt{2^2 - 4(1)(2)}}{2(1)}$$

$$x = \frac{-2 \pm \sqrt{-12}}{2}$$

$$x = \frac{-2 \pm 2i\sqrt{3}}{2}$$

$$x = -1 \pm i\sqrt{3}$$

The solution set is $\{0, 2, -1 \pm i\sqrt{3}\}$.

10. $3x^4 = 81x$

$$3x^4 - 81x = 0$$

$$3x(x^3 - 27) = 0$$

$$3x = 0 \quad x^3 - 27 = 0$$

$$x = 0;$$

$$(x-3)(x^2 + 3x + 9) = 0$$

$$x-3=0 \quad x^2 + 3x + 9 = 0$$

$$x=3 \quad x = \frac{-3 \pm \sqrt{3^2 - 4(1)(9)}}{2(1)}$$

$$x = \frac{-3 \pm \sqrt{9-36}}{2}$$

$$x = \frac{-3 \pm \sqrt{-27}}{2}$$

$$x = \frac{-3 \pm 3i\sqrt{3}}{2}$$

The solution set is $\left\{0, 3, \frac{-3 \pm 3i\sqrt{3}}{2}\right\}$.

11. $\sqrt{3x+18} = x$

$$3x+18 = x^2$$

$$x^2 - 3x - 18 = 0$$

$$(x+3)(x-6) = 0$$

$$x+3=0 \quad x-6=0$$

$$x=-3 \quad x=6$$

$$\sqrt{3(-3)+18} = -3 \quad \sqrt{3(6)+18} = 6$$

$$\sqrt{-9+18} = -3 \quad \sqrt{18+18} = 6$$

$$\sqrt{9} = -3 \quad \text{False} \quad \sqrt{36} = 6$$

The solution set is $\{6\}$.

12. $\sqrt{20-8x} = x$

$$20-8x = x^2$$

$$x^2 + 8x - 20 = 0$$

$$(x+10)(x-2) = 0$$

$$x+10=0 \quad x-2=0$$

$$x=-10 \quad x=2$$

$$\sqrt{20-8(-10)} = -10 \quad \sqrt{20-8(2)} = 2$$

$$\sqrt{20+80} = -10 \quad \sqrt{20-16} = 2$$

$$\sqrt{100} = -10 \quad \text{False} \quad \sqrt{4} = 2$$

The solution set is $\{2\}$.

$$13. \quad \sqrt{x+3} = x-3$$

$$x+3 = x^2 - 6x + 9$$

$$x^2 - 7x + 6 = 0$$

$$(x-1)(x-6) = 0$$

$$x-1 = 0 \quad x-6 = 0$$

$$x = 1 \quad x = 6$$

$$\sqrt{1+3} = 1-3 \quad \sqrt{6+3} = 6-3$$

$$\sqrt{4} = -2 \quad \text{False} \quad \sqrt{9} = 3$$

The solution set is $\{6\}$.

$$14. \quad \sqrt{x+10} = x-2$$

$$x+10 = (x-2)^2$$

$$x+10 = x^2 - 4x + 4$$

$$x^2 - 5x - 6 = 0$$

$$(x+1)(x-6) = 0$$

$$x+1 = 0 \quad x-6 = 0$$

$$x = -1 \quad x = 6$$

$$\sqrt{-1+10} = -1-2 \quad \sqrt{6+10} = 6-2$$

$$\sqrt{9} = -3 \quad \text{False} \quad \sqrt{16} = 4$$

The solution set is $\{6\}$.

$$15. \quad \sqrt{2x+13} = x+7$$

$$2x+13 = (x+7)^2$$

$$2x+13 = x^2 + 14x + 49$$

$$x^2 + 12x + 36 = 0$$

$$(x+6)^2 = 0$$

$$x+6 = 0$$

$$x = -6$$

$$\sqrt{2(-6)+13} = -6+7$$

$$\sqrt{-12+13} = 1$$

$$\sqrt{1} = 1$$

The solution set is $\{-6\}$.

$$16. \quad \sqrt{6x+1} = x-1$$

$$6x+1 = (x-1)^2$$

$$6x+1 = x^2 - 2x + 1$$

$$x^2 - 8x = 0$$

$$x(x-8) = 0$$

$$x-8 = 0 \quad x = 0$$

$$x = 8$$

$$\sqrt{6(0)+1} = 0-1$$

$$\sqrt{6(8)+1} = 8-1$$

$$\sqrt{0+1} = -1$$

$$\sqrt{48+1} = 7$$

$$\sqrt{1} = -1 \quad \text{False}$$

$$\sqrt{49} = 7$$

The solution set is $\{8\}$.

$$17. \quad x - \sqrt{2x+5} = 5$$

$$x-5 = \sqrt{2x+5}$$

$$(x-5)^2 = 2x+5$$

$$x^2 - 10x + 25 = 2x+5$$

$$x^2 - 12x + 20 = 0$$

$$(x-2)(x-10) = 0$$

$$x-2 = 0 \quad x-10 = 0$$

$$x = 2 \quad x = 10$$

$$2 - \sqrt{2(2)+5} = 5 \quad 10 - \sqrt{2(10)+5} = 5$$

$$2 - \sqrt{9} = 5$$

$$10 - \sqrt{25} = 5$$

$$2-3 = 5 \quad \text{False} \quad 10-5 = 5$$

The solution set is $\{10\}$.

$$18. \quad x - \sqrt{x+11} = 1$$

$$x-1 = \sqrt{x+11}$$

$$(x-1)^2 = x+11$$

$$x^2 - 2x + 1 = x+11$$

$$x^2 - 3x - 10 = 0$$

$$(x+2)(x-5) = 0$$

$$x+2 = 0 \quad x-5 = 0$$

$$x = -2 \quad x = 5$$

$$-2 - \sqrt{-2+11} = 1$$

$$5 - \sqrt{5+11} = 1$$

$$-2 - \sqrt{9} = 1$$

$$5 - \sqrt{16} = 1$$

$$-2-3 = 1 \quad \text{False}$$

$$5-4 = 1$$

The solution set is $\{5\}$.

$$\begin{aligned}
 19. \quad & \sqrt{2x+19} - 8 = x \\
 & \sqrt{2x+19} = x+8 \\
 & (\sqrt{2x+19})^2 = (x+8)^2
 \end{aligned}$$

$$2x+19 = x^2 + 16x + 64$$

$$0 = x^2 + 14x + 45$$

$$0 = (x+9)(x+5)$$

$$x+9=0 \quad \text{or} \quad x+5=0$$

$$x = -9 \quad x = -5$$

-9 does not check and must be rejected.

The solution set is $\{-5\}$.

$$\begin{aligned}
 20. \quad & \sqrt{2x+15} - 6 = x \\
 & \sqrt{2x+15} = x+6 \\
 & (\sqrt{2x+15})^2 = (x+6)^2
 \end{aligned}$$

$$2x+15 = x^2 + 12x + 36$$

$$0 = x^2 + 10x + 21$$

$$0 = (x+3)(x+7)$$

$$x+3=0 \quad \text{or} \quad x+7=0$$

$$x = -3 \quad x = -7$$

-7 does not check and must be rejected.

The solution set is $\{-3\}$.

$$\begin{aligned}
 21. \quad & \sqrt{3x} + 10 = x+4 \\
 & \sqrt{3x} = x-6 \\
 & 3x = (x-6)^2 \\
 & 3x = x^2 - 12x + 36
 \end{aligned}$$

$$x^2 - 15x + 36 = 0$$

$$(x-12)(x-3) = 0$$

$$x-12=0 \quad x-3=0$$

$$x = 12 \quad x = 3$$

$$\sqrt{3(12)} + 10 = 12 + 4 \quad \sqrt{3(3)} + 10 = 3 + 4$$

$$\sqrt{36} + 10 = 16 \quad \sqrt{9} + 10 = 7$$

$$6 + 10 = 16 \quad 3 + 10 = 7 \text{ False}$$

The solution set is $\{12\}$.

$$\begin{aligned}
 22. \quad & \sqrt{x} - 3 = x-9 \\
 & \sqrt{x} = x-6 \\
 & x = (x-6)^2 \\
 & x = x^2 - 12x + 36
 \end{aligned}$$

$$x^2 - 13x + 36 = 0$$

$$(x-9)(x-4) = 0$$

$$x-9=0 \quad x-4=0$$

$$x = 9 \quad x = 4$$

$$\sqrt{9} - 3 = 9 - 9 \quad \sqrt{4} - 3 = 4 - 9$$

$$3 - 3 = 9 - 9 \quad 2 - 3 = 4 - 9 \text{ False}$$

The solution set is $\{9\}$.

$$\begin{aligned}
 23. \quad & \sqrt{x+8} - \sqrt{x-4} = 2 \\
 & \sqrt{x+8} = \sqrt{x-4} + 2 \\
 & x+8 = (\sqrt{x-4} + 2)^2 \\
 & x+8 = x-4 + 4\sqrt{x-4} + 4 \\
 & x+8 = x+4\sqrt{x-4} \\
 & 8 = 4\sqrt{x-4} \\
 & 2 = \sqrt{x-4} \\
 & 4 = x-4 \\
 & x = 8
 \end{aligned}$$

$$\sqrt{8+8} - \sqrt{8-4} = 2$$

$$\sqrt{16} - \sqrt{4} = 2$$

$$4 - 2 = 2$$

The solution set is $\{8\}$.

$$\begin{aligned}
 24. \quad & \sqrt{x+5} - \sqrt{x-3} = 2 \\
 & \sqrt{x+5} = \sqrt{x-3} + 2 \\
 & x+5 = (\sqrt{x-3} + 2)^2 \\
 & x+5 = x-3 + 4\sqrt{x-3} + 4 \\
 & x+5 = x+1+4\sqrt{x-3} \\
 & 5 = 1+4\sqrt{x-3} \\
 & 4 = 4\sqrt{x-3} \\
 & 1 = \sqrt{x-3} \\
 & 1 = x-3 \\
 & x = 4
 \end{aligned}$$

$$\sqrt{4+5} - \sqrt{4-3} = 2$$

$$\sqrt{9} - \sqrt{1} = 2$$

$$3 - 1 = 2$$

The solution set is $\{4\}$.

25. $\sqrt{x-5} - \sqrt{x-8} = 3$

$$\sqrt{x-5} = \sqrt{x-8} + 3$$

$$x-5 = (\sqrt{x-8} + 3)^2$$

$$x-5 = x-8 + 6\sqrt{x-8} + 9$$

$$x-5 = x+1 + 6\sqrt{x-8}$$

$$-6 = 6\sqrt{x-8}$$

$$-1 = \sqrt{x-8}$$

$$1 = x-8$$

$$x = 9$$

$$\sqrt{9-5} - \sqrt{9-8} = 3$$

$$\sqrt{4} - \sqrt{1} = 3$$

$$2 - 1 = 3 \text{ False}$$

The solution set is the empty set, \emptyset .

26. $\sqrt{2x-3} - \sqrt{x-2} = 1$

$$\sqrt{2x-3} = \sqrt{x-2} + 1$$

$$2x-3 = (\sqrt{x-2} + 1)^2$$

$$2x-3 = x-2 + 2\sqrt{x-2} + 1$$

$$2x-3 = x-1 + 2\sqrt{x-2}$$

$$x-2 = 2\sqrt{x-2}$$

$$\frac{x}{2} - 1 = \sqrt{x-2}$$

$$\left(\frac{x}{2} - 1\right)^2 = x-2$$

$$\frac{x^2}{4} - x + 1 = x-2$$

$$x^2 - 4x + 4 = 4x - 8$$

$$x^2 - 8x + 12 = 0$$

$$(x-6)(x-2) = 0$$

$$x-6 = 0 \quad x-2 = 0$$

$$x = 6 \quad x = 2$$

$$\sqrt{2(6)-3} - \sqrt{6-2} = 1 \quad \sqrt{2(2)-3} - \sqrt{2-2} = 1$$

$$\sqrt{12-3} - \sqrt{4} = 1 \quad \sqrt{4-3} - \sqrt{0} = 1$$

$$\sqrt{9} - \sqrt{4} = 1 \quad \sqrt{1} - 0 = 1$$

$$3-2 = 1 \quad 1-0 = 1$$

The solution set is $\{2, 6\}$.

27. $\sqrt{2x+3} + \sqrt{x-2} = 2$

$$\sqrt{2x+3} = 2 - \sqrt{x-2}$$

$$2x+3 = (2 - \sqrt{x-2})^2$$

$$2x+3 = 4 - 4\sqrt{x-2} + x-2$$

$$x+1 = -4\sqrt{x-2}$$

$$(x+1)^2 = 16(x-2)$$

$$x^2 + 2x + 1 = 16x - 32$$

$$x^2 - 14x + 33 = 0$$

$$(x-11)(x-3) = 0$$

$$x-11 = 0 \quad x-3 = 0$$

$$x = 11 \quad x = 3$$

$$\sqrt{2(11)+3} + \sqrt{11-2} = 2$$

$$\sqrt{22+3} + \sqrt{9} = 2$$

$$5+3 = 2 \text{ False}$$

$$\sqrt{2(3)+3} + \sqrt{3-2} = 2$$

$$\sqrt{6+3} + \sqrt{1} = 2$$

$$3+1 = 2 \text{ False}$$

The solution set is the empty set, \emptyset .

28. $\sqrt{x+2} + \sqrt{3x+7} = 1$

$$\sqrt{x+2} = 1 - \sqrt{3x+7}$$

$$x+2 = (1 - \sqrt{3x+7})^2$$

$$x+2 = 1 - 2\sqrt{3x+7} + 3x+7$$

$$-2x-6 = -2\sqrt{3x+7}$$

$$x+3 = \sqrt{3x+7}$$

$$(x+3)^2 = 3x+7$$

$$x^2 + 6x + 9 = 3x+7$$

$$x^2 + 3x + 2 = 0$$

$$(x+1)(x+2) = 0$$

$$x+1 = 0 \quad x+2 = 0$$

$$x = -1 \quad x = -2$$

$$\sqrt{-1+2} + \sqrt{3(-1)+7} = 1$$

$$\sqrt{1} + \sqrt{4} = 1$$

$$1+2 = 1 \text{ False}$$

$$\sqrt{-2+2} + \sqrt{3(-2)+7} = 1$$

$$\sqrt{0} + \sqrt{1} = 1$$

$$0+1 = 1$$

The solution set is $\{-2\}$.

$$\begin{aligned}
 29. \quad & \sqrt{3\sqrt{x+1}} = \sqrt{3x-5} \\
 & 3\sqrt{x+1} = 3x-5 \\
 & 9(x+1) = 9x^2 - 30x + 25 \\
 & 9x^2 - 39x + 16 = 0 \\
 & x = \frac{39 \pm \sqrt{945}}{18} = \frac{13 \pm \sqrt{105}}{6}
 \end{aligned}$$

Check proposed solutions.

The solution set is $\left\{ \frac{13 + \sqrt{105}}{6} \right\}$.

$$\begin{aligned}
 30. \quad & \sqrt{1+4\sqrt{x}} = 1 + \sqrt{x} \\
 & 1 + 4\sqrt{x} = 1 + 2\sqrt{x} + x \\
 & 2\sqrt{x} = x \\
 & 4x = x^2 \\
 & x^2 - 4x = 0 \\
 & x(x-4) = 0 \\
 & x = 0 \text{ or } x = 4 \\
 & \text{The solution set is } \{0, 4\}.
 \end{aligned}$$

$$\begin{aligned}
 31. \quad & x^{3/2} = 8 \\
 & (x^{3/2})^{2/3} = 8^{2/3} \\
 & x = \sqrt[3]{8^2} \\
 & x = 2^2 \\
 & x = 4 \\
 & 4^{3/2} = 8 \\
 & \sqrt{4^3} = 8 \\
 & 2^3 = 8 \\
 & \text{The solution set is } \{4\}.
 \end{aligned}$$

$$\begin{aligned}
 32. \quad & x^{3/2} = 27 \\
 & (x^{3/2})^{2/3} = 27^{2/3} \\
 & x = \sqrt[3]{27^2} \\
 & x = 3^2 \\
 & x = 9 \\
 & 9^{3/2} = 27 \\
 & \sqrt{9^3} = 27 \\
 & 3^3 = 27 \\
 & \text{The solution set is } \{9\}.
 \end{aligned}$$

$$\begin{aligned}
 33. \quad & (x-4)^{3/2} = 27 \\
 & ((x-4)^{3/2})^{2/3} = 27^{2/3} \\
 & x-4 = \sqrt[3]{27^2} \\
 & x-4 = 3^2 \\
 & x-4 = 9 \\
 & x = 13 \\
 & (13-4)^{3/2} = 27 \\
 & 9^{3/2} = 27 \\
 & \sqrt{9^3} = 27 \\
 & 3^3 = 27 \\
 & \text{The solution set is } \{13\}.
 \end{aligned}$$

$$\begin{aligned}
 34. \quad & (x+5)^{3/2} = 8 \\
 & ((x+5)^{3/2})^{2/3} = 8^{2/3} \\
 & x+5 = \sqrt[3]{8^2} \\
 & x+5 = 2^2 \\
 & x+5 = 4 \\
 & x = -1 \\
 & (-1+5)^{3/2} = 8 \\
 & 4^{3/2} = 8 \\
 & \sqrt{4^3} = 8 \\
 & 2^3 = 8 \\
 & \text{The solution set is } \{-1\}.
 \end{aligned}$$

$$\begin{aligned}
 35. \quad & 6x^{5/2} - 12 = 0 \\
 & 6x^{5/2} = 12 \\
 & x^{5/2} = 2 \\
 & (x^{5/2})^{2/5} = 2^{2/5} \\
 & x = \sqrt[5]{2^2} \\
 & x = \sqrt[5]{4} \\
 & 6(\sqrt[5]{4})^{5/2} - 12 = 0 \\
 & 6(4^{1/5})^{5/2} - 12 = 0 \\
 & 6(4^{1/2}) - 12 = 0 \\
 & 6(2) - 12 = 0 \\
 & \text{The solution set is } \left\{ \sqrt[5]{4} \right\}.
 \end{aligned}$$

36. $8x^{5/3} - 24 = 0$

$$8x^{5/3} = 24$$

$$x^{5/3} = 3$$

$$(x^{5/3})^{3/5} = 3^{3/5}$$

$$x = \sqrt[5]{3^3}$$

$$x = \sqrt[5]{27}$$

$$8(\sqrt[5]{27})^{5/3} - 24 = 0$$

$$8(27^{1/5})^{5/3} - 24 = 0$$

$$8(27^{1/3}) - 24 = 0$$

$$8(3) - 24 = 0$$

The solution set is $\{\sqrt[5]{27}\}$.

37. $(x-4)^{2/3} = 16$

$$\left[(x-4)^{2/3}\right]^{3/2} = (16)^{3/2}$$

$$x-4 = (2^4)^{3/2}$$

$$x-4 = 4^3 \quad x-4 = (-4)^3$$

$$x-4 = 64 \quad x-4 = -64$$

$$x = 68 \quad x = -60$$

The solution set is $\{-60, 68\}$.

38. $(x+5)^{2/3} = 4$

$$\left[(x+5)^{2/3}\right]^{3/2} = (4)^{3/2}$$

$$x+5 = (2^2)^{3/2}$$

$$x+5 = 2^3 \quad \text{or} \quad x+5 = (-2)^3$$

$$x+5 = 8 \quad x+5 = -8$$

$$x = 3 \quad x = -13$$

The solution set is $\{-13, 3\}$.

39. $(x^2 - x - 4)^{3/4} - 2 = 6$

$$(x^2 - x - 4)^{3/4} = 8$$

$$((x^2 - x - 4)^{3/4})^{4/3} = 8^{4/3}$$

$$x^2 - x - 4 = \sqrt[3]{8^4}$$

$$x^2 - x - 4 = 2^4$$

$$x^2 - x - 4 = 16$$

$$x^2 - x - 20 = 0$$

$$(x-5)(x+4) = 0$$

$$x-5 = 0 \quad x+4 = 0$$

$$x = 5 \quad x = -4$$

$$(5^2 - 5 - 4)^{3/4} - 2 = 6$$

$$(25 - 9)^{3/4} - 2 = 6$$

$$16^{3/4} - 2 = 6$$

$$\sqrt[4]{16^3} - 2 = 6$$

$$2^3 - 2 = 6$$

$$8 - 2 = 6$$

$$((-4)^2 - (-4) - 4)^{3/4} - 2 = 6$$

$$(16 + 4 - 4)^{3/4} - 2 = 6$$

$$16^{3/4} - 2 = 6$$

$$\sqrt[4]{16^3} - 2 = 6$$

$$2^3 - 2 = 6$$

$$8 - 2 = 6$$

The solution set is $\{5, -4\}$.

40. $(x^2 - 3x + 3)^{3/2} - 1 = 0$

$$(x^2 - 3x + 3)^{3/2} = 1$$

$$x^2 - 3x + 3 = 1^{2/3}$$

$$x^2 - 3x + 3 = 1$$

$$x^2 - 3x + 2 = 0$$

$$(x-1)(x-2) = 0$$

$$x-1 = 0 \quad x-2 = 0$$

$$x = 1 \quad x = 2$$

$$(1^2 - 3(1) + 3)^{3/2} - 1 = 0$$

$$(1 - 3 + 3)^{3/2} - 1 = 0$$

$$1^{3/2} - 1 = 0$$

$$1 - 1 = 0$$

$$(2^2 - 3(2) + 3)^{3/2} - 1 = 0$$

$$(4 - 6 + 3)^{3/2} - 1 = 0$$

$$1^{3/2} - 1 = 0$$

$$1 - 1 = 0$$

The solution set is $\{1, 2\}$.

41. $x^4 - 5x^2 + 4 = 0$ let $t = x^2$

$$t^2 - 5t + 4 = 0$$

$$(t-1)(t-4) = 0$$

$$t-1=0 \quad t-4=0$$

$$t=1 \quad t=4$$

$$x^2=1 \quad x^2=4$$

$$x=\pm 1 \quad x=\pm 2$$

The solution set is $\{1, -1, 2, -2\}$.

42. $x^4 - 13x^2 + 36 = 0$ let $t = x^2$

$$t^2 - 13t + 36 = 0$$

$$(t-4)(t-9) = 0$$

$$t-4=0 \quad t-9=0$$

$$t=4 \quad t=9$$

$$x^2=4 \quad x^2=9$$

$$x=\pm 2 \quad x=\pm 3$$

The solution set is $\{-3, -2, 2, 3\}$.

43. $9x^4 = 25x^2 - 16$

$$9x^4 - 25x^2 + 16 = 0 \text{ let } t = x^2$$

$$9t^2 - 25t + 16 = 0$$

$$(9t-16)(t-1) = 0$$

$$9t-16=0 \quad t-1=0$$

$$9t=16 \quad t=1$$

$$t = \frac{16}{9} \quad x^2 = 1$$

$$x = \pm 1$$

$$x^2 = \frac{16}{9}$$

$$x = \pm \frac{4}{3}$$

The solution set is $\left\{1, -1, \frac{4}{3}, -\frac{4}{3}\right\}$.

44. $4x^4 = 13x^2 - 9$

$$4x^4 - 13x^2 + 9 = 0 \text{ let } t = x^2$$

$$4t^2 - 13t + 9 = 0$$

$$(4t-9)(t-1) = 0$$

$$4t-9=0 \quad t-1=0$$

$$4t=9 \quad t=1$$

$$t = \frac{9}{4} \quad x^2 = 1$$

$$x^2 = \frac{9}{4} \quad x = \pm 1$$

$$x = \pm \frac{3}{2}$$

The solution set is $\left\{-\frac{3}{2}, -1, 1, \frac{3}{2}\right\}$.

45. $x - 13\sqrt{x} + 40 = 0$ Let $t = \sqrt{x}$.

$$t^2 - 13t + 40 = 0$$

$$(t-8)(t-5) = 0$$

$$t-8=0 \quad t-5=0$$

$$t=8 \quad t=5$$

$$\sqrt{x}=8 \quad \sqrt{x}=5$$

$$x=64 \quad x=25$$

The solution set is $\{25, 64\}$.

46. $2x - 7\sqrt{x} - 30 = 0$ Let $t = \sqrt{x}$.

$$2t^2 - 7t - 30 = 0$$

$$(2t+5)(t-6) = 0$$

$$2t+5=0$$

$$t = \frac{5}{2} \quad t-6=0$$

$$t=6$$

$$\sqrt{x} = \frac{5}{2} \quad \sqrt{x} = 6$$

$$x = \frac{25}{4} \quad x = 36$$

The solution set is $\{36\}$ since $25/4$ does not check in the original equation.

47. $x^{-2} - x^{-1} - 20 = 0$ Let $t = x^{-1}$

$$t^2 - t - 20 = 0$$

$$(t-5)(t+4) = 0$$

$$t-5=0 \quad t+4=0$$

$$t=5 \quad t=-4$$

$$x^{-1}=5 \quad x^{-1}=-4$$

$$\frac{1}{x}=5 \quad \frac{1}{x}=-4$$

$$1=5x \quad 1=-4x$$

$$\frac{1}{5}=x \quad -\frac{1}{4}=x$$

The solution set is $\left\{-\frac{1}{4}, \frac{1}{5}\right\}$.

48. $x^{-2} - x^{-1} - 6 = 0$ Let $t = x^{-1}$.

$$t^2 - t - 6 = 0$$

$$(t-3)(t+2) = 0$$

$$t-3=0 \quad t+2=0$$

$$t=3 \quad t=-2$$

$$x^{-1}=3 \quad x^{-1}=-2$$

$$\frac{1}{x}=3 \quad \frac{1}{x}=-2$$

$$1=3x \quad 1=-2x$$

$$\frac{1}{3}=x \quad -\frac{1}{2}=x$$

The solution set is $\left\{-\frac{1}{2}, \frac{1}{3}\right\}$.

49. $x^{2/3} - x^{1/3} - 6 = 0$ let $t = x^{1/3}$

$$t^2 - t - 6 = 0$$

$$(t-3)(t+2) = 0$$

$$t-3=0 \quad t+2=0$$

$$t=3 \quad t=-2$$

$$x^{1/3}=3 \quad x^{1/3}=-2$$

$$x=3^3 \quad x=(-2)^3$$

$$x=27 \quad x=-8$$

The solution set is $\{27, -8\}$.

50. $2x^{2/3} + 7x^{1/3} - 15 = 0$ let $t = x^{1/3}$

$$2t^2 + 7t - 15 = 0$$

$$(2t-3)(t+5) = 0$$

$$2t-3=0 \quad t+5=0$$

$$2t=3 \quad t=-5$$

$$t=\frac{3}{2} \quad x^{1/3}=-5$$

$$x^{1/3}=\frac{3}{2} \quad x=(-5)^2$$

$$x=\left(\frac{3}{2}\right)^3 \quad x=-125$$

$$x=\frac{27}{8}$$

The solution set is $\left\{-125, \frac{27}{8}\right\}$.

51. $x^{3/2} - 2x^{3/4} + 1 = 0$ let $t = x^{3/4}$

$$t^2 - 2t + 1 = 0$$

$$(t-1)(t-1) = 0$$

$$t-1=0$$

$$t=1$$

$$x^{3/4}=1$$

$$x=1^{4/3}$$

$$x=1$$

The solution set is $\{1\}$.

52. $x^{2/5} + x^{1/5} - 6 = 0$ let $t = x^{1/5}$

$$t^2 + t - 6 = 0$$

$$(t+3)(t-2) = 0$$

$$t+3=0 \quad t-2=0$$

$$t=-3 \quad t=2$$

$$x^{1/5}=-3 \quad x^{1/5}=2$$

$$x=(-3)^5 \quad x=2^5$$

$$x=-243 \quad x=32$$

The solution set is $\{-243, 32\}$.

53. $2x - 3x^{1/2} + 1 = 0$ let $t = x^{1/2}$

$$2t^2 - 3t + 1 = 0$$

$$(2t-1)(t-1) = 0$$

$$2t-1=0 \quad t-1=0$$

$$2t=1$$

$$t = \frac{1}{2} \quad t = 1$$

$$x^{1/2} = \frac{1}{2} \quad x^{1/2} = 1$$

$$x = \left(\frac{1}{2}\right)^2 \quad x = 1^2$$

$$x = \frac{1}{4} \quad x = 1$$

The solution set is $\left\{\frac{1}{4}, 1\right\}$.

54. $x + 3x^{1/2} - 4 = 0$ let $t = x^{1/2}$

$$t^2 + 3t - 4 = 0$$

$$(t-1)(t+4) = 0$$

$$t-1=0 \quad t+4=0$$

$$t = 1 \quad t = -4$$

$$x^{1/2} = 1 \quad x^{1/2} = -4$$

$$x = 1^2 \quad x = (-4)^2$$

$$x = 1 \quad x = 16$$

The solution set is $\{1\}$.

55. $(x-5)^2 - 4(x-5) - 21 = 0$ let $t = x-5$

$$t^2 - 4t - 21 = 0$$

$$(t+3)(t-7) = 0$$

$$t+3=0 \quad t-7=0$$

$$t = -3 \quad t = 7$$

$$x-5 = -3 \quad x-5 = 7$$

$$x = 2 \quad x = 12$$

The solution set is $\{2, 12\}$.

56. $(x+3)^2 + 7(x+3) - 18 = 0$ let $t = x+3$

$$t^2 + 7t - 18 = 0$$

$$(t+9)(t-2) = 0$$

$$t+9=0 \quad t-2=0$$

$$t = -9 \quad t = 2$$

$$x+3 = -9 \quad x+3 = 2$$

$$x = -12 \quad x = -1$$

The solution set is $\{-12, -1\}$.

57. $(x^2 - x)^2 - 14(x^2 - x) + 24 = 0$

Let $t = x^2 - x$.

$$t^2 - 14t + 24 = 0$$

$$(t-2)(t-12) = 0$$

$$t = 2 \text{ or } t = 12$$

$$x^2 - x = 2 \quad \text{or} \quad x^2 - x = 12$$

$$x^2 - x - 2 = 0 \quad x^2 - x - 12 = 0$$

$$(x-2)(x+1) = 0 \quad (x-4)(x+3) = 0$$

The solution set is $\{-3, -1, 2, 4\}$.

58. $(x^2 - 2x)^2 - 11(x^2 - 2x) + 24 = 0$

Let $t = x^2 - 2x$

$$t^2 - 11t + 24 = 0$$

$$(t-3)(t-8) = 0$$

$$t = 3 \text{ or } t = 8$$

$$x^2 - 2x = 3 \quad \text{or} \quad x^2 - 2x = 8$$

$$x^2 - 2x - 3 = 0 \quad x^2 - 2x - 8 = 0$$

$$(x-3)(x+1) = 0 \quad (x-4)(x+2) = 0$$

The solution set is $\{-2, -1, 3, 4\}$.

59. $\left(y - \frac{8}{y}\right)^2 + 5\left(y - \frac{8}{y}\right) - 14 = 0$

Let $t = y - \frac{8}{y}$.

$$t^2 + 5t - 14 = 0$$

$$(t+7)(t-2) = 0$$

$$t = -7 \text{ or } t = 2$$

$$y - \frac{8}{y} = -7 \quad \text{or} \quad y - \frac{8}{y} = 2$$

$$y^2 + 7y - 8 = 0 \quad y^2 - 2y - 8 = 0$$

$$(y+8)(y-1) = 0 \quad (y-4)(y+2) = 0$$

The solution set is $\{-8, -2, 1, 4\}$.

$$60. \left(y - \frac{10}{y}\right)^2 + 6\left(y - \frac{10}{y}\right) - 27 = 0$$

$$\text{Let } t = y - \frac{10}{y}.$$

$$t^2 + 6t - 27 = 0$$

$$(t+9)(t-3) = 0$$

$$t = -9 \text{ or } t = 3$$

$$y - \frac{10}{y} = -9 \quad \text{or} \quad y - \frac{10}{y} = 3$$

$$y^2 + 9y - 10 = 0 \quad y^2 - 3y - 10 = 0$$

$$(y+10)(y-1) = 0 \quad (y-5)(y+2) = 0$$

The solution set is $\{-10, -2, 1, 5\}$.

$$61. |x| = 8$$

$$x = 8, x = -8$$

The solution set is $\{8, -8\}$.

$$62. |x| = 6$$

$$x = 6, x = -6$$

The solution set is $\{-6, 6\}$.

$$63. |x-2| = 7$$

$$x-2 = 7 \quad x-2 = -7$$

$$x = 9 \quad x = -5$$

The solution set is $\{9, -5\}$.

$$64. |x+1| = 5$$

$$x+1 = 5 \quad x+1 = -5$$

$$x = 4 \quad x = -6$$

The solution set is $\{-6, 4\}$.

$$65. |2x-1| = 5$$

$$2x-1 = 5 \quad 2x-1 = -5$$

$$2x = 6 \quad 2x = -4$$

$$x = 3 \quad x = -2$$

The solution set is $\{3, -2\}$.

$$66. |2x-3| = 11$$

$$2x-3 = 11 \quad 2x-3 = -11$$

$$2x = 14 \quad 2x = -8$$

$$x = 7 \quad x = -4$$

The solution set is $\{-4, 7\}$.

$$67. 2|3x-2| = 14$$

$$|3x-2| = 7$$

$$3x-2 = 7 \quad 3x-2 = -7$$

$$3x = 9 \quad 3x = -5$$

$$x = 3 \quad x = -5/3$$

The solution set is $\{3, -5/3\}$.

$$68. 3|2x-1| = 21$$

$$|2x-1| = 7$$

$$2x-1 = 7 \quad \text{or} \quad 2x-1 = -7$$

$$2x = 8 \quad 2x = -6$$

$$x = 4 \quad x = -3$$

The solution set is $\{4, -3\}$.

$$69. 7|5x| + 2 = 16$$

$$7|5x| = 14$$

$$|5x| = 2$$

$$5x = 2 \quad 5x = -2$$

$$x = 2/5 \quad x = -2/5$$

The solution set is $\left\{\frac{2}{5}, -\frac{2}{5}\right\}$.

$$70. 7|3x| + 2 = 16$$

$$7|3x| = 14$$

$$|3x| = 2$$

$$3x = 2 \quad \text{or} \quad 3x = -2$$

$$x = 2/3 \quad x = -2/3$$

The solution set is $\{-2/3, 2/3\}$.

$$71. 2\left|4 - \frac{5}{2}x\right| + 6 = 18$$

$$2\left|4 - \frac{5}{2}x\right| = 12$$

$$\left|4 - \frac{5}{2}x\right| = 6$$

$$4 - \frac{5}{2}x = 6 \quad \text{or} \quad 4 - \frac{5}{2}x = -6$$

$$-\frac{5}{2}x = 2 \quad -\frac{5}{2}x = -10$$

$$-\frac{2}{5}\left(-\frac{5}{2}\right)x = -\frac{2}{5}(2) \quad -\frac{2}{5}\left(-\frac{5}{2}\right)x = -\frac{2}{5}(-10)$$

$$x = -\frac{4}{5} \quad x = 4$$

The solution set is $\left\{-\frac{4}{5}, 4\right\}$.

$$72. \quad 4\left|1 - \frac{3}{4}x\right| + 7 = 10$$

$$4\left|1 - \frac{3}{4}x\right| = 3$$

$$\left|1 - \frac{3}{4}x\right| = \frac{3}{4}$$

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

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

$$-\frac{4}{3}\left(-\frac{3}{4}\right)x = -\frac{4}{3}\left(-\frac{1}{4}\right)$$

$$x = \frac{1}{3}$$

or

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

$$-\frac{3}{4}x = -\frac{7}{4}$$

$$-\frac{4}{3}\left(-\frac{3}{4}\right)x = -\frac{4}{3}\left(-\frac{7}{4}\right)$$

$$x = \frac{7}{3}$$

The solution set is $\left\{\frac{1}{3}, \frac{7}{3}\right\}$.

$$73. \quad |x + 1| + 5 = 3$$

$$|x + 1| = -2$$

No solution

The solution set is $\{ \}$.

$$74. \quad |x + 1| + 6 = 2$$

$$|x + 1| = -4$$

No solution

The solution set is $\{ \}$.

$$75. \quad |2x - 1| + 3 = 3$$

$$|2x - 1| = 0$$

$$2x - 1 = 0$$

$$2x = 1$$

$$x = \frac{1}{2}$$

The solution set is $\left\{\frac{1}{2}\right\}$.

$$76. \quad |3x - 2| + 4 = 4$$

$$|3x - 2| = 0$$

$$3x - 2 = 0$$

$$3x = 2$$

$$x = \frac{2}{3}$$

The solution set is $\left\{\frac{2}{3}\right\}$.

$$77. \quad |3x - 1| = |x + 5|$$

$$3x - 1 = x + 5$$

$$2x - 1 = 5$$

$$2x = 6$$

$$x = 3$$

$$3x - 1 = -x - 5$$

$$4x - 1 = -5$$

$$4x = -4$$

$$x = -1$$

The solution set is $\{3, -1\}$.

$$78. \quad |2x - 7| = |x + 3|$$

$$2x - 7 = x + 3$$

$$x = 10$$

$$\text{or } 2x - 7 = -(x + 3)$$

$$2x - 7 = -x - 3$$

$$3x = 4$$

$$x = \frac{4}{3}$$

The solution set is $\left\{10, \frac{4}{3}\right\}$.

$$79. \quad \text{Set } y = 0 \text{ to find the } x\text{-intercept(s).}$$

$$0 = \sqrt{x+2} + \sqrt{x-1} - 3$$

$$-\sqrt{x+2} = \sqrt{x-1} - 3$$

$$(-\sqrt{x+2})^2 = (\sqrt{x-1} - 3)^2$$

$$x + 2 = (\sqrt{x-1})^2 - 2(\sqrt{x-1})(3) + (3)^2$$

$$x + 2 = x - 1 - 6\sqrt{x-1} + 9$$

$$x + 2 = x - 1 - 6\sqrt{x-1} + 9$$

$$2 = 8 - 6\sqrt{x-1}$$

$$-6 = -6\sqrt{x-1}$$

$$\frac{-6}{-6} = \frac{-6\sqrt{x-1}}{-6}$$

$$1 = \sqrt{x-1}$$

$$(1)^2 = (\sqrt{x-1})^2$$

$$1 = x - 1$$

$$2 = x$$

The x -intercept is 2.

The corresponding graph is graph (c).

80. Set $y = 0$ to find the x -intercept(s).

$$\begin{aligned} 0 &= \sqrt{x-4} + \sqrt{x+4} - 4 \\ -\sqrt{x-4} &= \sqrt{x+4} - 4 \\ (-\sqrt{x-4})^2 &= (\sqrt{x+4} - 4)^2 \\ x-4 &= (\sqrt{x+4})^2 - 2(\sqrt{x+4})(4) + (4)^2 \\ x-4 &= x+4 - 8\sqrt{x+4} + 16 \\ -4 &= 20 - 8\sqrt{x+4} \\ -24 &= -8\sqrt{x+4} \\ \frac{-24}{-8} &= \frac{-8\sqrt{x+4}}{-8} \\ 3 &= \sqrt{x+4} \\ (3)^2 &= (\sqrt{x+4})^2 \\ 9 &= x+4 \\ 5 &= x \end{aligned}$$

The x -intercept is 5.

The corresponding graph is graph (a).

81. Set $y = 0$ to find the x -intercept(s).

$$0 = x^{\frac{1}{3}} + 2x^{\frac{1}{6}} - 3$$

$$\text{Let } t = x^{\frac{1}{6}}.$$

$$x^{\frac{1}{3}} + 2x^{\frac{1}{6}} - 3 = 0$$

$$\left(x^{\frac{1}{6}}\right)^2 + 2x^{\frac{1}{6}} - 3 = 0$$

$$t^2 + 2t - 3 = 0$$

$$(t+3)(t-1) = 0$$

$$t+3=0 \quad \text{or} \quad t-1=0$$

$$t=-3 \quad t=1$$

Substitute $x^{\frac{1}{6}}$ for t .

$$x^{\frac{1}{6}} = -3 \quad \text{or} \quad x^{\frac{1}{6}} = 1$$

$$\left(x^{\frac{1}{6}}\right)^6 = (-3)^6 \quad \left(x^{\frac{1}{6}}\right)^6 = (1)^6$$

$$x = 729 \quad x = 1$$

729 does not check and must be rejected.

The x -intercept is 1.

The corresponding graph is graph (e).

82. Set $y = 0$ to find the x -intercept(s).

$$0 = x^{-2} - x^{-1} - 6$$

$$\text{Let } t = x^{-1}.$$

$$x^{-2} - x^{-1} - 6 = 0$$

$$(x^{-1})^2 - x^{-1} - 6 = 0$$

$$t^2 - t - 6 = 0$$

$$(t+2)(t-3) = 0$$

$$t+2=0 \quad \text{or} \quad t-3=0$$

$$t=-2 \quad t=3$$

Substitute x^{-1} for t .

$$x^{-1} = -2 \quad \text{or} \quad x^{-1} = 3$$

$$x = -\frac{1}{2} \quad x = \frac{1}{3}$$

The x -intercepts are $-\frac{1}{2}$ and $\frac{1}{3}$.

The corresponding graph is graph (b).

83. Set $y = 0$ to find the x -intercept(s).

$$(x+2)^2 - 9(x+2) + 20 = 0$$

$$\text{Let } t = x+2.$$

$$(x+2)^2 - 9(x+2) + 20 = 0$$

$$t^2 - 9t + 20 = 0$$

$$(t-5)(t-4) = 0$$

$$t-5=0 \quad \text{or} \quad t-4=0$$

$$t=5 \quad t=4$$

Substitute $x+2$ for t .

$$x+2=5 \quad \text{or} \quad x+2=4$$

$$x=3 \quad x=2$$

The x -intercepts are 2 and 3.

The corresponding graph is graph (f).

84. Set
- $y = 0$
- to find the
- x
- intercept(s).

$$0 = 2(x+2)^2 + 5(x+2) - 3$$

Let $t = x + 2$.

$$2(x+2)^2 + 5(x+2) - 3 = 0$$

$$2t^2 + 5t - 3 = 0$$

$$(2t-1)(t+3) = 0$$

$$2t-1=0 \quad \text{or} \quad t+3=0$$

$$2t=1 \quad t=-3$$

$$t = \frac{1}{2}$$

Substitute $x + 2$ for t .

$$x+2 = \frac{1}{2} \quad \text{or} \quad x+2 = -3$$

$$x = -5$$

$$x = \frac{1}{2} - 2$$

$$x = -\frac{3}{2}$$

The x -intercepts are -5 and $-\frac{3}{2}$.

The corresponding graph is graph (d).

- 85.
- $|5-4x| = 11$

$$5-4x=11 \quad 5-4x=-11$$

$$-4x=6 \quad \text{or} \quad -4x=-16$$

$$x = -\frac{3}{2} \quad x=4$$

The solution set is $\left\{-\frac{3}{2}, 4\right\}$.

- 86.
- $|2-3x| = 13$

$$2-3x=13 \quad 2-3x=-13$$

$$-3x=11 \quad \text{or} \quad -3x=-15$$

$$x = -\frac{11}{3} \quad x=5$$

The solution set is $\left\{-\frac{11}{3}, 5\right\}$.

- 87.
- $x + \sqrt{x+5} = 7$

$$\sqrt{x+5} = 7-x$$

$$(\sqrt{x+5})^2 = (7-x)^2$$

$$x+5 = 49-14x+x^2$$

$$0 = x^2 - 15x + 44$$

$$0 = (x-4)(x-11)$$

$$x-4=0 \quad \text{or} \quad x-11=0$$

$$x=4 \quad x=11$$

11 does not check and must be rejected.

The solution set is $\{4\}$.

- 88.
- $x - \sqrt{x-2} = 4$

$$-\sqrt{x-2} = 4-x$$

$$(-\sqrt{x-2})^2 = (4-x)^2$$

$$x-2 = 16-8x+x^2$$

$$0 = x^2 - 9x + 18$$

$$0 = (x-6)(x-3)$$

$$x-6=0 \quad \text{or} \quad x-3=0$$

$$x=6 \quad x=3$$

3 does not check and must be rejected.

The solution set is $\{6\}$.

- 89.
- $2x^3 + x^2 - 8x + 2 = 6$

$$2x^3 + x^2 - 8x - 4 = 0$$

$$x^2(2x+1) - 4(2x+1) = 0$$

$$(2x+1)(x^2-4) = 0$$

$$(2x+1)(x+2)(x-2) = 0$$

$$2x+1=0 \quad \text{or} \quad x+2=0 \quad \text{or} \quad x-2=0$$

$$x = -\frac{1}{2} \quad x = -2 \quad x = 2$$

The solution set is $\left\{-\frac{1}{2}, -2, 2\right\}$.

- 90.
- $x^3 + 4x^2 - x + 6 = 10$

$$x^3 + 4x^2 - x - 4 = 0$$

$$x^2(x+4) - 1(x+4) = 0$$

$$(x+4)(x^2-1) = 0$$

$$(x+4)(x+1)(x-1) = 0$$

$$x+4=0 \quad \text{or} \quad x+1=0 \quad \text{or} \quad x-1=0$$

$$x = -4 \quad x = -1 \quad x = 1$$

The solution set is $\{-4, -1, 1\}$.

91. $(x+4)^{\frac{3}{2}} = 8$

$$\left((x+4)^{\frac{3}{2}}\right)^{\frac{2}{3}} = (8)^{\frac{2}{3}}$$

$$x+4 = (\sqrt[3]{8})^2$$

$$x+4 = (2)^2$$

$$x+4 = 4$$

$$x = 0$$

The solution set is $\{0\}$.

92. $(x-5)^{\frac{3}{2}} = 125$

$$\left((x-5)^{\frac{3}{2}}\right)^{\frac{2}{3}} = (125)^{\frac{2}{3}}$$

$$x-5 = (\sqrt[3]{125})^2$$

$$x-5 = (5)^2$$

$$x-5 = 25$$

$$x = 30$$

The solution set is $\{30\}$.

93. $y_1 = y_2 + 3$

$$(x^2 - 1)^2 = 2(x^2 - 1) + 3$$

$$(x^2 - 1)^2 - 2(x^2 - 1) - 3 = 0$$

Let $t = x^2 - 1$ and substitute.

$$t^2 - 2t - 3 = 0$$

$$(t+1)(t-3) = 0$$

$$t+1 = 0 \quad \text{or} \quad t-3 = 0$$

$$t = -1 \quad \quad \quad t = 3$$

Substitute $x^2 - 1$ for t .

$$x^2 - 1 = -1 \quad \text{or} \quad x^2 - 1 = 3$$

$$x^2 = 0 \quad \quad \quad x^2 = 4$$

$$x = 0 \quad \quad \quad x = \pm 2$$

The solution set is $\{-2, 0, 2\}$.

94. $y_1 = y_2 + 6$

$$6\left(\frac{2x}{x-3}\right)^2 = 5\left(\frac{2x}{x-3}\right) + 6$$

$$6\left(\frac{2x}{x-3}\right)^2 - 5\left(\frac{2x}{x-3}\right) - 6 = 0$$

Let $t = \frac{2x}{x-3}$ and substitute.

$$6t^2 - 5t - 6 = 0$$

$$(3t+2)(2t-3) = 0$$

$$3t+2 = 0 \quad \text{or} \quad 2t-3 = 0$$

$$t = -\frac{2}{3} \quad \quad \quad t = \frac{3}{2}$$

Substitute $\frac{2x}{x-3}$ for t .

$$\frac{2x}{x-3} = -\frac{2}{3} \quad \text{or} \quad \frac{2x}{x-3} = \frac{3}{2}$$

First solve $\frac{2x}{x-3} = -\frac{2}{3}$

$$\frac{2x(3)(x-3)}{x-3} = -\frac{2(3)(x-3)}{3}$$

$$2x(3) = -2(x-3)$$

$$6x = -2x + 6$$

$$8x = 6$$

$$x = \frac{3}{4}$$

Next solve $\frac{2x}{x-3} = \frac{3}{2}$

$$\frac{2x(2)(x-3)}{x-3} = \frac{3(2)(x-3)}{2}$$

$$2x(2) = 3(x-3)$$

$$4x = 3x - 9$$

$$x = -9$$

The solution set is $\left\{-9, \frac{3}{4}\right\}$.

95. $|x^2 + 2x - 36| = 12$

$$x^2 + 2x - 36 = 12 \quad \quad \quad x^2 + 2x - 36 = -12$$

$$x^2 + 2x - 48 = 0 \quad \text{or} \quad x^2 + 2x - 24 = 0$$

$$(x+8)(x-6) = 0 \quad \quad \quad (x+6)(x-4) = 0$$

Setting each of the factors above equal to zero gives

$$x = -8, \quad x = 6, \quad x = -6, \quad \text{and} \quad x = 4.$$

The solution set is $\{-8, -6, 4, 6\}$.

96. $|x^2 + 6x + 1| = 8$

$$x^2 + 6x + 1 = 8 \quad \text{or} \quad x^2 + 6x + 1 = -8$$

$$x^2 + 6x - 7 = 0 \quad \quad \quad x^2 + 6x + 9 = 0$$

$$(x+7)(x-1) = 0 \quad \quad \quad (x+3)(x+3) = 0$$

Setting each of the factors above equal to zero gives

$$x = -7, \quad x = -3, \quad \text{and} \quad x = 1.$$

The solution set is $\{-7, -3, 1\}$.

97. $x(x+1)^3 - 42(x+1)^2 = 0$

$$(x+1)^2(x(x+1) - 42) = 0$$

$$(x+1)^2(x^2 + x - 42) = 0$$

$$(x+1)^2(x+7)(x-6) = 0$$

Setting each of the factors above equal to zero gives

$$x = -7, \quad x = -1, \quad \text{and} \quad x = 6.$$

The solution set is $\{-7, -1, 6\}$.

98. $x(x-2)^3 - 35(x-2)^2 = 0$

$$x(x-2)^3 - 35(x-2)^2 = 0$$

$$(x-2)^2(x(x-2) - 35) = 0$$

$$(x-2)^2(x^2 - 2x - 35) = 0$$

$$(x-2)^2(x+5)(x-7) = 0$$

Setting each of the factors above equal to zero gives

$$x = -5, \quad x = 2, \quad \text{and} \quad x = 7.$$

The solution set is $\{-5, 2, 7\}$.

99. Let $x =$ the number.

$$\sqrt{5x-4} = x-2$$

$$(\sqrt{5x-4})^2 = (x-2)^2$$

$$5x-4 = x^2 - 4x + 4$$

$$0 = x^2 - 9x + 8$$

$$0 = (x-8)(x-1)$$

$$x-8 = 0 \quad \text{or} \quad x-1 = 0$$

$$x = 8 \quad \quad \quad x = 1$$

Check $x = 8$: $\sqrt{5(8)-4} = 8-2$

$$\sqrt{40-4} = 6$$

$$\sqrt{36} = 6$$

$$6 = 6$$

Check $x = 1$: $\sqrt{5(1)-4} = 1-2$

$$\sqrt{5-4} = -1$$

$$\sqrt{-1} \neq -1$$

Discard $x = 1$. The number is 8.

100. Let $x =$ the number.

$$\sqrt{x-3} = x-5$$

$$(\sqrt{x-3})^2 = (x-5)^2$$

$$x-3 = x^2 - 10x + 25$$

$$0 = x^2 - 11x + 28$$

$$0 = (x-7)(x-4)$$

$$x-7 = 0 \quad \text{or} \quad x-4 = 0$$

$$x = 7 \quad \quad \quad x = 4$$

Check $x = 7$: $\sqrt{7-3} = 7-5$

$$\sqrt{4} = 2$$

$$2 = 2$$

Check $x = 4$: $\sqrt{4-3} = 4-5$

$$\sqrt{1} = -1$$

$$1 \neq -1$$

Discard 4. The number is 7.

101.

$$r = \sqrt{\frac{3V}{\pi h}}$$

$$r^2 = \left(\sqrt{\frac{3V}{\pi h}} \right)^2$$

$$r^2 = \frac{3V}{\pi h}$$

$$\pi r^2 h = 3V$$

$$\frac{\pi r^2 h}{3} = V$$

$$V = \frac{\pi r^2 h}{3} \quad \text{or} \quad V = \frac{1}{3} \pi r^2 h$$

102.

$$r = \sqrt{\frac{A}{4\pi}}$$

$$r^2 = \left(\sqrt{\frac{A}{4\pi}} \right)^2$$

$$r^2 = \frac{A}{4\pi}$$

$$4\pi r^2 = A \quad \text{or} \quad A = 4\pi r^2$$

- 103.** Exclude any value that causes the denominator to equal zero.

$$|x+2|-14=0$$

$$|x+2|=14$$

$$x+2=14 \quad \text{or} \quad x+2=-14$$

$$x=12 \quad \text{or} \quad x=-16$$

-16 and 12 must be excluded from the domain.

- 104.** Exclude any value that causes the denominator to equal zero.

$$x^3 + 3x^2 - x - 3 = 0$$

$$x^2(x+3) - 1(x+3) = 0$$

$$(x+3)(x^2-1) = 0$$

$$(x+3)(x+1)(x-1) = 0$$

Setting each of the factors above equal to zero gives

$$x = -3, \quad x = -1, \quad \text{and} \quad x = 1.$$

-3, -1, and 1 must be excluded from the domain.

105. $t = \frac{\sqrt{d}}{2}$

$$1.16 = \frac{\sqrt{d}}{2}$$

$$2.32 = \sqrt{d}$$

$$2.32^2 = (\sqrt{d})^2$$

$$d \approx 5.4$$

The vertical distance was about 5.4 feet.

106. $t = \frac{\sqrt{d}}{2}$

$$0.85 = \frac{\sqrt{d}}{2}$$

$$1.7 = \sqrt{d}$$

$$1.7^2 = (\sqrt{d})^2$$

$$d \approx 2.9$$

The vertical distance was about 2.9 feet.

- 107.** It is represented by the point (5.4, 1.16).

- 108.** It is represented by the point (2.9, 0.85).

- 109. a.** According to the line graph, about 48% $\pm 1\%$ of U.S. women participated in the labor force in 2000.

b. $p = 2.2\sqrt{t} + 36.2$

$$p = 2.2\sqrt{28} + 36.2 \approx 47.8$$

According to the formula, 47.8% of U.S. women participated in the labor force in 2000.

c. $p = 2.2\sqrt{t} + 36.2$

$$52 = 2.2\sqrt{t} + 36.2$$

$$15.8 = 2.2\sqrt{t}$$

$$\frac{15.8}{2.2} = \frac{2.2\sqrt{t}}{2.2}$$

$$\frac{15.8}{2.2} = \sqrt{t}$$

$$\left(\frac{15.8}{2.2}\right)^2 = (\sqrt{t})^2$$

$$52 \approx t$$

According to the formula, 52% of U.S. women will participate in the labor force 52 years after 1972, or 2024.

- 110. a.** According to the line graph, about 52% $\pm 1\%$ of U.S. men participated in the labor force in 2000.

b. $p = -2.2\sqrt{t} + 63.8$

$$p = -2.2\sqrt{28} + 63.8 \approx 52.2$$

According to the formula, 52.2% of U.S. men participated in the labor force in 2000.

c. $p = -2.2\sqrt{t} + 63.8$

$$48 = -2.2\sqrt{t} + 63.8$$

$$-15.8 = -2.2\sqrt{t}$$

$$\frac{-15.8}{-2.2} = \frac{-2.2\sqrt{t}}{-2.2}$$

$$\frac{-15.8}{-2.2} = \sqrt{t}$$

$$\left(\frac{-15.8}{-2.2}\right)^2 = (\sqrt{t})^2$$

$$52 \approx t$$

According to the formula, 48% of U.S. men will participate in the labor force 52 years after 1972, or 2024.

111. $365 = 0.2x^{3/2}$

$$\frac{365}{0.2} = \frac{0.2x^{3/2}}{0.2}$$

$$1825 = x^{3/2}$$

$$1825^2 = (x^{3/2})^2$$

$$3,330,625 = x^3$$

$$\sqrt[3]{3,330,625} = \sqrt[3]{x^3}$$

$$149.34 \approx x$$

The average distance of the Earth from the sun is approximately 149 million kilometers.

112. $f(x) = 0.2x^{3/2}$

$$88 = 0.2x^{3/2}$$

$$\frac{88}{0.2} = \frac{0.2x^{3/2}}{0.2}$$

$$440 = x^{3/2}$$

$$440^2 = (x^{3/2})^2$$

$$193,600 = x^3$$

$$\sqrt[3]{193,600} = \sqrt[3]{x^3}$$

$$58 \approx x$$

The average distance of Mercury from the sun is approximately 58 million kilometers.

113. $\sqrt{6^2 + x^2} + \sqrt{8^2 + (10 - x)^2} = 18$

$$\sqrt{36 + x^2} = 18 - \sqrt{64 + 100 - 20x + x^2}$$

$$36 + x^2 = 324 - 36\sqrt{x^2 - 20x + 164} + x^2 - 20x + 164$$

$$36\sqrt{x^2 - 20x + 164} = -20x + 452$$

$$9\sqrt{x^2 - 20x + 164} = -5x + 113$$

$$81(x^2 - 20x + 164) = 25x^2 - 1130x + 12769$$

$$81x^2 - 1620x + 13284 = 25x^2 - 1130x + 12769$$

$$56x^2 - 490x + 515 = 0$$

$$x = \frac{490 \pm \sqrt{(-490)^2 - 4(56)(515)}}{2(56)}$$

$$x = \frac{490 \pm 353.19}{112}$$

$$x \approx 1.2 \quad x \approx 7.5$$

The point should be located approximately either 1.2 feet or 7.5 feet from the base of the 6-foot pole.

114. a. Distance from point $A = \sqrt{6^2 + x^2} + \sqrt{3^2 + (12 - x)^2}$ or $A = \sqrt{x^2 + 36} + \sqrt{(12 - x)^2 + 9}$.

- b. Let the distance = 15.

$$\sqrt{6^2 + x^2} + \sqrt{3^2 + (12 - x)^2} = 15$$

$$\sqrt{36 + x^2} = 15 - \sqrt{9 + 144 - 24x + x^2}$$

$$36 + x^2 = 225 - 30\sqrt{153 - 24x + x^2} + x^2 - 24x + 153$$

$$30\sqrt{x^2 - 24x + 153} = -24x + 342$$

$$5\sqrt{x^2 - 24x + 153} = -4x + 157$$

$$25(x^2 - 24x + 153) = 16x^2 - 456x + 3249$$

$$25x^2 - 600x + 3825 = 16x^2 - 456x + 3249$$

$$9x^2 - 144x + 576 = 0$$

$$x^2 - 16x + 64 = 0$$

$$(x - 8)(x - 8) = 0$$

$$x = 8$$

The distance is 8 miles.

115. – 121. Answers will vary.

122. $x^3 + 3x^2 - x - 3 = 0$

The solution set is $\{-3, -1, 1\}$.

$$(-3)^3 + 3(-3)^2 - (-3) - 3 = 0$$

$$-27 + 27 + 3 - 3 = 0$$

$$(-1)^3 + 3(-1)^2 - (-1) - 3 = 0$$

$$-1 + 3 + 1 - 3 = 0$$

$$1^3 + 3(1)^2 - (1) - 3 = 0$$

$$1 + 3 - 1 - 3 = 0$$

123. $-x^4 + 4x^3 - 4x^2 = 0$

The solution set is $\{0, 2\}$.

$$-(0)^4 + 4(0)^3 - 4(0)^2 = 0$$

$$0 = 0$$

$$-(2)^4 + 4(2)^3 - 4(2)^2 = 0$$

$$-16 + 32 - 16 = 0$$

$$0 = 0$$

124. $\sqrt{2x+13} - x - 5 = 0$

The solution set is $\{-2\}$.

$$\sqrt{2(-2)+13} - (-2) - 5 = 0$$

$$\sqrt{-4+13} + 2 - 5 = 0$$

$$\sqrt{9} - 3 = 0$$

$$3 - 3 = 0$$

125. does not make sense; Explanations will vary. Sample explanation: You should substitute into the original equation.

126. makes sense

127. does not make sense; Explanations will vary. Sample explanation: Changing the order of the terms does not change the fact that this equation is quadratic in form.

128. makes sense
129. false; Changes to make the statement true will vary. A sample change is: Squaring $x + 2$ results in $x^2 + 4x + 4$.
130. false; Changes to make the statement true will vary. A sample change is: 21 satisfies the linear equation but not the radical equation.
131. false; Changes to make the statement true will vary. A sample change is: To solve the equation, let $u^2 = x$.
132. false; Changes to make the statement true will vary. A sample change is: Neither 6 nor -6 satisfies the absolute value equation.

133. $\sqrt{6x-2} = \sqrt{2x+3} - \sqrt{4x-1}$

$$6x-2 = 2x+3 - 2\sqrt{(2x+3)(4x-1)} + 4x-1$$

$$-4 = -2\sqrt{(2x+3)(4x-1)}$$

$$2 = \sqrt{8x^2 + 10x - 3}$$

$$4 = 8x^2 + 10x - 3$$

$$8x^2 + 10x - 7 = 0$$

$$x = \frac{-10 \pm \sqrt{10^2 - 4(8)(-7)}}{2(8)}$$

$$x = \frac{-10 \pm \sqrt{100 + 224}}{16}$$

$$x = \frac{-10 \pm \sqrt{324}}{16}$$

$$x = \frac{-10 \pm 18}{16}$$

$$x = \frac{-28}{16}, \frac{8}{16}$$

$$x = \frac{1}{2}$$

The solution set is $\left\{\frac{1}{2}\right\}$.

134. $5 - \frac{2}{x} = \sqrt{5 - \frac{2}{x}}$

or

$$5 - \frac{2}{x} = 0 \quad 5 - \frac{2}{x} = 1$$

$$5 = \frac{2}{x} \quad -\frac{2}{x} = -4$$

$$5x = 2 \quad -4x = -2$$

$$x = \frac{2}{5} \quad x = \frac{1}{2}$$

The solution set is $\left\{\frac{2}{5}, \frac{1}{2}\right\}$.

135. $\sqrt[3]{x\sqrt{x}} = 9$

$$\sqrt[3]{x\sqrt{x}} = 9$$

$$\sqrt[3]{x^1 x^{\frac{1}{2}}} = 9$$

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

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

$$x^{\frac{1}{2}} = 9$$

$$\left(x^{\frac{1}{2}}\right)^2 = (9)^2$$

$$x = 81$$

The solution set is $\{81\}$.

136. $x^{5/6} + x^{2/3} - 2x^{1/2} = 0$

$$x^{1/2}(x^{2/6} + x^{1/6} - 2) = 0 \text{ let } t = x^{1/6}$$

$$x^{1/2}(t^2 + t - 2) = 0$$

$$x^{1/2} = 0 \quad t^2 + t - 2 = 0$$

$$(t-1)(t+2) = 0$$

$$t-1=0 \quad t+2=0$$

$$t=1 \quad t=-2$$

$$x^{1/6} = 1 \quad x^{1/6} = -2$$

$$x = 1^6 \quad x = (-2)^6$$

$$x = 0 \quad x = 1 \quad x = 64$$

64 does not check and must be rejected.

The solution set is $\{0, 1\}$.

137. $3 - 2x \leq 11$

$$3 - 2(-1) \leq 11$$

$$3 + 2 \leq 11$$

$$5 \leq 11, \text{ true}$$

Yes, -1 is a solution.

138. $-2x - 4 = x + 5$

$$-2x - x = 5 + 4$$

$$-3x = 9$$

$$x = \frac{9}{-3}$$

$$x = -3$$

The solution set is $\{-3\}$.

139. $\frac{x+3}{4} = \frac{x-2}{3} + \frac{1}{4}$

$$12\left(\frac{x+3}{4}\right) = 12\left(\frac{x-2}{3} + \frac{1}{4}\right)$$

$$3(x+3) = 4(x-2) + 3$$

$$3x + 9 = 4x - 8 + 3$$

$$3x + 9 = 4x - 5$$

$$3x - 4x = -5 - 9$$

$$-x = -14$$

$$x = 14$$

The solution set is $\{14\}$.

Section 1.7

Check Point Exercises

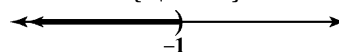
1. a. $[-2, 5) = \{x | -2 \leq x < 5\}$

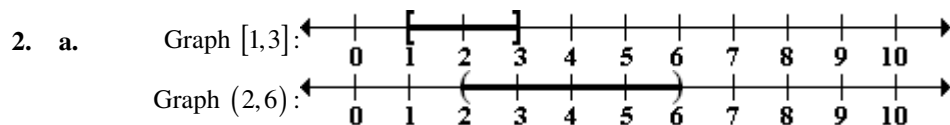


b. $[1, 3.5] = \{x | 1 \leq x \leq 3.5\}$

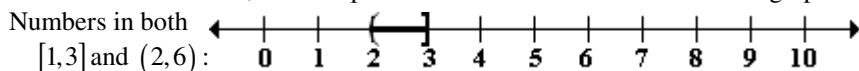


c. $[-\infty, -1) = \{x | x < -1\}$

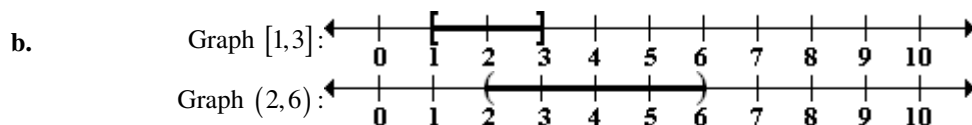




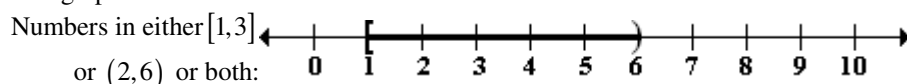
To find the intersection, take the portion of the number line that the two graphs have in common.



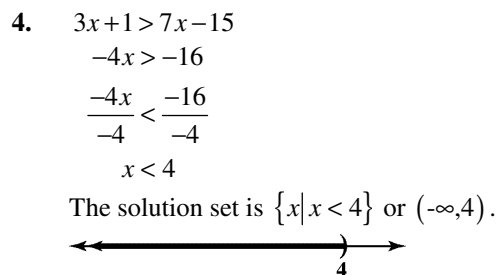
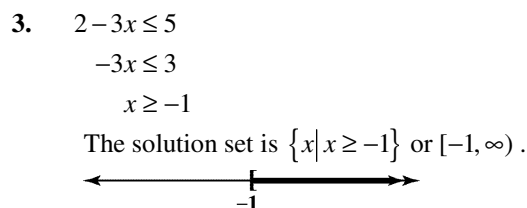
Thus, $[1, 3] \cap (2, 6) = (2, 3]$.



To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

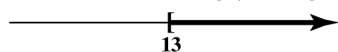


Thus, $[1, 3] \cup (2, 6) = [1, 6)$.




5. $\frac{x-4}{2} \geq \frac{x-2}{3} + \frac{5}{6}$
 $6\left(\frac{x-4}{2}\right) \geq 6\left(\frac{x-2}{3} + \frac{5}{6}\right)$
 $3(x-4) \geq 2(x-2) + 5$
 $3x - 12 \geq 2x - 4 + 5$
 $3x - 12 \geq 2x + 1$
 $3x - 2x \geq 1 + 12$
 $x \geq 13$


The solution set is $\{x \mid x \geq 13\}$ or $[13, \infty)$.




6. a. $3(x+1) > 3x+2$
 $3x+3 > 3x+2$
 $3 > 2$
 $3 > 2$ is true for all values of x .
 The solution set is $\{x \mid x \text{ is a real number}\}$ or \mathbb{R}
 or $(-\infty, \infty)$.

b. $x+1 \leq x-1$
 $1 \leq -1$
 $1 \leq -1$ is false for all values of x .
 The solution set is \emptyset .

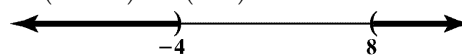
7. $1 \leq 2x+3 < 11$
 $-2 \leq 2x < 8$
 $-1 \leq x < 4$
 The solution set is $\{x \mid -1 \leq x < 4\}$ or $[-1, 4)$.


8. $|x-2| < 5$
 $-5 < x-2 < 5$
 $-3 < x < 7$
 The solution set is $\{x \mid -3 < x < 7\}$ or $(-3, 7)$.


9. $-3|5x-2|+20 \geq -19$
 $-3|5x-2| \geq -39$
 $\frac{-3|5x-2|}{-3} \leq \frac{-39}{-3}$
 $|5x-2| \leq 13$
 $-13 \leq 5x-2 \leq 13$
 $-11 \leq 5x \leq 15$
 $\frac{-11}{5} \leq \frac{5x}{5} \leq \frac{15}{5}$
 $-\frac{11}{5} \leq x \leq 3$
 The solution set is $\{x \mid -\frac{11}{5} \leq x \leq 3\}$ or $[-\frac{11}{5}, 3]$.


10. $18 < |6-3x|$
 $6-3x < -18$ or $6-3x > 18$
 $-3x < -24$ or $-3x > 12$
 $\frac{-3x}{-3} > \frac{-24}{-3}$ $\frac{-3x}{-3} < \frac{12}{-3}$
 $x > 8$ $x < -4$

The solution set is $\{x \mid x < -4 \text{ or } x > 8\}$
 or $(-\infty, -4) \cup (8, \infty)$.



11. Let x = the number of miles driven in a week.
 $260 < 80 + 0.25x$
 $180 < 0.25x$
 $720 < x$
 Driving more than 720 miles in a week makes Basic the better deal.

Concept and Vocabulary Check 1.7

- 2; 5; 2; 5
- greater than
- less than or equal to
- $(-\infty, 9)$; intersection
- $(-\infty, 12)$; union
- adding 4; dividing; -3 ; direction; $>$; $<$
- \emptyset
- $(-\infty, \infty)$
- middle
- $-c$; c
- $-c$; c
- $-2 < x-7 < 2$
- $x-7 < -2$ or $-7 > 2$

Exercise Set 1.7

1. $1 < x \leq 6$

2. $-2 < x \leq 4$

3. $-5 \leq x < 2$

4. $-4 \leq x < 3$

5. $-3 \leq x \leq 1$

6. $-2 \leq x \leq 5$

7. $x > 2$

8. $x > 3$

9. $x \geq -3$

10. $x \geq -5$

11. $x < 3$

12. $x < 2$

13. $x < 5.5$

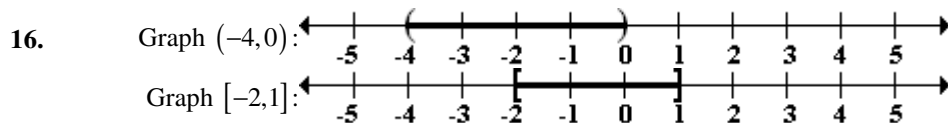
14. $x \leq 3.5$

15. Graph $(-3, 0)$:
 Graph $[-1, 2]$:

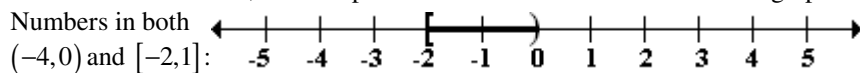
To find the intersection, take the portion of the number line that the two graphs have in common.

Numbers in both $(-3, 0)$ and $[-1, 2]$:

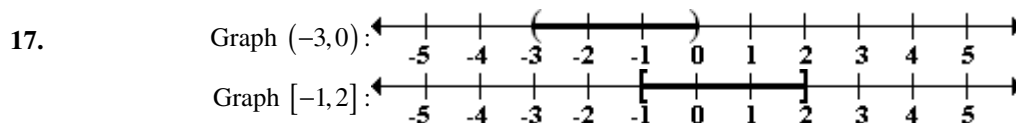
Thus, $(-3, 0) \cap [-1, 2] = [-1, 0)$.



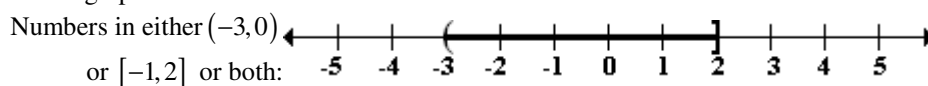
To find the intersection, take the portion of the number line that the two graphs have in common.



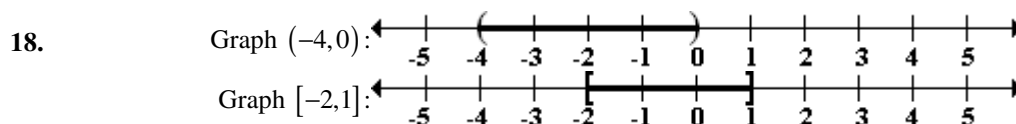
Thus, $(-4, 0) \cap [-2, 1] = [-2, 0)$.



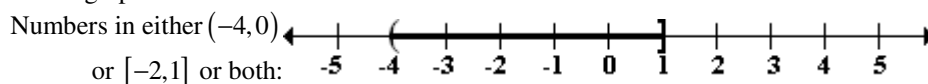
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.



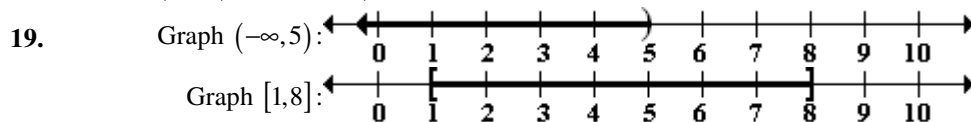
Thus, $(-3, 0) \cup [-1, 2] = (-3, 2]$.



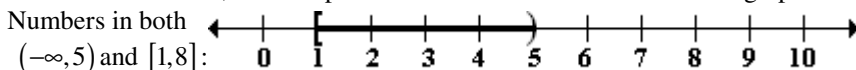
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.



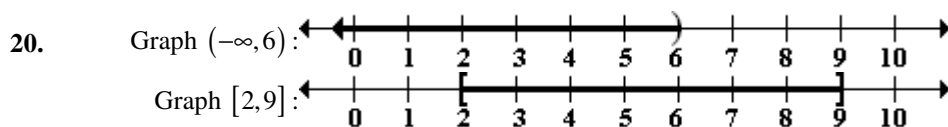
Thus, $(-4, 0) \cup [-2, 1] = (-4, 1]$.



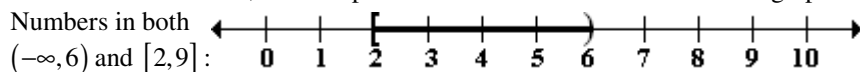
To find the intersection, take the portion of the number line that the two graphs have in common.



Thus, $(-\infty, 5) \cap [1, 8] = [1, 5)$.

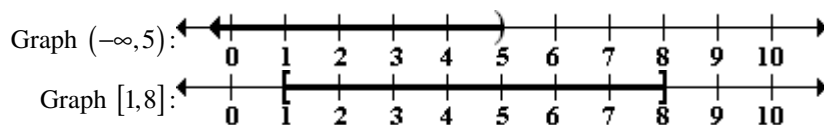


To find the intersection, take the portion of the number line that the two graphs have in common.

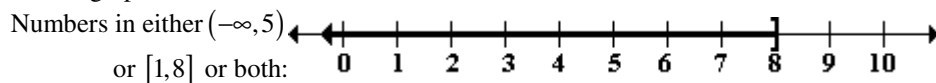


Thus, $(-\infty, 6) \cap [2, 9] = [2, 6)$.

21.

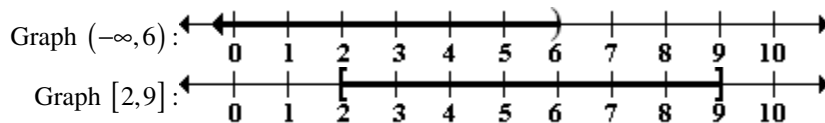


To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

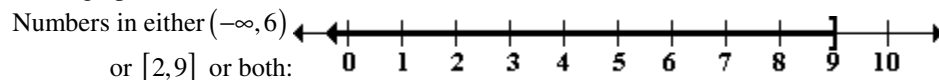


Thus, $(-\infty, 5) \cup [1, 8] = (-\infty, 8]$.

22.

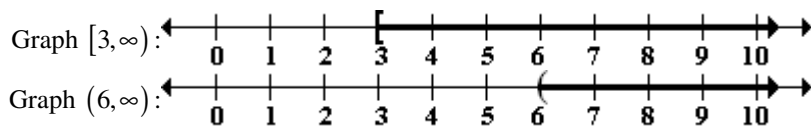


To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

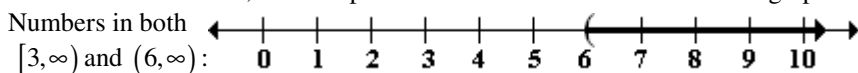


Thus, $(-\infty, 6) \cup [2, 9] = (-\infty, 9]$.

23.

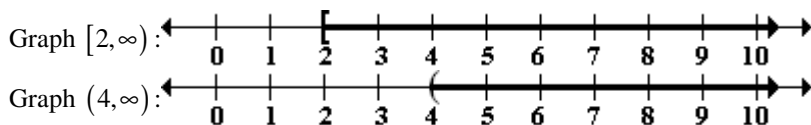


To find the intersection, take the portion of the number line that the two graphs have in common.

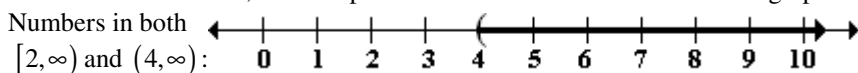


Thus, $[3, \infty) \cap (6, \infty) = (6, \infty)$.

24.

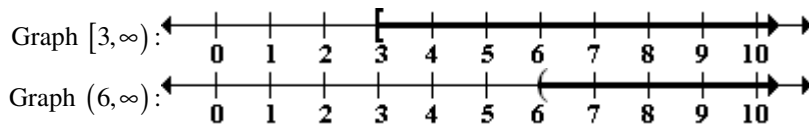


To find the intersection, take the portion of the number line that the two graphs have in common.

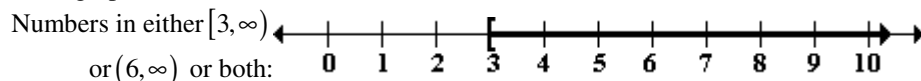


Thus, $[2, \infty) \cap (4, \infty) = (4, \infty)$.

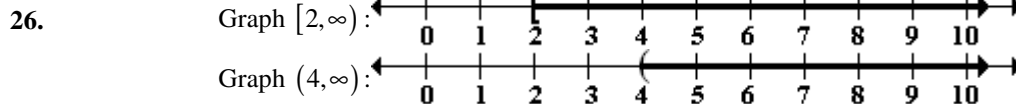
25.



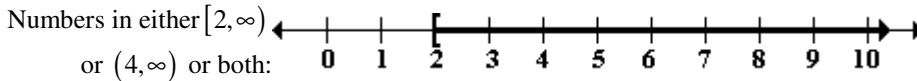
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.



Thus, $[3, \infty) \cup (6, \infty) = [3, \infty)$.



To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.



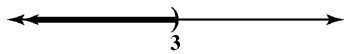
Thus, $[2, \infty) \cup (4, \infty) = [2, \infty)$.

27. $5x + 11 < 26$

$5x < 15$

$x < 3$

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

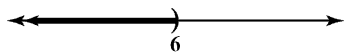


28. $2x + 5 < 17$

$2x < 12$

$x < 6$

The solution set is $\{x \mid x < 6\}$ or $(-\infty, 6)$.

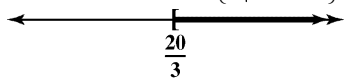


29. $3x - 7 \geq 13$

$3x \geq 20$

$x \geq \frac{20}{3}$

The solution set is $\left\{x \mid x \geq \frac{20}{3}\right\}$, or $\left[\frac{20}{3}, \infty\right)$.

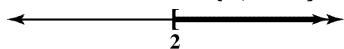


30. $8x - 2 \geq 14$

$8x \geq 16$

$x \geq 2$

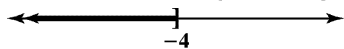
The solution set is $\{x \mid x \geq 2\}$ or $[2, \infty)$.



31. $-9x \geq 36$

$x \leq -4$

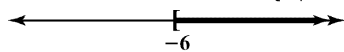
The solution set is $\{x \mid x \leq -4\}$, or $(-\infty, -4]$.



32. $-5x \leq 30$

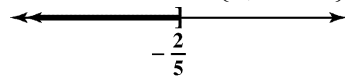
$x \geq -6$

The solution set is $\{x \mid x \geq -6\}$ or $[-6, \infty)$.



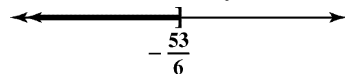
$$\begin{aligned}
 33. \quad & 8x - 11 \leq 3x - 13 \\
 & 8x - 3x \leq -13 + 11 \\
 & 5x \leq -2 \\
 & x \leq -\frac{2}{5}
 \end{aligned}$$

The solution set is $\left\{x \mid x \leq -\frac{2}{5}\right\}$, or $\left(-\infty, -\frac{2}{5}\right]$.



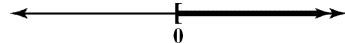
$$\begin{aligned}
 34. \quad & 18x + 45 \leq 12x - 8 \\
 & 18x - 12x \leq -8 - 45 \\
 & 6x \leq -53 \\
 & x \leq -\frac{53}{6}
 \end{aligned}$$

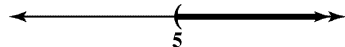
The solution set is $\left\{x \mid x \leq -\frac{53}{6}\right\}$ or $\left(-\infty, -\frac{53}{6}\right]$.

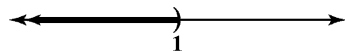


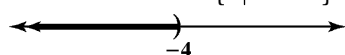
$$\begin{aligned}
 35. \quad & 4(x + 1) + 2 \geq 3x + 6 \\
 & 4x + 4 + 2 \geq 3x + 6 \\
 & 4x + 6 \geq 3x + 6 \\
 & 4x - 3x \geq 6 - 6 \\
 & x \geq 0
 \end{aligned}$$

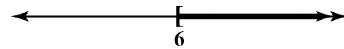
The solution set is $\{x \mid x \geq 0\}$, or $[0, \infty)$.

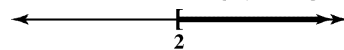


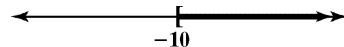
$$\begin{aligned}
 36. \quad & 8x + 3 > 3(2x + 1) + x + 5 \\
 & 8x + 3 > 6x + 3 + x + 5 \\
 & 8x + 3 > 7x + 8 \\
 & 8x - 7x > 8 - 3 \\
 & x > 5 \\
 & \text{The solution set is } \{x \mid x > 5\} \text{ or } (5, \infty).
 \end{aligned}$$


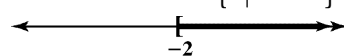
$$\begin{aligned}
 37. \quad & 2x - 11 < -3(x + 2) \\
 & 2x - 11 < -3x - 6 \\
 & 5x < 5 \\
 & x < 1 \\
 & \text{The solution set is } \{x \mid x < 1\}, \text{ or } (-\infty, 1).
 \end{aligned}$$


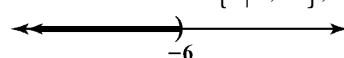
$$\begin{aligned}
 38. \quad & -4(x + 2) > 3x + 20 \\
 & -4x - 8 > 3x + 20 \\
 & -7x > 28 \\
 & x < -4 \\
 & \text{The solution set is } \{x \mid x < -4\} \text{ or } (-\infty, -4).
 \end{aligned}$$


$$\begin{aligned}
 39. \quad & 1 - (x + 3) \geq 4 - 2x \\
 & 1 - x - 3 \geq 4 - 2x \\
 & -x - 2 \geq 4 - 2x \\
 & x \geq 6 \\
 & \text{The solution set is } \{x \mid x \geq 6\}, \text{ or } [6, \infty).
 \end{aligned}$$


$$\begin{aligned}
 40. \quad & 5(3 - x) \leq 3x - 1 \\
 & 15 - 5x \leq 3x - 1 \\
 & -8x \leq -16 \\
 & x \geq 2 \\
 & \text{The solution set is } \{x \mid x \geq 2\} \text{ or } [2, \infty).
 \end{aligned}$$


$$\begin{aligned}
 41. \quad & \frac{x}{4} - \frac{3}{2} \leq \frac{x}{2} + 1 \\
 & \frac{4x}{4} - \frac{4 \cdot 3}{2} \leq \frac{4 \cdot x}{2} + 4 \cdot 1 \\
 & x - 6 \leq 2x + 4 \\
 & -x \leq 10 \\
 & x \geq -10 \\
 & \text{The solution set is } \{x \mid x \geq -10\}, \text{ or } [-10, \infty).
 \end{aligned}$$


$$\begin{aligned}
 42. \quad & \frac{3x}{10} + 1 \geq \frac{1}{5} - \frac{x}{10} \\
 & 10\left(\frac{3x}{10} + 1\right) \geq 10\left(\frac{1}{5} - \frac{x}{10}\right) \\
 & 3x + 10 \geq 2 - x \\
 & 4x \geq -8 \\
 & x \geq -2 \\
 & \text{The solution set is } \{x \mid x \geq -2\} \text{ or } [-2, \infty).
 \end{aligned}$$


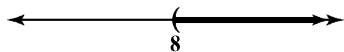
$$\begin{aligned}
 43. \quad & 1 - \frac{x}{2} > 4 \\
 & -\frac{x}{2} > 3 \\
 & x < -6 \\
 & \text{The solution set is } \{x \mid x < -6\}, \text{ or } (-\infty, -6).
 \end{aligned}$$


$$44. \quad 7 - \frac{4}{5}x < \frac{3}{5}$$

$$-\frac{4}{5}x < -\frac{32}{5}$$

$$x > 8$$

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



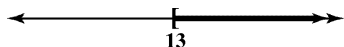
$$45. \quad \frac{x-4}{6} \geq \frac{x-2}{9} + \frac{5}{18}$$

$$3(x-4) \geq 2(x-2) + 5$$

$$3x - 12 \geq 2x - 4 + 5$$

$$x \geq 13$$

The solution set is $\{x \mid x \geq 13\}$, or $[13, \infty)$.



46.

$$\frac{4x-3}{6} + 2 \geq \frac{2x-1}{12}$$

$$2(4x-3) + 24 \geq 2x-1$$

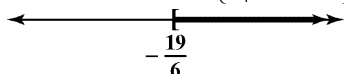
$$8x - 6 + 24 \geq 2x - 1$$

$$6x + 18 \geq -1$$

$$6x \geq -19$$

$$x \geq -\frac{19}{6}$$

The solution set is $\{x \mid x \geq -\frac{19}{6}\}$ or $[-\frac{19}{6}, \infty)$.



$$47. \quad 4(3x-2) - 3x < 3(1+3x) - 7$$

$$12x - 8 - 3x < 3 + 9x - 7$$

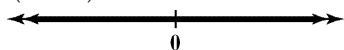
$$9x - 8 < -4 + 9x$$

$$-8 < -4$$

True for all x

The solution set is $\{x \mid x \text{ is any real number}\}$, or

$$(-\infty, \infty).$$



$$48. \quad 3(x-8) - 2(10-x) > 5(x-1)$$

$$3x - 24 - 20 + 2x > 5x - 5$$

$$5x - 44 > 5x - 5$$

$$-44 > -5$$

Not true for any x .

The solution set is the empty set, \emptyset .

$$49. \quad 5(x-2) - 3(x+4) \geq 2x-20$$

$$5x - 10 - 3x - 12 \geq 2x - 20$$

$$2x - 22 \geq 2x - 20$$

$$-22 \geq -20$$

Not true for any x .

The solution set is the empty set, \emptyset .

$$50. \quad 6(x-1) - (4-x) \geq 7x-8$$

$$6x - 6 - 4 + x \geq 7x - 8$$

$$7x - 10 \geq 7x - 8$$

$$-10 \geq -8$$

Not true for any x .

The solution set is the empty set, \emptyset .

$$51. \quad 6 < x + 3 < 8$$

$$6 - 3 < x + 3 - 3 < 8 - 3$$

$$3 < x < 5$$

The solution set is $\{x \mid 3 < x < 5\}$, or $(3, 5)$.

$$52. \quad 7 < x + 5 < 11$$

$$7 - 5 < x + 5 - 5 < 11 - 5$$

$$2 < x < 6$$

The solution set is $\{x \mid 2 < x < 6\}$ or $(2, 6)$.

$$53. \quad -3 \leq x - 2 < 1$$

$$-1 \leq x < 3$$

The solution set is $\{x \mid -1 \leq x < 3\}$, or $[-1, 3)$.

$$54. \quad -6 < x - 4 \leq 1$$

$$-2 < x \leq 5$$

The solution set is $\{x \mid -2 < x \leq 5\}$ or $(-2, 5]$.

$$55. \quad -11 < 2x - 1 \leq -5$$

$$-10 < 2x \leq -4$$

$$-5 < x \leq -2$$

The solution set is $\{x \mid -5 < x \leq -2\}$, or

$$(-5, -2].$$

$$56. \quad 3 \leq 4x - 3 < 19$$

$$6 \leq 4x < 22$$

$$\frac{6}{4} \leq x < \frac{22}{4}$$

$$\frac{3}{2} \leq x < \frac{11}{2}$$

The solution set is $\{x \mid \frac{3}{2} \leq x < \frac{11}{2}\}$ or $[\frac{3}{2}, \frac{11}{2})$.

57. $-3 \leq \frac{2}{3}x - 5 < -1$

$$2 \leq \frac{2}{3}x < 4$$

$$3 \leq x < 6$$

The solution set is $\{x \mid 3 \leq x < 6\}$, or $[3, 6)$.

58. $-6 \leq \frac{1}{2}x - 4 < -3$

$$-2 \leq \frac{1}{2}x < 1$$

$$-4 \leq x < 2$$

The solution set is $\{x \mid -4 \geq x < 2\}$ or $[-4, 2)$.

59. $|x| < 3$
 $-3 < x < 3$

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

60. $|x| < 5$
 $-5 < x < 5$

The solution set is $\{x \mid -5 < x < 5\}$ or $(-5, 5)$.

61. $|x - 1| \leq 2$
 $-2 \leq x - 1 \leq 2$
 $-1 \leq x \leq 3$

The solution set is $\{x \mid -1 \leq x \leq 3\}$, or $[-1, 3]$.

62. $|x + 3| \leq 4$
 $-4 \leq x + 3 \leq 4$
 $-7 \leq x \leq 1$

The solution set is $\{x \mid -7 \leq x \leq 1\}$ or $[-7, 1]$.

63. $|2x - 6| < 8$
 $-8 < 2x - 6 < 8$
 $-2 < 2x < 14$
 $-1 < x < 7$

The solution set is $\{x \mid -1 < x < 7\}$, or $(-1, 7)$.

64. $|3x + 5| < 17$
 $-17 < 3x + 5 < 17$
 $-22 < 3x < 12$

The solution set is $\left\{x \mid -\frac{22}{3} < x < 4\right\}$ or $\left(-\frac{22}{3}, 4\right)$.

65. $|2(x - 1) + 4| \leq 8$
 $-8 \leq 2(x - 1) + 4 \leq 8$
 $-8 \leq 2x - 2 + 4 \leq 8$
 $-8 \leq 2x + 2 \leq 8$
 $-10 \leq 2x \leq 6$
 $-5 \leq x \leq 3$

The solution set is $\{x \mid -5 \leq x \leq 3\}$, or $[-5, 3]$.

66. $|3(x - 1) + 2| \leq 20$
 $-20 \leq 3(x - 1) + 2 \leq 20$
 $-20 \leq 3x - 1 \leq 20$
 $-19 \leq 3x \leq 21$
 $-\frac{19}{3} \leq x \leq 7$

The solution set is $\left\{x \mid -\frac{19}{3} \leq x \leq 7\right\}$ or $\left[-\frac{19}{3}, 7\right]$.

67. $\left|\frac{2y + 6}{3}\right| < 2$
 $-2 < \frac{2y + 6}{3} < 2$
 $-6 < 2y + 6 < 6$
 $-12 < 2y < 0$
 $-6 < y < 0$

The solution set is $\{x \mid -6 < y < 0\}$, or $(-6, 0)$.

68. $\left|\frac{3(x - 1)}{4}\right| < 6$
 $-6 < \frac{3(x - 1)}{4} < 6$
 $-24 < 3x - 3 < 24$
 $-21 < 3x < 27$
 $-7 < x < 9$

The solution set is $\{x \mid -7 < x < 9\}$ or $(-7, 9)$.

69. $|x| > 3$
 $x > 3$ or $x < -3$
The solution set is $\{x \mid x > 3 \text{ or } x < -3\}$, that is,
 $(-\infty, -3)$ or $(3, \infty)$.

70. $|x| > 5$
 $x > 5$ or $x < -5$
The solution set is $\{x \mid x < -5 \text{ or } x > 5\}$, that is,
all x in $(-\infty, -5)$ or $(5, \infty)$.

71. $|x - 1| \geq 2$
 $x - 1 \geq 2$ or $x - 1 \leq -2$
 $x \geq 3$ or $x \leq -1$
The solution set is $\{x \mid x \leq -1 \text{ or } x \geq 3\}$, that is,
 $(-\infty, -1]$ or $[3, \infty)$.

72. $|x + 3| \geq 4$
 $x + 3 \geq 4$ or $x + 3 \leq -4$
 $x \geq 1$ $x \leq -7$
 The solution set is $\{x \mid x \leq -7 \text{ or } x \geq 1\}$ that is,
 $(-\infty, -7) \cup (1, \infty)$.

73. $|3x - 8| > 7$
 $3x - 8 > 7$ or $3x - 8 < -7$
 $3x > 15$ $3x < 1$
 $x > 5$ $x < \frac{1}{3}$
 The solution set is $\left\{x \mid x < \frac{1}{3} \text{ or } x > 5\right\}$, that is,
 $\left(-\infty, \frac{1}{3}\right) \cup (5, \infty)$.

74. $|5x - 2| > 13$
 $5x - 2 > 13$ or $5x - 2 < -13$
 $5x > 15$ $5x < -11$
 $x > 3$ $x < -\frac{11}{5}$
 The solution set is $\left\{x \mid x < -\frac{11}{5} \text{ or } x > 3\right\}$,
 that is, all x in $\left(-\infty, -\frac{11}{5}\right) \cup (3, \infty)$

75. $\left|\frac{2x+2}{4}\right| \geq 2$
 $\frac{2x+2}{4} \geq 2$ or $\frac{2x+2}{4} \leq -2$
 $2x+2 \geq 8$ $2x+2 \leq -8$
 $2x \geq 6$ $2x \leq -10$
 $x \geq 3$ $x \leq -5$
 The solution set is $\{x \mid x \leq -5 \text{ or } x \geq 3\}$, that is,
 $(-\infty, -5] \cup [3, \infty)$.

76. $\left|\frac{3x-3}{9}\right| \geq 1$
 $\frac{3x-3}{9} \geq 1$ or $\frac{3x-3}{9} \leq -1$
 $3x-3 \geq 9$ $3x-3 \leq -9$
 $3x \geq 12$ $3x \leq -6$
 $x \geq 4$ $x \leq -2$
 The solution set is $\{x \mid x \leq -2 \text{ or } x \geq 4\}$,
 or $(-\infty, -2] \cup [4, \infty)$.

77. $\left|3 - \frac{2}{3}x\right| > 5$
 $3 - \frac{2}{3}x > 5$ or $3 - \frac{2}{3}x < -5$
 $-\frac{2}{3}x > 2$ $-\frac{2}{3}x < -8$
 $x < -3$ $x > 12$
 The solution set is $\{x \mid x < -3 \text{ or } x > 12\}$, that is,
 $(-\infty, -3) \cup (12, \infty)$.

78. $\left|3 - \frac{3}{4}x\right| > 9$
 $3 - \frac{3}{4}x > 9$ or $3 - \frac{3}{4}x < -9$
 $-\frac{3}{4}x > 6$ $-\frac{3}{4}x < -12$
 $x < -8$ $x > 16$
 $\{x \mid x < -8 \text{ or } x > 16\}$, that is all x in
 $(-\infty, -8) \cup (16, \infty)$.

79. $3|x - 1| + 2 \geq 8$
 $3|x - 1| \geq 6$
 $|x - 1| \geq 2$
 $x - 1 \geq 2$ or $x - 1 \leq -2$
 $x \geq 3$ $x \leq -1$
 The solution set is $\{x \mid x \leq -1 \text{ or } x \geq 3\}$, that is,
 $(-\infty, -1] \cup [3, \infty)$.

80. $5|2x+1| - 3 \geq 9$
 $5|2x+1| \geq 12$
 $|2x+1| \geq \frac{12}{5}$
 $2x+1 \geq \frac{12}{5}$ $2x+1 \leq -\frac{12}{5}$
 $2x \geq \frac{7}{5}$ or $2x \leq -\frac{17}{5}$
 $x \geq \frac{7}{10}$ $x \leq -\frac{17}{10}$
 The solution set is $\left\{x \mid x \leq -\frac{17}{10} \text{ or } x \geq \frac{7}{10}\right\}$.

81. $-2|x-4| \geq -4$

$$\frac{-2|x-4|}{-2} \leq \frac{-4}{-2}$$

$$|x-4| \leq 2$$

$$-2 \leq x-4 \leq 2$$

$$2 \leq x \leq 6$$

The solution set is $\{x | 2 \leq x \leq 6\}$.

82. $-3|x+7| \geq -27$

$$\frac{-3|x+7|}{-3} \leq \frac{-27}{-3}$$

$$|x+7| \leq 9$$

$$-9 \leq x+7 \leq 9$$

$$-16 \leq x \leq 2$$

The solution set is $\{x | -16 \leq x \leq 2\}$.

83. $-4|1-x| < -16$

$$\frac{-4|1-x|}{-4} > \frac{-16}{-4}$$

$$|1-x| > 4$$

$$1-x > 4 \quad 1-x < -4$$

$$-x > 3 \quad \text{or} \quad -x < -5$$

$$x < -3 \quad x > 5$$

The solution set is $\{x | x < -3 \text{ or } x > 5\}$.

84. $-2|5-x| < -6$

$$-2|5-x| < -6$$

$$\frac{-2|5-x|}{-2} > \frac{-6}{-2}$$

$$|5-x| > 3$$

$$5-x > 3 \quad 5-x < -3$$

$$-x > -2 \quad \text{or} \quad -x < -8$$

$$x < 2 \quad x > 8$$

The solution set is $\{x | x < 2 \text{ or } x > 8\}$.

85. $3 \leq |2x-1|$

$$2x-1 \geq 3 \quad 2x-1 \leq -3$$

$$2x \geq 4 \quad \text{or} \quad 2x \leq -2$$

$$x \geq 2 \quad x \leq -1$$

The solution set is $\{x | x \leq -1 \text{ or } x \geq 2\}$.

86. $9 \leq |4x+7|$

$$4x+7 \geq 9 \quad \text{or} \quad 4x+7 \leq -9$$

$$4x \geq 2 \quad 4x \leq -16$$

$$x \geq \frac{2}{4} \quad x \leq -4$$

$$x \geq \frac{1}{2}$$

The solution set is $\left\{x \left| x \leq -4 \text{ or } x \geq \frac{1}{2} \right.\right\}$.

87. $5 > |4-x|$ is equivalent to $|4-x| < 5$.

$$-5 < 4-x < 5$$

$$-9 < -x < 1$$

$$\frac{-9}{-1} > \frac{-x}{-1} > \frac{1}{-1}$$

$$9 > x > -1$$

$$-1 < x < 9$$

The solution set is $\{x | -1 < x < 9\}$.

88. $2 > |11-x|$ is equivalent to $|11-x| < 2$.

$$-2 < 11-x < 2$$

$$-13 < -x < -9$$

$$\frac{-13}{-1} > \frac{-x}{-1} > \frac{-9}{-1}$$

$$13 > x > 9$$

$$9 < x < 13$$

The solution set is $\{x | 9 < x < 13\}$.

89. $1 < |2-3x|$ is equivalent to $|2-3x| > 1$.

$$2-3x > 1$$

$$2-3x < -1$$

$$-3x > -1$$

$$-3x < -3$$

$$\frac{-3x}{-3} < \frac{-1}{-3}$$

$$\frac{-3x}{-3} > \frac{-3}{-3}$$

$$x < \frac{1}{3}$$

$$x > 1$$

The solution set is $\left\{x \left| x < \frac{1}{3} \text{ or } x > 1 \right.\right\}$.

90. $4 < |2 - x|$ is equivalent to $|2 - x| > 4$.

$$2 - x > 4 \quad \text{or} \quad 2 - x < -4$$

$$-x > 2 \quad -x < -6$$

$$\frac{-x}{-1} < \frac{2}{-1} \quad \frac{-x}{-1} > \frac{-6}{-1}$$

$$x < -2 \quad x > 6$$

The solution set is $\{x \mid x < -2 \text{ or } x > 6\}$.

91. $12 < \left| -2x + \frac{6}{7} \right| + \frac{3}{7}$

$$\frac{81}{7} < \left| -2x + \frac{6}{7} \right|$$

$$-2x + \frac{6}{7} > \frac{81}{7} \quad \text{or} \quad -2x + \frac{6}{7} < -\frac{81}{7}$$

$$-2x > \frac{75}{7} \quad -2x < -\frac{87}{7}$$

$$x < -\frac{75}{14} \quad x > \frac{87}{14}$$

The solution set is $\left\{ x \mid x < -\frac{75}{14} \text{ or } x > \frac{87}{14} \right\}$, that is,

$$\left(-\infty, -\frac{75}{14} \right) \text{ or } \left(\frac{87}{14}, \infty \right).$$

92. $1 < \left| x - \frac{11}{3} \right| + \frac{7}{3}$

$$-\frac{4}{3} < \left| x - \frac{11}{3} \right|$$

Since $\left| x - \frac{11}{3} \right| > -\frac{4}{3}$ is true for all x ,

the solution set is $\{x \mid x \text{ is any real number}\}$

or $(-\infty, \infty)$.

93. $4 + \left| 3 - \frac{x}{3} \right| \geq 9$

$$\left| 3 - \frac{x}{3} \right| \geq 5$$

$$3 - \frac{x}{3} \geq 5 \quad \text{or} \quad 3 - \frac{x}{3} \leq -5$$

$$-\frac{x}{3} \geq 2 \quad -\frac{x}{3} \leq -8$$

$$x \leq -6 \quad x \geq 24$$

The solution set is $\{x \mid x \leq -6 \text{ or } x \geq 24\}$, that is,

$$(-\infty, -6] \text{ or } [24, \infty).$$

94. $\left| 2 - \frac{x}{2} \right| - 1 \leq 1$

$$\left| 2 - \frac{x}{2} \right| \leq 2$$

$$-2 \leq 2 - \frac{x}{2} \leq 2$$

$$-4 \leq -\frac{x}{2} \leq 0$$

$$8 \geq x \geq 0$$

The solution set is $\{x \mid 0 \leq x \leq 8\}$ or $[0, 8]$.

95. $y_1 \leq y_2$

$$\frac{x}{2} + 3 \leq \frac{x}{3} + \frac{5}{2}$$

$$6\left(\frac{x}{2} + 3\right) \leq 6\left(\frac{x}{3} + \frac{5}{2}\right)$$

$$\frac{6x}{2} + 6(3) \leq \frac{6x}{3} + \frac{6(5)}{2}$$

$$3x + 18 \leq 2x + 15$$

$$x \leq -3$$

The solution set is $(-\infty, -3]$.

96. $y_1 > y_2$

$$\frac{2}{3}(6x - 9) + 4 > 5x + 1$$

$$3\left(\frac{2}{3}(6x - 9) + 4\right) > 3(5x + 1)$$

$$2(6x - 9) + 12 > 15x + 3$$

$$12x - 18 + 12 > 15x + 3$$

$$12x - 6 > 15x + 3$$

$$-3x > 9$$

$$\frac{-3x}{-3} < \frac{9}{-3}$$

$$x < -3$$

The solution set is $(-\infty, -3)$.

97. $y \geq 4$

$$1 - (x + 3) + 2x \geq 4$$

$$1 - x - 3 + 2x \geq 4$$

$$x - 2 \geq 4$$

$$x \geq 6$$

The solution set is $[6, \infty)$.

98. $y \leq 0$

$$2x - 11 + 3(x + 2) \leq 0$$

$$2x - 11 + 3x + 6 \leq 0$$

$$5x - 5 \leq 0$$

$$5x \leq 5$$

$$x \leq 1$$

The solution set is $(-\infty, 1]$.

99. $y < 8$

$$|3x - 4| + 2 < 8$$

$$|3x - 4| < 6$$

$$-6 < 3x - 4 < 6$$

$$-2 < 3x < 10$$

$$-\frac{2}{3} < \frac{3x}{3} < \frac{10}{3}$$

$$-\frac{2}{3} < x < \frac{10}{3}$$

The solution set is $\left(-\frac{2}{3}, \frac{10}{3}\right)$.

100. $y > 9$

$$|2x - 5| + 1 > 9$$

$$|2x - 5| > 8$$

$$2x - 5 < -8 \quad \text{or} \quad 2x - 5 > 8$$

$$2x < -3 \quad \text{or} \quad 2x > 13$$

$$x < -\frac{3}{2} \quad \text{or} \quad x > \frac{13}{2}$$

The solution set is $\left(-\infty, -\frac{3}{2}\right) \cup \left(\frac{13}{2}, \infty\right)$.

101. $y \leq 4$

$$7 - \left|\frac{x}{2} + 2\right| \leq 4$$

$$-\left|\frac{x}{2} + 2\right| \leq -3$$

$$\left|\frac{x}{2} + 2\right| \geq 3$$

$$\frac{x}{2} + 2 \geq 3 \quad \text{or} \quad \frac{x}{2} + 2 \leq -3$$

$$x + 4 \geq 6 \quad \text{or} \quad x + 4 \leq -6$$

$$x \geq 2 \quad \text{or} \quad x \leq -10$$

The solution set is $(-\infty, -10] \cup [2, \infty)$.

102. $y \geq 6$

$$8 - |5x + 3| \geq 6$$

$$-|5x + 3| \geq -2$$

$$-(-|5x + 3|) \leq -(-2)$$

$$|5x + 3| \leq 2$$

$$-2 \leq 5x + 3 \leq 2$$

$$-5 \leq 5x \leq -1$$

$$-\frac{5}{5} \leq \frac{5x}{5} \leq \frac{-1}{5}$$

$$-1 \leq x \leq -\frac{1}{5}$$

The solution set is $\left[-1, -\frac{1}{5}\right]$.

103. The graph's height is below 5 on the interval $(-1, 9)$.

104. The graph's height is at or above 5 on the interval $(-\infty, -1] \cup [9, \infty)$.

105. The solution set is $\{x \mid -1 \leq x < 2\}$ or $[-1, 2)$.

106. The solution set is $\{x \mid 1 < x \leq 4\}$ or $(1, 4]$.

107. Let x be the number.

$$|4 - 3x| \geq 5 \quad \text{or} \quad |3x - 4| \geq 5$$

$$3x - 4 \geq 5 \quad \text{or} \quad 3x - 4 \leq -5$$

$$3x \geq 9 \quad \text{or} \quad 3x \leq -1$$

$$x \geq 3 \quad \text{or} \quad x \leq -\frac{1}{3}$$

The solution set is $\left\{x \mid x \leq -\frac{1}{3} \text{ or } x \geq 3\right\}$ or

$$\left(-\infty, -\frac{1}{3}\right] \cup [3, \infty).$$

108. Let x be the number.

$$|5 - 4x| \leq 13 \quad \text{or} \quad |4x - 5| \leq 13$$

$$-13 \leq 4x - 5 \leq 13$$

$$-8 \leq 4x \leq 18$$

$$-2 \leq x \leq \frac{9}{2}$$

The solution set is $\left\{x \mid -2 \leq x \leq \frac{9}{2}\right\}$ or $\left[-2, \frac{9}{2}\right]$.

109. $(0, 4)$

110. $[0, 5]$

111. $\text{passion} \leq \text{intimacy}$ or $\text{intimacy} \geq \text{passion}$

112. $\text{commitment} \geq \text{intimacy}$ or
 $\text{intimacy} \leq \text{commitment}$

113. $\text{passion} < \text{commitment}$ or
 $\text{commitment} > \text{passion}$

114. $\text{commitment} > \text{passion}$ or
 $\text{passion} < \text{commitment}$

115. 9, after 3 years

116. after approximately $5\frac{1}{2}$ years

117. a. $I = \frac{1}{4}x + 26$

$$\frac{1}{4}x + 26 > 33$$

$$\frac{1}{4}x > 7$$

$$x > 28$$

More than 33% of U.S. households will have an interfaith marriage in years after 2016 (i.e. $1988 + 28$).

b. $N = \frac{1}{4}x + 6$

$$\frac{1}{4}x + 6 > 14$$

$$\frac{1}{4}x > 8$$

$$x > 32$$

More than 14% of U.S. households will have a person of faith married to someone with no religion in years after 2020 (i.e. $1988 + 32$).

c. More than 33% of U.S. households will have an interfaith marriage *and* more than 14% of U.S. households will have a person of faith married to someone with no religion in years after 2020.

d. More than 33% of U.S. households will have an interfaith marriage *or* more than 14% of U.S. households will have a person of faith married to someone with no religion in years after 2016.

118. a. $I = \frac{1}{4}x + 26$

$$\frac{1}{4}x + 26 > 34$$

$$\frac{1}{4}x > 8$$

$$x > 32$$

More than 34% of U.S. households will have an interfaith marriage in years after 2020 (i.e. $1988 + 32$).

b. $N = \frac{1}{4}x + 6$

$$\frac{1}{4}x + 6 > 15$$

$$\frac{1}{4}x > 9$$

$$x > 36$$

More than 15% of U.S. households will have a person of faith married to someone with no religion in years after 2024 (i.e. $1988 + 36$).

c. More than 34% of U.S. households will have an interfaith marriage *and* more than 15% of U.S. households will have a person of faith married to someone with no religion in years after 2024.

d. More than 34% of U.S. households will have an interfaith marriage *or* more than 15% of U.S. households will have a person of faith married to someone with no religion in years after 2020.

119. $28 \leq 20 + 0.40(x - 60) \leq 40$

$$28 \leq 20 + 0.40x - 24 \leq 40$$

$$28 \leq 0.40x - 4 \leq 40$$

$$32 \leq 0.40x \leq 44$$

$$80 \leq x \leq 110$$

Between 80 and 110 ten minutes, inclusive.

120. $15 \leq \frac{5}{9}(F - 32) \leq 35$

$$\frac{9}{5}(15) \leq \frac{9}{5}\left(\frac{5}{9}(F - 32)\right) \leq \frac{9}{5}(35)$$

$$9(3) \leq F - 32 \leq 9(7)$$

$$27 \leq F - 32 \leq 63$$

$$59 \leq F \leq 95$$

The range for Fahrenheit temperatures is 59°F to 95°F , inclusive or $[59^{\circ}\text{F}, 95^{\circ}\text{F}]$.

121. $\left|\frac{h - 50}{5}\right| \geq 1.645$

$$\frac{h - 50}{5} \geq 1.645 \quad \text{or} \quad \frac{h - 50}{5} \leq -1.645$$

$$h - 50 \geq 8.225 \quad h - 50 \leq -8.225$$

$$h \geq 58.225 \quad h \leq 41.775$$

The number of outcomes would be 59 or more, or 41 or less.

122. $50 + 0.20x < 20 + 0.50x$

$$30 < 0.3x$$

$$100 < x$$

Basic Rental is a better deal when driving more than 100 miles per day.

$$123. 15 + 0.08x < 3 + .12x$$

$$12 < 0.04x$$

$$300 < x$$

Plan A is a better deal when texting more than 300 times per month.

$$124. 1800 + 0.03x < 200 + 0.08x$$

$$1600 < 0.05x$$

$$32000 < x$$

A home assessment of greater than \$32,000 would make the first bill a better deal.

$$125. 2 + 0.08x < 8 + 0.05x$$

$$0.03x < 6$$

$$x < 200$$

The credit union is a better deal when writing less than 200 checks.

$$126. 2x > 10,000 + 0.40x$$

$$1.6x > 10,000$$

$$\frac{1.6x}{1.6} > \frac{10,000}{1.6}$$

$$x > 6250$$

More than 6250 tapes need to be sold a week to make a profit.

$$127. 3000 + 3x < 5.5x$$

$$3000 < 2.5x$$

$$1200 < x$$

More than 1200 packets of stationary need to be sold each week to make a profit.

$$128. 265 + 65x \leq 2800$$

$$65x \leq 2535$$

$$x \leq 39$$

39 bags or fewer can be lifted safely.

$$129. 245 + 95x \leq 3000$$

$$95x \leq 2755$$

$$x \leq 29$$

29 bags or less can be lifted safely.

$$130. \text{ Let } x = \text{the grade on the final exam.}$$

$$\frac{86 + 88 + 92 + 84 + x + x}{6} \geq 90$$

$$86 + 88 + 92 + 84 + x + x \geq 540$$

$$2x + 350 \geq 540$$

$$2x \geq 190$$

$$x \geq 95$$

You must receive at least a 95% to earn an A.

$$131. \text{ a. } \frac{86 + 88 + x}{3} \geq 90$$

$$\frac{174 + x}{3} \geq 90$$

$$174 + x \geq 270$$

$$x \geq 96$$

You must get at least a 96.

$$\text{b. } \frac{86 + 88 + x}{3} < 80$$

$$\frac{174 + x}{3} < 80$$

$$174 + x < 240$$

$$x < 66$$

This will happen if you get a grade less than 66.

$$132. \text{ Let } x = \text{the number of hours the mechanic works on the car.}$$

$$226 \leq 175 + 34x \leq 294$$

$$51 \leq 34x \leq 119$$

$$1.5 \leq x \leq 3.5$$

The man will be working on the job at least 1.5 and at most 3.5 hours.

$$133. \text{ Let } x = \text{the number of times the bridge is crossed per three month period}$$

$$\text{The cost with the 3-month pass is } C_3 = 7.50 + 0.50x.$$

$$\text{The cost with the 6-month pass is } C_6 = 30.$$

Because we need to buy two 3-month passes per 6-month pass, we multiply the cost with the 3-month pass by 2.

$$2(7.50 + 0.50x) < 30$$

$$15 + x < 30$$

$$x < 15$$

We also must consider the cost without purchasing a pass. We need this cost to be less than the cost with a 3-month pass.

$$3x > 7.50 + 0.50x$$

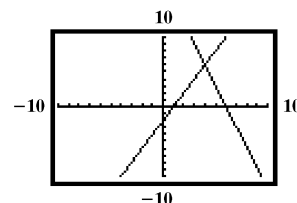
$$2.50x > 7.50$$

$$x > 3$$

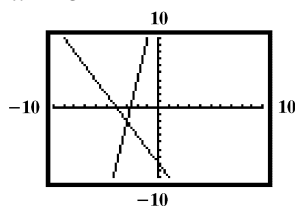
The 3-month pass is the best deal when making more than 3 but less than 15 crossings per 3-month period.

$$134. - 141. \text{ Answers will vary.}$$

$$142. x < 4$$



143. $x < -3$



144. Verify exercise 142.

X	Y1	Y2
2	12	2
3	13	4
4	14	6
5	15	8
6	16	10
7	17	12
8	18	14

X=4

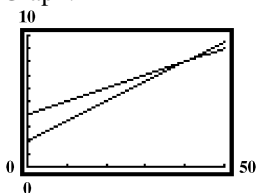
Verify exercise 143.

X	Y1	Y2
-5	2	-14
-4	3	-12
-3	4	-10
-2	5	-8
-1	6	-6
0	7	-4
1	8	-2
2	9	0
3	10	2
4	11	4
5	12	6
6	13	8
7	14	10
8	15	12
9	16	14
10	17	16
11	18	18
12	19	20
13	20	22

X=-3

145. a. The cost of Plan A is $4 + 0.10x$;
The cost of Plan B is $2 + 0.15x$.

b. Graph:



c. 41 or more checks make Plan A better.

d. $4 + 0.10x < 2 + 0.15x$

$2 < 0.05x$

$x > 40$

The solution set is $\{x \mid x > 40\}$ or $(40, \infty)$.

146. makes sense

147. makes sense

148. makes sense

149. makes sense

150. true

151. false; Changes to make the statement true will vary.
A sample change is: $(-\infty, 3) \cup (-\infty, -2) = (-\infty, 3)$

152. false; Changes to make the statement true will vary.
A sample change is: $3x > 6$ is equivalent to $x > 2$.

153. true

154. Because $x > y$, $y - x$ represents a negative number.
When both sides are multiplied by $(y - x)$ the inequality must be reversed.

155. a. $|x - 4| < 3$

b. $|x - 4| \geq 3$

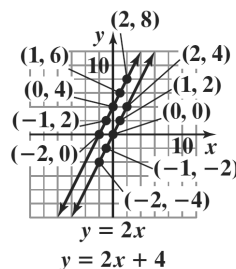
156. Answers will vary.

157. Set 1 has each x -coordinate paired with only one y -coordinate.

158.

x	$y = 2x$	(x, y)
-2	$y = 2(-2) = -4$	$(-2, -4)$
-1	$y = 2(-1) + 4 = 2$	$(-1, 2)$
0	$y = 2(0) = 0$	$(0, 0)$
1	$y = 2(1) = 2$	$(1, 2)$
2	$y = 2(2) = 4$	$(2, 4)$

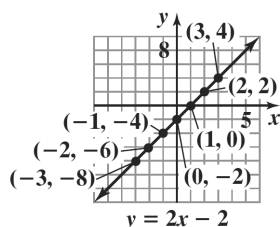
x	$y = 2x + 4$	(x, y)
-2	$y = 2(-2) + 4 = 0$	$(-2, 0)$
-1	$y = 2(-1) + 4 = 2$	$(-1, 2)$
0	$y = 2(0) + 4 = 4$	$(0, 4)$
1	$y = 2(1) + 4 = 6$	$(1, 6)$
2	$y = 2(2) + 4 = 8$	$(2, 8)$



159. a. When the x -coordinate is 2, the y -coordinate is 3.
- b. When the y -coordinate is 4, the x -coordinates are -3 and 3.
- c. The x -coordinates are all real numbers.
- d. The y -coordinates are all real numbers greater than or equal to 1.

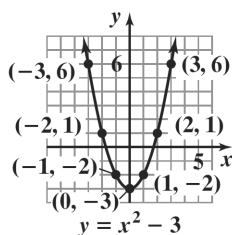
Chapter 1 Review Exercises

1.



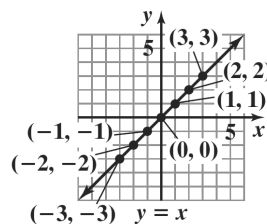
- $x = -3, y = -8$
 $x = -2, y = -6$
 $x = -1, y = -4$
 $x = 0, y = -2$
 $x = 1, y = 0$
 $x = 2, y = 2$
 $x = 3, y = 4$

2.



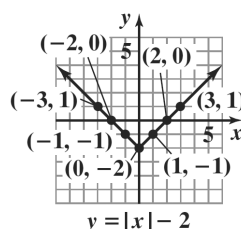
- $x = -3, y = 6$
 $x = -2, y = 1$
 $x = -1, y = -2$
 $x = 0, y = -3$
 $x = 1, y = -2$
 $x = 2, y = 1$
 $x = 3, y = 6$

3.



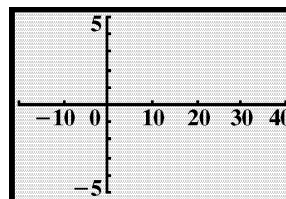
- $x = -3, y = -3$
 $x = -2, y = -2$
 $x = -1, y = -1$
 $x = 0, y = 0$
 $x = 1, y = 1$
 $x = 2, y = 2$
 $x = 3, y = 3$

4.



- $x = -3, y = 1$
 $x = -2, y = 0$
 $x = -1, y = -1$
 $x = 0, y = -2$
 $x = 1, y = -1$
 $x = 2, y = 0$
 $x = 3, y = 1$

5. A portion of Cartesian coordinate plane with minimum x -value equal to -20 , maximum x -value equal to 40 , x -scale equal to 10 and with minimum y -value equal to -5 , maximum y -value equal to 5 , and y -scale equal to 1 .



6. x -intercept: -2 ; The graph intersects the x -axis at $(-2, 0)$.
 y -intercept: 2 ; The graph intersects the y -axis at $(0, 2)$.

7. x -intercepts: 2, -2; The graph intersects the x -axis at $(-2, 0)$ and $(2, 0)$.
 y -intercept: -4; The graph intersects the y -axis at $(0, -4)$.
8. x -intercept: 5; The graph intersects the x -axis at $(5, 0)$.
 y -intercept: None; The graph does not intersect the y -axis.
9. The coordinates are $(20, 8)$. This means that 8% of college students anticipated a starting salary of \$20 thousand.
10. The starting salary that was anticipated by the greatest percentage of college students was \$30 thousand. 22% of students anticipated this salary.
11. The starting salary that was anticipated by the least percentage of college students was \$70 thousand. 2% of students anticipated this salary.
12. Starting salaries of \$25 thousand and \$30 thousand were anticipated by more than 20% of college students
13. 14% of students anticipated a starting salary of \$40 thousand.
14. $p = -0.01s^2 + 0.8s + 3.7$
 $p = -0.01(40)^2 + 0.8(40) + 3.7$
 $p = 19.7$
 This is greater than the estimate of the previous question.
15. $2x - 5 = 7$
 $2x = 12$
 $x = 6$
 The solution set is $\{6\}$.
 This is a conditional equation.
16. $5x + 20 = 3x$
 $2x = -20$
 $x = -10$
 The solution set is $\{-10\}$.
 This is a conditional equation.
17. $7(x - 4) = x + 2$
 $7x - 28 = x + 2$
 $6x = 30$
 $x = 5$
 The solution set is $\{5\}$.
 This is a conditional equation.

18. $1 - 2(6 - x) = 3x + 2$
 $1 - 12 + 2x = 3x + 2$
 $-11 - x = 2$
 $-x = 13$
 $x = -13$
 The solution set is $\{-13\}$.
 This is a conditional equation.
19. $2(x - 4) + 3(x + 5) = 2x - 2$
 $2x - 8 + 3x + 15 = 2x - 2$
 $5x + 7 = 2x - 2$
 $3x = -9$
 $x = -3$
 The solution set is $\{-3\}$.
 This is a conditional equation.
20. $2x - 4(5x + 1) = 3x + 17$
 $2x - 20x - 4 = 3x + 17$
 $-18x - 4 = 3x + 17$
 $-21x = 21$
 $x = -1$
 The solution set is $\{-1\}$.
 This is a conditional equation.
21. $7x + 5 = 5(x + 3) + 2x$
 $7x + 5 = 5x + 15 + 2x$
 $7x + 5 = 7x + 15$
 $5 = 15$
 The solution set is \emptyset .
 This is an inconsistent equation.
22. $7x + 13 = 2(2x - 5) + 3x + 23$
 $7x + 13 = 2(2x - 5) + 3x + 23$
 $7x + 13 = 4x - 10 + 3x + 23$
 $7x + 13 = 7x + 13$
 $13 = 13$
 The solution set is all real numbers.
 This is an identity.
23. $\frac{2x}{3} = \frac{x}{6} + 1$
 $2(2x) = x + 6$
 $4x = x + 6$
 $3x = 6$
 $x = 2$
 The solution set is $\{2\}$.
 This is a conditional equation.

$$\begin{aligned}
 24. \quad \frac{x}{2} - \frac{1}{10} &= \frac{x}{5} + \frac{1}{2} \\
 5x - 1 &= 2x + 5 \\
 3x &= 6 \\
 x &= 2
 \end{aligned}$$

The solution set is $\{2\}$.

This is a conditional equation.

$$\begin{aligned}
 25. \quad \frac{2x}{3} &= 6 - \frac{x}{4} \\
 4(2x) &= 12(6) - 3x \\
 8x &= 72 - 3x \\
 11x &= 72 \\
 x &= \frac{72}{11}
 \end{aligned}$$

The solution set is $\left\{\frac{72}{11}\right\}$.

This is a conditional equation.

$$\begin{aligned}
 26. \quad \frac{x}{4} &= 2 - \frac{x-3}{3} \\
 \frac{12 \cdot x}{4} &= 12(2) - \frac{12(x-3)}{3} \\
 3x &= 24 - 4x + 12 \\
 7x &= 36 \\
 x &= \frac{36}{7}
 \end{aligned}$$

The solution set is $\left\{\frac{36}{7}\right\}$.

This is a conditional equation.

$$\begin{aligned}
 27. \quad \frac{3x+1}{3} - \frac{13}{2} &= \frac{1-x}{4} \\
 4(3x+1) - 6(13) &= 3(1-x) \\
 12x + 4 - 78 &= 3 - 3x \\
 12x - 74 &= 3 - 3x \\
 15x &= 77 \\
 x &= \frac{77}{15}
 \end{aligned}$$

The solution set is $\left\{\frac{77}{15}\right\}$.

This is a conditional equation.

$$\begin{aligned}
 28. \quad \frac{9}{4} - \frac{1}{2x} &= \frac{4}{x} \\
 9x - 2 &= 16 \\
 9x &= 18 \\
 x &= 2
 \end{aligned}$$

The solution set is $\{2\}$.

This is a conditional equation.

$$\begin{aligned}
 29. \quad \frac{7}{x-5} + 2 &= \frac{x+2}{x-5} \\
 7 + 2(x-5) &= x+2 \\
 7 + 2x - 10 &= x+2 \\
 2x - 3 &= x+2 \\
 x &= 5
 \end{aligned}$$

5 does not check and must be rejected.

The solution set is the empty set, \emptyset .

This is an inconsistent equation.

$$\begin{aligned}
 30. \quad \frac{1}{x-1} - \frac{1}{x+1} &= \frac{2}{x^2-1} \\
 \frac{1}{x-1} - \frac{1}{x+1} &= \frac{2}{(x+1)(x-1)} \\
 x+1 - (x-1) &= 2 \\
 x+1 - x+1 &= 2 \\
 2 &= 2
 \end{aligned}$$

The solution set is all real numbers except -1 and 1 .

This is a conditional equation.

$$\begin{aligned}
 31. \quad \frac{5}{x+3} + \frac{1}{x-2} &= \frac{8}{x^2+x-6} \\
 \frac{5}{x+3} + \frac{1}{x-2} &= \frac{8}{(x+3)(x-2)} \\
 \frac{5(x+3)(x-2)}{x+3} + \frac{(x+3)(x-2)}{x-2} &= \frac{8(x+3)(x-2)}{(x+3)(x-2)} \\
 5(x-2) + 1(x+3) &= 8 \\
 5x - 10 + x + 3 &= 8 \\
 6x - 7 &= 8 \\
 6x &= 15 \\
 x &= \frac{15}{6} \\
 x &= \frac{5}{2}
 \end{aligned}$$

The solution set is $\left\{\frac{5}{2}\right\}$.

This is a conditional equation.

$$32. \quad \frac{1}{x+5} = 0$$

$$(x+5)\frac{1}{x+5} = (x+5)(0)$$

$$1 = 0$$

The solution set is the empty set, \emptyset .

This is an inconsistent equation.

$$33. \quad \frac{4}{x+2} + \frac{3}{x} = \frac{10}{x^2+2x}$$

$$\frac{4}{x+2} + \frac{3}{x} = \frac{10}{x(x+2)}$$

$$\frac{4 \cdot x(x+2)}{x+2} + \frac{3 \cdot x(x+2)}{x} = \frac{10 \cdot x(x+2)}{x(x+2)}$$

$$4x+3(x+2)=10$$

$$4x+3x+6=10$$

$$7x+6=10$$

$$7x=4$$

$$x = \frac{4}{7}$$

The solution set is $\left\{\frac{4}{7}\right\}$.

This is a conditional equation.

$$34. \quad 3-5(2x+1)-2(x-4)=0$$

$$3-5(2x+1)-2(x-4)=0$$

$$3-10x-5-2x+8=0$$

$$-12x+6=0$$

$$-12x=-6$$

$$x = \frac{-6}{-12}$$

$$x = \frac{1}{2}$$

The solution set is $\left\{\frac{1}{2}\right\}$.

This is a conditional equation.

$$35. \quad \frac{x+2}{x+3} + \frac{1}{x^2+2x-3} - 1 = 0$$

$$\frac{x+2}{x+3} + \frac{1}{(x+3)(x-1)} - 1 = 0$$

$$\frac{x+2}{x+3} + \frac{1}{(x+3)(x-1)} = 1$$

$$\frac{(x+2)(x+3)(x-1)}{x+3} + 1 = (x+3)(x-1)$$

$$(x+2)(x-1)+1=(x+3)(x-1)$$

$$x^2+x-2+1=x^2+2x-3$$

$$x-1=2x-3$$

$$-x=-2$$

$$x=2$$

The solution set is $\{2\}$.

This is a conditional equation.

36. Let x = the body count in *Scream*.

Let $x+2$ = the body count in *Scream 2*.

Let $x+3$ = the body count in *Scream 3*.

$$x+(x+2)+(x+3)+10=33$$

$$x+x+2+x+3+10=33$$

$$3x+15=33$$

$$3x=18$$

$$x=6$$

$$x+2=8$$

$$x+3=9$$

The body count in *Scream*, *Scream 2*, and *Scream 3*, respectively, is 6, 8, and 9.

37. Let x = the number of years after 1980.

$$2.69+0.15x=8.69$$

$$0.15x=6$$

$$x=40$$

The average price of a movie ticket will be \$8.69 40 years after 1980, or 2020.

$$38. \quad 15+.05x=5+.07x$$

$$10=.02x$$

$$500=x$$

Both plans cost the same at 500 text messages.

39. Let x = the original price of the phone

$$48=x-0.20x$$

$$48=0.80x$$

$$60=x$$

The original price is \$60.

40. Let x = the amount sold to earn \$800 in one week
 $800 = 300 + 0.05x$
 $500 = 0.05x$
 $10,000 = x$
 Sales must be \$10,000 in one week to earn \$800.

41. Let x = the amount invested at 4%
 Let y = the amount invested at 7%
 $x + y = 9000$
 $0.04x + 0.07y = 555$
 Multiply the first equation by -0.04 and add.
 $-0.04x - 0.04y = -360$

$$\begin{array}{r} 0.04x + 0.07y = 555 \\ -0.04x - 0.04y = -360 \\ \hline 0.03y = 195 \end{array}$$

$$0.03y = 195$$

$$y = 6500$$

Back-substitute 6500 for y in one of the original equations to find x .

$$x + y = 9000$$

$$x + 6500 = 9000$$

$$x = 2500$$

There was \$2500 invested at 4% and \$6500 invested at 7%.

42. Let x = the amount invested at 2%
 Let $8000 - x$ = the amount invested at 5%.
 $0.05(8000 - x) = 0.02x + 85$
 $400 - 0.05x = 0.02x + 85$
 $-0.05x - 0.02x = 85 - 400$

$$-0.07x = -315$$

$$\frac{-0.07x}{-0.07} = \frac{-315}{-0.07}$$

$$x = 4500$$

$$8000 - x = 3500$$

\$4500 was invested at 2% and \$3500 was invested at 5%.

43. Let w = the width of the playing field,
 Let $3w - 6$ = the length of the playing field
 $P = 2(\text{length}) + 2(\text{width})$
 $340 = 2(3w - 6) + 2w$
 $340 = 6w - 12 + 2w$
 $340 = 8w - 12$
 $352 = 8w$
 $44 = w$
 The dimensions are 44 yards by 126 yards.

44. a. Let x = the number of years after 2010.
 College A's enrollment: $14,100 + 1500x$
 College B's enrollment: $41,700 - 800x$
 $14,100 + 1500x = 41,700 - 800x$

- b. Check some points to determine that
 $y_1 = 14,100 + 1500x$ and
 $y_2 = 41,700 - 800x$. Since
 $y_1 = y_2 = 32,100$ when $x = 12$, the two colleges will have the same enrollment in the year $2010 + 12 = 2022$. That year the enrollments will be 32,100 students.

45. $vt + gt^2 = s$

$$gt^2 = s - vt$$

$$\frac{gt^2}{t^2} = \frac{s - vt}{t^2}$$

$$g = \frac{s - vt}{t^2}$$

46. $T = gr + gvt$

$$T = g(r + vt)$$

$$\frac{T}{r + vt} = \frac{g(r + vt)}{r + vt}$$

$$\frac{T}{r + vt} = g$$

$$g = \frac{T}{r + vt}$$

47. $T = \frac{A - P}{Pr}$

$$Pr(T) = Pr \frac{A - P}{Pr}$$

$$PrT = A - P$$

$$PrT + P = A$$

$$P(rT + 1) = A$$

$$P = \frac{A}{1 + rT}$$

48. $(8 - 3i) - (17 - 7i) = 8 - 3i - 17 + 7i$
 $= -9 + 4i$

49. $4i(3i - 2) = (4i)(3i) + (4i)(-2)$
 $= 12i^2 - 8i$
 $= -12 - 8i$

$$\begin{aligned} 50. \quad (7-i)(2+3i) \\ = 7 \cdot 2 + 7(3i) + (-i)(2) + (-i)(3i) \\ = 14 + 21i - 2i + 3 \\ = 17 + 19i \end{aligned}$$

$$\begin{aligned} 51. \quad (3-4i)^2 &= 3^2 + 2 \cdot 3(-4i) + (-4i)^2 \\ &= 9 - 24i - 16 \\ &= -7 - 24i \end{aligned}$$

$$52. \quad (7+8i)(7-8i) = 7^2 + 8^2 = 49 + 64 = 113$$

$$\begin{aligned} 53. \quad \frac{6}{5+i} &= \frac{6}{5+i} \cdot \frac{5-i}{5-i} \\ &= \frac{30-6i}{25+1} \\ &= \frac{30-6i}{26} \\ &= \frac{15-3i}{13} \\ &= \frac{15}{13} - \frac{3}{13}i \end{aligned}$$

$$\begin{aligned} 54. \quad \frac{3+4i}{4-2i} &= \frac{3+4i}{4-2i} \cdot \frac{4+2i}{4+2i} \\ &= \frac{12+6i+16i+8i^2}{16-4i^2} \\ &= \frac{12+22i-8}{16+4} \\ &= \frac{4+22i}{20} \\ &= \frac{1}{5} + \frac{11}{10}i \end{aligned}$$

$$\begin{aligned} 55. \quad \sqrt{-32} - \sqrt{-18} &= i\sqrt{32} - i\sqrt{18} \\ &= i\sqrt{16 \cdot 2} - i\sqrt{9 \cdot 2} \\ &= 4i\sqrt{2} - 3i\sqrt{2} \\ &= (4i-3i)\sqrt{2} \\ &= i\sqrt{2} \end{aligned}$$

$$\begin{aligned} 56. \quad (-2+\sqrt{-100})^2 &= (-2+i\sqrt{100})^2 \\ &= (-2+10i)^2 \\ &= 4 - 40i + (10i)^2 \\ &= 4 - 40i - 100 \\ &= -96 - 40i \end{aligned}$$

$$57. \quad \frac{4+\sqrt{-8}}{2} = \frac{4+i\sqrt{8}}{2} = \frac{4+2i\sqrt{2}}{2} = 2+i\sqrt{2}$$

$$\begin{aligned} 58. \quad 2x^2 + 15x &= 8 \\ 2x^2 + 15x - 8 &= 0 \\ (2x-1)(x+8) &= 0 \\ 2x-1=0 \quad x+8=0 \\ x=\frac{1}{2} \quad \text{or } x=-8 \end{aligned}$$

The solution set is $\left\{\frac{1}{2}, -8\right\}$.

$$\begin{aligned} 59. \quad 5x^2 + 20x &= 0 \\ 5x(x+4) &= 0 \\ 5x=0 \quad x+4=0 \\ x=0 \quad \text{or } x=-4 \\ \text{The solution set is } \{0, -4\}. \end{aligned}$$

$$\begin{aligned} 60. \quad 2x^2 - 3 &= 125 \\ 2x^2 &= 128 \\ x^2 &= 64 \\ x &= \pm 8 \\ \text{The solution set is } \{8, -8\}. \end{aligned}$$

$$\begin{aligned} 61. \quad \frac{x^2}{2} + 5 &= -3 \\ \frac{x^2}{2} &= -8 \\ x^2 &= -16 \\ \sqrt{x^2} &= \pm\sqrt{-16} \\ x &= \pm 4i \end{aligned}$$

$$\begin{aligned} 62. \quad (x+3)^2 &= -10 \\ \sqrt{(x+3)^2} &= \pm\sqrt{-10} \\ x+3 &= \pm i\sqrt{10} \\ x &= -3 \pm i\sqrt{10} \end{aligned}$$

$$\begin{aligned} 63. \quad (3x-4)^2 &= 18 \\ \sqrt{(3x-4)^2} &= \pm\sqrt{18} \\ 3x-4 &= \pm 3\sqrt{2} \\ 3x &= 4 \pm 3\sqrt{2} \\ \frac{3x}{3} &= \frac{4 \pm 3\sqrt{2}}{3} \\ x &= \frac{4 \pm 3\sqrt{2}}{3} \end{aligned}$$

$$\begin{aligned}
 64. \quad & x^2 + 20x \\
 & \left(\frac{20}{2}\right)^2 = 10^2 = 100 \\
 & x^2 + 20x + 100 = (x+10)^2
 \end{aligned}$$

$$\begin{aligned}
 65. \quad & x^2 - 3x \\
 & \left(\frac{3}{2}\right)^2 = \frac{9}{4} \\
 & x^2 - 3x + \frac{9}{4} = \left(x - \frac{3}{2}\right)^2
 \end{aligned}$$

$$\begin{aligned}
 66. \quad & x^2 - 12x = -27 \\
 & x^2 - 12x + 36 = -27 + 36 \\
 & (x-6)^2 = 9 \\
 & x-6 = \pm 3 \\
 & x = 6 \pm 3 \\
 & x = 9, 3 \\
 & \text{The solution set is } \{9, 3\}.
 \end{aligned}$$

$$\begin{aligned}
 67. \quad & 3x^2 - 12x + 11 = 0 \\
 & x^2 - 4x = -\frac{11}{3} \\
 & x^2 - 4x + 4 = -\frac{11}{3} + 4 \\
 & (x-2)^2 = \frac{1}{3} \\
 & x-2 = \pm \sqrt{\frac{1}{3}} \\
 & x = 2 \pm \frac{\sqrt{3}}{3} \\
 & \text{The solution set is } \left\{2 + \frac{\sqrt{3}}{3}, 2 - \frac{\sqrt{3}}{3}\right\}.
 \end{aligned}$$

$$\begin{aligned}
 68. \quad & x^2 = 2x + 4 \\
 & x^2 - 2x - 4 = 0 \\
 & x = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(-4)}}{2(1)} \\
 & x = \frac{2 \pm \sqrt{4+16}}{2} \\
 & x = \frac{2 \pm \sqrt{20}}{2} \\
 & x = \frac{2 \pm 2\sqrt{5}}{2} \\
 & x = 1 \pm \sqrt{5} \\
 & \text{The solution set is } \{1 + \sqrt{5}, 1 - \sqrt{5}\}.
 \end{aligned}$$

$$\begin{aligned}
 69. \quad & x^2 - 2x + 19 = 0 \\
 & x = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(19)}}{2(1)} \\
 & x = \frac{2 \pm \sqrt{4-76}}{2} \\
 & x = \frac{2 \pm \sqrt{-72}}{2} \\
 & x = \frac{2 \pm 6i\sqrt{2}}{2} \\
 & x = 1 \pm 3i\sqrt{2} \\
 & \text{The solution set is } \{1 + 3i\sqrt{2}, 1 - 3i\sqrt{2}\}.
 \end{aligned}$$

$$\begin{aligned}
 70. \quad & 2x^2 = 3 - 4x \\
 & 2x^2 + 4x - 3 = 0 \\
 & x = \frac{-4 \pm \sqrt{4^2 - 4(2)(-3)}}{2(2)} \\
 & x = \frac{-4 \pm \sqrt{16+24}}{4} \\
 & x = \frac{-4 \pm \sqrt{40}}{4} \\
 & x = \frac{-4 \pm 2\sqrt{10}}{4} \\
 & x = \frac{-2 \pm \sqrt{10}}{2} \\
 & \text{The solution set is } \left\{\frac{-2 + \sqrt{10}}{2}, \frac{-2 - \sqrt{10}}{2}\right\}.
 \end{aligned}$$

$$\begin{aligned}
 71. \quad x^2 - 4x + 13 &= 0 \\
 (-4)^2 - 4(1)(13) & \\
 &= 16 - 52 \\
 &= -36; 2 \text{ complex imaginary solutions}
 \end{aligned}$$

$$\begin{aligned}
 72. \quad 9x^2 &= 2 - 3x \\
 9x^2 + 3x - 2 &= 0 \\
 3^2 - 4(9)(-2) & \\
 &= 9 + 72 \\
 &= 81; 2 \text{ unequal real solutions}
 \end{aligned}$$

$$\begin{aligned}
 73. \quad 2x^2 - 11x + 5 &= 0 \\
 (2x - 1)(x - 5) &= 0 \\
 2x - 1 = 0 \quad x - 5 &= 0 \\
 x = \frac{1}{2} \text{ or } x &= 5
 \end{aligned}$$

The solution set is $\left\{5, \frac{1}{2}\right\}$.

$$\begin{aligned}
 74. \quad (3x + 5)(x - 3) &= 5 \\
 3x^2 + 5x - 9x - 15 &= 5 \\
 3x^2 - 4x - 20 &= 0 \\
 x = \frac{4 \pm \sqrt{(-4)^2 - 4(3)(-20)}}{2(3)} \\
 x = \frac{4 \pm \sqrt{16 + 240}}{6} \\
 x = \frac{4 \pm \sqrt{256}}{6} \\
 x = \frac{4 \pm 16}{6} \\
 x = \frac{20}{6}, \frac{-12}{6} \\
 x = \frac{10}{3}, -2
 \end{aligned}$$

The solution set is $\left\{-2, \frac{10}{3}\right\}$.

$$\begin{aligned}
 75. \quad 3x^2 - 7x + 1 &= 0 \\
 x = \frac{7 \pm \sqrt{(-7)^2 - 4(3)(1)}}{2(3)} \\
 x = \frac{7 \pm \sqrt{49 - 12}}{6} \\
 x = \frac{7 \pm \sqrt{37}}{6}
 \end{aligned}$$

The solution set is $\left\{\frac{7 + \sqrt{37}}{6}, \frac{7 - \sqrt{37}}{6}\right\}$.

$$\begin{aligned}
 76. \quad x^2 - 9 &= 0 \\
 x^2 &= 9 \\
 x &= \pm 3 \\
 \text{The solution set is } &\{-3, 3\}.
 \end{aligned}$$

$$\begin{aligned}
 77. \quad (x - 3)^2 - 25 &= 0 \\
 (x - 3)^2 &= 25 \\
 x - 3 &= \pm 5 \\
 x &= 3 \pm 5 \\
 x &= 8, -2 \\
 \text{The solution set is } &\{8, -2\}.
 \end{aligned}$$

$$\begin{aligned}
 78. \quad 3x^2 - x + 2 &= 0 \\
 x = \frac{1 \pm \sqrt{(-1)^2 - 4(3)(2)}}{2(3)} \\
 x = \frac{1 \pm \sqrt{1 - 24}}{6} \\
 x = \frac{1 \pm \sqrt{-23}}{6} \\
 x = \frac{1 \pm i\sqrt{23}}{6} \\
 \text{The solution set is } &\left\{\frac{1 + i\sqrt{23}}{6}, \frac{1 - i\sqrt{23}}{6}\right\}.
 \end{aligned}$$

$$\begin{aligned}
 79. \quad 3x^2 - 10x &= 8 \\
 3x^2 - 10x - 8 &= 0 \\
 (3x + 2)(x - 4) &= 0 \\
 3x + 2 = 0 \quad \text{or} \quad x - 4 &= 0 \\
 3x = -2 \quad \text{or} \quad x &= 4 \\
 x = -\frac{2}{3}
 \end{aligned}$$

The solution set is $\left\{-\frac{2}{3}, 4\right\}$.

$$\begin{aligned}
 80. \quad (x + 2)^2 + 4 &= 0 \\
 (x + 2)^2 &= -4 \\
 \sqrt{(x + 2)^2} &= \pm \sqrt{-4} \\
 x + 2 &= \pm 2i \\
 x &= -2 \pm 2i \\
 \text{The solution set is } &\{-2 + 2i, -2 - 2i\}.
 \end{aligned}$$

81.
$$\frac{5}{x+1} + \frac{x-1}{4} = 2$$

$$\frac{5 \cdot 4(x+1)}{x+1} + \frac{(x-1) \cdot 4(x+1)}{4} = 2 \cdot 4(x+1)$$

$$20 + (x-1)(x+1) = 8(x+1)$$

$$20 + x^2 - 1 = 8x + 8$$

$$x^2 - 8x - 11 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(11)}}{2(1)}$$

$$x = \frac{8 \pm \sqrt{20}}{2}$$

$$x = \frac{8 \pm 2\sqrt{5}}{2}$$

$$x = 4 \pm \sqrt{5}$$

The solution set is $\{4 + \sqrt{5}, 4 - \sqrt{5}\}$.

82. $W(t) = 3t^2$

$$588 = 3t^2$$

$$196 = t^2$$

Apply the square root property.

$$t^2 = 196$$

$$t = \pm \sqrt{196}$$

$$t = \pm 14$$

The solutions are -14 and 14. We disregard -14, because we cannot have a negative time measurement. The fetus will weigh 588 grams after 14 weeks.

83. a. 2011 is 8 years after 2003.

$$B = 1.7x^2 + 6x + 26$$

$$B = 1.7(8)^2 + 6(8) + 26$$

$$= 182.8$$

$$\approx 183$$

According to the function, in 2011 there were 183 "Bicycle Friendly" communities. This overestimates the number shown in the graph by 3.

b. $B = 1.7x^2 + 6x + 26$

$$826 = 1.7x^2 + 6x + 26$$

$$0 = 1.7x^2 + 6x - 800$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(6) \pm \sqrt{(6)^2 - 4(1.7)(-800)}}{2(1.7)}$$

$$= \frac{-6 \pm \sqrt{36 + 5440}}{2(1.7)}$$

$$= \frac{-6 \pm \sqrt{5476}}{3.4}$$

$$= \frac{-6 \pm 74}{3.4}$$

$$x = 20 \text{ or } -23\frac{9}{17}$$

According to the function, there will be 826 "Bicycle Friendly" communities 20 years after 2003, or 2023.

84. $A = lw$

$$15 = l(2l - 7)$$

$$15 = 2l^2 - 7l$$

$$0 = 2l^2 - 7l - 15$$

$$0 = (2l + 3)(l - 5)$$

$$l = 5$$

$$2l - 7 = 3$$

The length is 5 yards, the width is 3 yards.

85. Let x = height of building
 $2x$ = shadow height

$$x^2 + (2x)^2 = 300^2$$

$$x^2 + 4x^2 = 90,000$$

$$5x^2 = 90,000$$

$$x^2 = 18,000$$

$$x \approx \pm 134.164$$

Discard negative height.
 The building is approximately 134 meters high.

86. $2x^4 = 50x^2$

$$2x^4 - 50x^2 = 0$$

$$2x^2(x^2 - 25) = 0$$

$$x = 0$$

$$x = \pm 5$$

The solution set is $\{-5, 0, 5\}$.

$$87. \quad 2x^3 - x^2 - 18x + 9 = 0$$

$$x^2(2x-1) - 9(2x-1) = 0$$

$$(x^2 - 9)(2x-1) = 0$$

$$x = \pm 3, \quad x = \frac{1}{2}$$

The solution set is $\left\{-3, \frac{1}{2}, 3\right\}$.

$$88. \quad \sqrt{2x-3} + x = 3$$

$$\sqrt{2x-3} = 3-x$$

$$2x-3 = 9-6x+x^2$$

$$x^2 - 8x + 12 = 0$$

$$x^2 - 8x = -12$$

$$x^2 - 8x + 16 = -12 + 16$$

$$(x-4)^2 = 4$$

$$x-4 = \pm 2$$

$$x = 4 + 2$$

$$x = 6, 2$$

The solution set is $\{2\}$.

$$89. \quad \sqrt{x-4} + \sqrt{x+1} = 5$$

$$\sqrt{x-4} = 5 - \sqrt{x+1}$$

$$x-4 = 25 - 10\sqrt{x+1} + (x+1)$$

$$x-4 = 26 + x - 10\sqrt{x+1}$$

$$-30 = -10\sqrt{x+1}$$

$$3 = \sqrt{x+1}$$

$$9 = x+1$$

$$x = 8$$

The solution set is $\{8\}$.

$$90. \quad 3x^{\frac{3}{4}} - 24 = 0$$

$$3x^{\frac{3}{4}} = 24$$

$$x^{\frac{3}{4}} = 8$$

$$\left(x^{\frac{3}{4}}\right)^{\frac{4}{3}} = (8)^{\frac{4}{3}}$$

$$x = 16$$

The solution set is $\{16\}$.

$$91. \quad (x-7)^{\frac{2}{3}} = 25$$

$$\left[(x-7)^{\frac{2}{3}}\right]^{\frac{3}{2}} = 25^{\frac{3}{2}}$$

$$x-7 = (5^2)^{\frac{3}{2}}$$

$$x-7 = 5^3$$

$$x-7 = 125$$

$$x = 132$$

The solution set is $\{132\}$.

$$92. \quad x^4 - 5x^2 + 4 = 0$$

$$\text{Let } t = x^2$$

$$t^2 - 5t + 4 = 0$$

$$t = 4 \quad \text{or} \quad t = 1$$

$$x^2 = 4 \quad x^2 = 1$$

$$x = \pm 2 \quad x = \pm 1$$

The solution set is $\{-2, -1, 1, 2\}$.

$$93. \quad x^{1/2} + 3x^{1/4} - 10 = 0$$

$$\text{Let } t = x^{1/4}$$

$$t^2 + 3t - 10 = 0$$

$$(t+5)(t-2) = 0$$

$$t = -5 \quad \text{or} \quad t = 2$$

$$x^{\frac{1}{4}} = -5 \quad x^{\frac{1}{4}} = 2$$

$$\left(x^{\frac{1}{4}}\right)^4 = (-5)^4 \quad \left(x^{\frac{1}{4}}\right)^4 = (2)^4$$

$$x = 625 \quad x = 16$$

625 does not check and must be rejected.

The solution set is $\{16\}$.

$$94. \quad |2x+1| = 7$$

$$2x+1 = 7 \quad \text{or} \quad 2x+1 = -7$$

$$2x = 6 \quad 2x = -8$$

$$x = 3 \quad x = -8$$

The solution set is $\{-8, 3\}$.

$$95. \quad 2|x-3| - 6 = 10$$

$$2|x-3| = 16$$

$$|x-3| = 8$$

$$x-3 = 8 \quad \text{or} \quad x-3 = -8$$

$$x = 11 \quad x = -5$$

The solution set is $\{-5, 11\}$.

96. $3x^{4/3} - 5x^{2/3} + 2 = 0$

Let $t = x^{2/3}$.

$$3t^2 - 5t + 2 = 0$$

$$(3t-2)(t-1) = 0$$

$$3t-2=0$$

$$3t=2$$

$$t = \frac{2}{3}$$

$$x^{2/3} = \frac{2}{3}$$

$$\left(x^{2/3}\right)^{3/2} = \pm \left(\frac{2}{3}\right)^{3/2}$$

$$x = \pm \sqrt[3]{\left(\frac{2}{3}\right)^3}$$

$$x = \pm \frac{2}{3} \sqrt{\frac{2}{3}}$$

$$x = \pm \frac{2}{3} \cdot \frac{\sqrt{2}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$$

$$x = \pm \frac{2\sqrt{6}}{9}$$

The solution set is $\left\{-\frac{2\sqrt{6}}{9}, \frac{2\sqrt{6}}{9}, -1, 1\right\}$.

97. $2\sqrt{x-1} = x$

$$4(x-1) = x^2$$

$$4x-4 = x^2$$

$$x^2 - 4x + 4 = 0$$

$$(x-2)^2 = 0$$

$$x = 2$$

The solution set is $\{2\}$.

98. $|2x-5|-3=0$

$$2x-5=3 \quad \text{or} \quad 2x-5=-3$$

$$2x=8 \quad 2x=2$$

$$x=4 \quad x=1$$

The solution set is $\{4, 1\}$.

99. $x^3 + 2x^2 - 9x - 18 = 0$

$$x^2(x+2) - 9(x+2) = 0$$

$$(x+2)(x^2-9) = 0$$

$$(x+2)(x+3)(x-3) = 0$$

The solution set is $\{-3, -2, 3\}$.

100. $\sqrt{8-2x} - x = 0$

$$\sqrt{8-2x} = x$$

$$(\sqrt{8-2x})^2 = (x)^2$$

$$8-2x = x^2$$

$$0 = x^2 + 2x - 8$$

$$0 = (x+4)(x-2)$$

$$x+4=0 \quad \text{or} \quad x-2=0$$

$$x=-4 \quad x=2$$

-4 does not check.

The solution set is $\{2\}$.

101. $x^3 + 3x^2 - 2x - 6 = 0$

$$x^2(x+3) - 2(x+3) = 0$$

$$(x+3)(x^2-2) = 0$$

$$x+3=0 \quad \text{or} \quad x^2-2=0$$

$$x=-3 \quad x^2=2$$

$$x = \pm\sqrt{2}$$

The solution set is $\{-3, -\sqrt{2}, \sqrt{2}\}$.

102. $-4|x+1|+12=0$

$$-4|x+1| = -12$$

$$|x+1| = 3$$

$$x+1=3 \quad \text{or} \quad x+1=-3$$

$$x=2 \quad x=-4$$

The solution set is $\{-4, 2\}$.

103. $p = -2.5\sqrt{t} + 17$

$$7 = -2.5\sqrt{t} + 17$$

$$-10 = -2.5\sqrt{t}$$

$$4 = \sqrt{t}$$

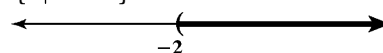
$$16 = t$$

The percentage will drop to 7% 16 years after 1993, or 2009.

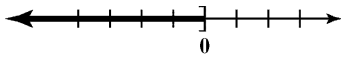
104. $\{x | -3 \leq x < 5\}$



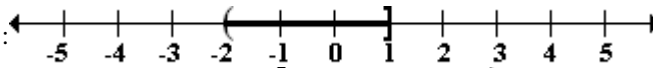
105. $\{x | x > -2\}$



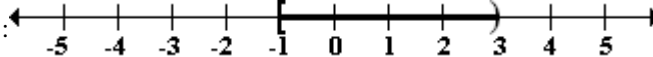
106. $\{x|x \leq 0\}$



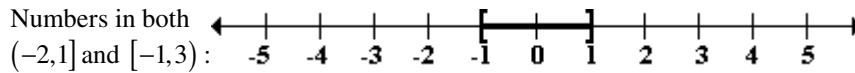
107. Graph $(-2, 1]$:



Graph $[-1, 3)$:

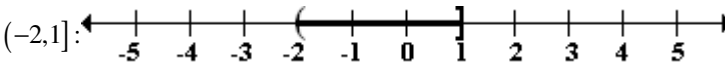


To find the intersection, take the portion of the number line that the two graphs have in common.

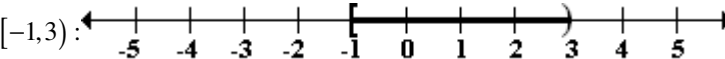


Thus, $(-2, 1] \cap [-1, 3) = [-1, 1]$.

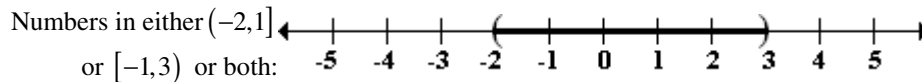
108. Graph $(-2, 1]$:



Graph $[-1, 3)$:

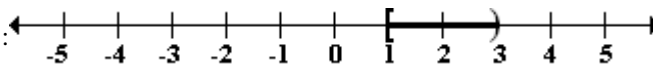


To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

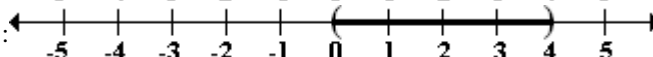


Thus, $(-2, 1] \cup [-1, 3) = (-2, 3)$.

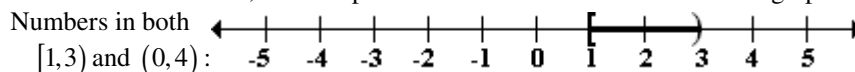
109. Graph $[1, 3)$:



Graph $(0, 4)$:

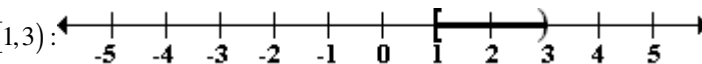


To find the intersection, take the portion of the number line that the two graphs have in common.

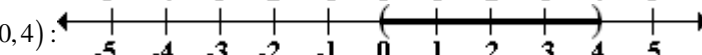


Thus, $[1, 3) \cap (0, 4) = [1, 3)$.

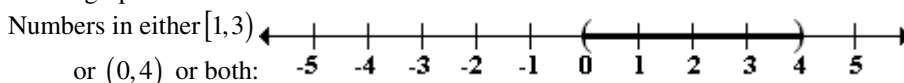
110. Graph $[1, 3)$:



Graph $(0, 4)$:



To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

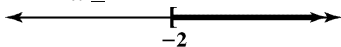


Thus, $[1, 3) \cup (0, 4) = (0, 4)$.

111. $-6x + 3 \leq 15$

$-6x \leq 12$

$x \geq 2$

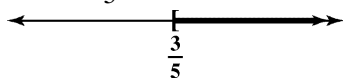


The solution set is $[2, \infty)$.

112. $6x - 9 \geq -4x - 3$

$10x \geq 6$

$x \geq \frac{3}{5}$

The solution set is $\left[\frac{3}{5}, \infty\right)$.

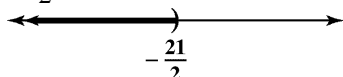
113. $\frac{x}{3} - \frac{3}{4} - 1 > \frac{x}{2}$

$12\left(\frac{x}{3} - \frac{3}{4} - 1\right) > 12\left(\frac{x}{2}\right)$

$4x - 9 - 12 > 6x$

$-21 > 2x$

$-\frac{21}{2} > x$

The solution set is $\left(-\infty, -\frac{21}{2}\right)$.

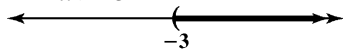
114. $6x + 5 > -2(x - 3) - 25$

$6x + 5 > -2x + 6 - 25$

$8x + 5 > -19$

$8x > -24$

$x > -3$

The solution set is $(-3, \infty)$.

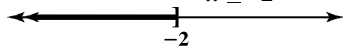
115. $3(2x - 1) - 2(x - 4) \geq 7 + 2(3 + 4x)$

$6x - 3 - 2x + 8 \geq 7 + 6 + 8x$

$4x + 5 \geq 8x + 13$

$-4x \geq 8$

$x \leq -2$

The solution set is $[-\infty, -2]$.

116. $5(x - 2) - 3(x + 4) \geq 2x - 20$

$5x - 10 - 3x - 12 \geq 2x - 20$

$2x - 22 \geq 2x - 20$

$-22 \geq -20$

The solution set is \emptyset .

117. $7 < 2x + 3 \leq 9$

$4 < 2x \leq 6$

$2 < x \leq 3$

$(2, 3]$

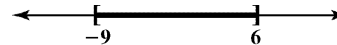
The solution set is $[2, 3]$.

118. $|2x + 3| \leq 15$

$-15 \leq 2x + 3 \leq 15$

$-18 \leq 2x \leq 12$

$-9 \leq x \leq 6$

The solution set is $[-9, 6]$.

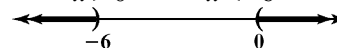
119. $\left|\frac{2x+6}{3}\right| > 2$

$\frac{2x+6}{3} > 2 \quad \frac{2x+6}{3} < -2$

$2x+6 > 6 \quad 2x+6 < -6$

$2x > 0 \quad 2x < -12$

$x > 0 \quad x < -6$

The solution set is $(-\infty, -6)$ or $(0, \infty)$.

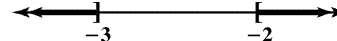
120. $|2x + 5| - 7 \geq -6$

$|2x + 5| \geq 1$

$2x + 5 \geq 1 \text{ or } 2x + 5 \leq -1$

$2x \geq -4 \quad 2x \leq -6$

$x \geq -2 \text{ or } x \leq -3$

The solution set is $(-\infty, -3]$ or $[-2, \infty)$.

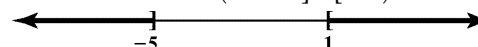
121. $-4|x + 2| + 5 \leq -7$

$-4|x + 2| \leq -12$

$|x + 2| \geq 3$

$x + 2 \geq 3 \text{ or } x + 2 \leq -3$

$x \geq 1 \text{ or } x \leq -5$

The solution set is $(-\infty, -5] \cup [1, \infty)$.

122. $y_1 > y_2$
 $-10 - 3(2x + 1) > 8x + 1$
 $-10 - 6x - 3 > 8x + 1$
 $-6x - 13 > 8x + 1$
 $-14x > 14$
 $\frac{-14x}{-14} < \frac{14}{-14}$
 $x < -1$
The solution set is $(-\infty, -1)$.

123. $3 - |2x - 5| \geq -6$
 $-|2x - 5| \geq -9$
 $\frac{-|2x - 5|}{-1} \leq \frac{-9}{-1}$
 $|2x - 5| \leq 9$
 $-9 \leq 2x - 5 \leq 9$
 $-4 \leq 2x \leq 14$
 $-2 \leq x \leq 7$
The solution set is $[-2, 7]$.

124. $0.20x + 24 \leq 40$
 $0.20x \leq 16$
 $\frac{0.20x}{0.20} \leq \frac{16}{0.20}$
 $x \leq 80$
A customer can drive no more than 80 miles.

125. $80 \leq \frac{95 + 79 + 91 + 86 + x}{5} < 90$
 $400 \leq 95 + 79 + 91 + 86 + x < 450$
 $400 \leq 351 + x < 450$
 $49 \leq x < 99$
A grade of at least 49% but less than 99% will result in a B.

126. $0.075x \geq 9000$
 $\frac{0.075x}{0.075} \geq \frac{9000}{0.075}$
 $x \geq 120,000$
The investment must be at least \$120,000.

Chapter 1 Test

1. $7(x - 2) = 4(x + 1) - 21$
 $7x - 14 = 4x + 4 - 21$
 $7x - 14 = 4x - 17$
 $3x = -3$
 $x = -1$
The solution set is $\{-1\}$.

2. $-10 - 3(2x + 1) - 8x - 1 = 0$
 $-10 - 6x - 3 - 8x - 1 = 0$
 $-14x - 14 = 0$
 $-14x = 14$
 $x = -1$
The solution set is $\{-1\}$.

3. $\frac{2x - 3}{4} = \frac{x - 4}{2} - \frac{x + 1}{4}$
 $2x - 3 = 2(x - 4) - (x + 1)$
 $2x - 3 = 2x - 8 - x - 1$
 $2x - 3 = x - 9$
 $x = -6$
The solution set is $\{-6\}$.

4. $\frac{2}{x - 3} - \frac{4}{x + 3} = \frac{8}{(x - 3)(x + 3)}$
 $2(x + 3) - 4(x - 3) = 8$
 $2x + 6 - 4x + 12 = 8$
 $-2x + 18 = 8$
 $-2x = -10$
 $x = 5$
The solution set is $\{5\}$.

5. $2x^2 - 3x - 2 = 0$
 $(2x + 1)(x - 2) = 0$
 $2x + 1 = 0$ or $x - 2 = 0$
 $x = -\frac{1}{2}$ or $x = 2$
The solution set is $\left\{-\frac{1}{2}, 2\right\}$.

6. $(3x - 1)^2 = 75$
 $3x - 1 = \pm\sqrt{75}$
 $3x = 1 \pm 5\sqrt{3}$
 $x = \frac{1 \pm 5\sqrt{3}}{3}$
The solution set is $\left\{\frac{1 - 5\sqrt{3}}{3}, \frac{1 + 5\sqrt{3}}{3}\right\}$.

7. $(x+3)^2 + 25 = 0$

$$(x+3)^2 = -25$$

$$x+3 = \pm\sqrt{-25}$$

$$x = -3 \pm 5i$$

The solution set is $\{-3+5i, -3-5i\}$.

8. $x(x-2) = 4$

$$x^2 - 2x - 4 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(-4)}}{2}$$

$$x = \frac{2 \pm 2\sqrt{5}}{2}$$

$$x = 1 \pm \sqrt{5}$$

The solution set is $\{1-\sqrt{5}, 1+\sqrt{5}\}$.

9. $4x^2 = 8x - 5$

$$4x^2 - 8x + 5 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(4)(5)}}{2(4)}$$

$$x = \frac{8 \pm \sqrt{-16}}{8}$$

$$x = \frac{8 \pm 4i}{8}$$

$$x = 1 \pm \frac{1}{2}i$$

The solution set is $\left\{1 + \frac{1}{2}i, 1 - \frac{1}{2}i\right\}$.

10. $x^3 - 4x^2 - x + 4 = 0$

$$x^2(x-4) - 1(x-4) = 0$$

$$(x^2 - 1)(x-4) = 0$$

$$(x-1)(x+1)(x-4) = 0$$

$$x=1 \text{ or } x=-1 \text{ or } x=4$$

The solution set is $\{-1, 1, 4\}$.

11. $\sqrt{x-3} + 5 = x$

$$\sqrt{x-3} = x-5$$

$$x-3 = x^2 - 10x + 25$$

$$x^2 - 11x + 28 = 0$$

$$x = \frac{11 \pm \sqrt{11^2 - 4(1)(28)}}{2(1)}$$

$$x = \frac{11 \pm \sqrt{121 - 112}}{2}$$

$$x = \frac{11 \pm \sqrt{9}}{2}$$

$$x = \frac{11 \pm 3}{2}$$

$$x = 7 \text{ or } x = 4$$

4 does not check and must be rejected.

The solution set is $\{7\}$.

12. $\sqrt{8-2x} - x = 0$

$$\sqrt{8-2x} = x$$

$$(\sqrt{8-2x})^2 = (x)^2$$

$$8-2x = x^2$$

$$0 = x^2 + 2x - 8$$

$$0 = (x+4)(x-2)$$

$$x+4=0 \text{ or } x-2=0$$

$$x=-4 \text{ or } x=2$$

-4 does not check and must be rejected.

The solution set is $\{2\}$.

13. $\sqrt{x+4} + \sqrt{x-1} = 5$

$$\sqrt{x+4} = 5 - \sqrt{x-1}$$

$$x+4 = 25 - 10\sqrt{x-1} + (x-1)$$

$$x+4 = 25 - 10\sqrt{x-1} + x-1$$

$$-20 = -10\sqrt{x-1}$$

$$2 = \sqrt{x-1}$$

$$4 = x-1$$

$$x = 5$$

The solution set is $\{5\}$.

14. $5x^{3/2} - 10 = 0$

$$5x^{3/2} = 10$$

$$x^{3/2} = 2$$

$$x = 2^{2/3}$$

$$x = \sqrt[3]{4}$$

The solution set is $\{\sqrt[3]{4}\}$.

15. $x^{2/3} - 9x^{1/3} + 8 = 0$ let $t = x^{1/3}$

$$t^2 - 9t + 8 = 0$$

$$(t-1)(t-8) = 0$$

$$t = 1 \quad t = 8$$

$$x^{1/3} = 1 \quad x^{1/3} = 8$$

$$x = 1 \quad x = 512$$

The solution set is $\{1, 512\}$.

16. $\left| \frac{2}{3}x - 6 \right| = 2$

$$\frac{2}{3}x - 6 = 2 \quad \frac{2}{3}x - 6 = -2$$

$$\frac{2}{3}x = 8 \quad \frac{2}{3}x = 4$$

$$x = 12 \quad x = 6$$

The solution set is $\{6, 12\}$.

17. $-3|4x-7|+15=0$

$$-3|4x-7| = -15$$

$$|4x-7| = 5$$

$$4x-7=5 \quad \text{or} \quad 4x-7=-5$$

$$4x=12 \quad \text{or} \quad 4x=2$$

$$x=3 \quad x=\frac{1}{2}$$

The solution set is $\left\{ \frac{1}{2}, 3 \right\}$

18. $\frac{1}{x^2} - \frac{4}{x} + 1 = 0$

$$\frac{x^2}{x^2} - \frac{4x^2}{x^2} + x^2 = 0$$

$$1 - 4x + x^2 = 0$$

$$x^2 - 4x + 1 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(1)}}{2(1)}$$

$$x = \frac{4 \pm \sqrt{12}}{2}$$

$$x = \frac{4 \pm 2\sqrt{3}}{2}$$

$$x = 2 \pm \sqrt{3}$$

The solution set is $\{2 + \sqrt{3}, 2 - \sqrt{3}\}$.

19. $\frac{2x}{x^2+6x+8} + \frac{2}{x+2} = \frac{x}{x+4}$

$$\frac{2x}{(x+4)(x+2)} + \frac{2}{x+2} = \frac{x}{x+4}$$

$$\frac{2x(x+4)(x+2)}{(x+4)(x+2)} + \frac{2(x+4)(x+2)}{x+2} = \frac{x(x+4)(x+2)}{x+4}$$

$$2x + 2(x+4) = x(x+2)$$

$$2x + 2x + 8 = x^2 + 2x$$

$$2x + 8 = x^2$$

$$0 = x^2 - 2x - 8$$

$$0 = (x-4)(x+2)$$

$$x-4=0 \quad \text{or} \quad x+2=0$$

$$x=4 \quad x=-2 \text{ (rejected)}$$

The solution set is $\{4\}$.

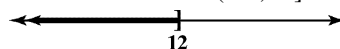
20. $3(x+4) \geq 5x-12$

$$3x+12 \geq 5x-12$$

$$-2x \geq -24$$

$$x \leq 12$$

The solution set is $(-\infty, 12]$.



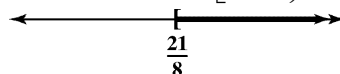
21. $\frac{x}{6} + \frac{1}{8} \leq \frac{x}{2} - \frac{3}{4}$

$$4x+3 \leq 12x-18$$

$$-8x \leq -21$$

$$x \geq \frac{21}{8}$$

The solution set is $\left[\frac{21}{8}, \infty \right)$.



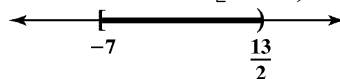
22. $-3 \leq \frac{2x+5}{3} < 6$

$$-9 \leq 2x+5 < 18$$

$$-14 \leq 2x < 13$$

$$-7 \leq x < \frac{13}{2}$$

The solution set is $\left[-7, \frac{13}{2} \right)$.

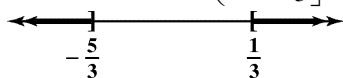


23. $|3x+2| \geq 3$

$3x+2 \geq 3 \quad \text{or} \quad 3x+2 \leq -3$

$3x \geq 1 \quad 3x \leq -5$

$x \geq \frac{1}{3} \quad x \leq -\frac{5}{3}$

The solution set is $\left(-\infty, -\frac{5}{3}\right] \cup \left[\frac{1}{3}, \infty\right)$.

24. $-3 \leq y \leq 7$

$-3 \leq 2x-5 \leq 7$

$2 \leq 2x \leq 12$

$1 \leq x \leq 6$

The solution set is $[1, 6]$.

25. $y \geq 1$

$\left|\frac{2-x}{4}\right| \geq 1$

$\frac{2-x}{4} \geq 1 \quad \text{or} \quad \frac{2-x}{4} \leq -1$

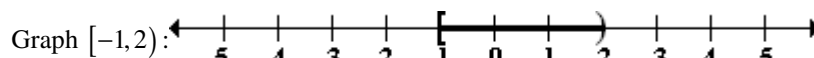
$2-x \geq 4 \quad 2-x \leq -4$

$-x \geq 2 \quad -x \leq -6$

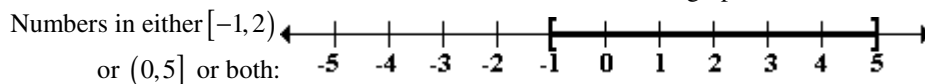
$x \leq -2 \quad x \geq 6$

The solution set is $(-\infty, -2] \cup [6, \infty)$.

26.



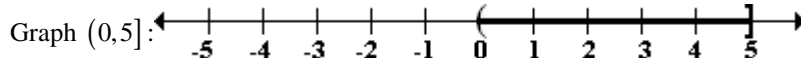
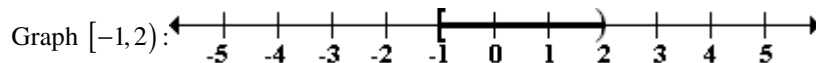
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.



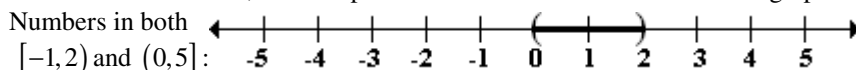
Thus,

$[-1, 2) \cup (0, 5] = [-1, 5]$.

27.



To find the intersection, take the portion of the number line that the two graphs have in common.



Thus, $[-1, 2) \cap (0, 5] = (0, 2)$.

$$28. \quad V = \frac{1}{3}lwh$$

$$3V = lwh$$

$$\frac{3V}{lw} = \frac{lwh}{lw}$$

$$\frac{3V}{lw} = h$$

$$h = \frac{3V}{lw}$$

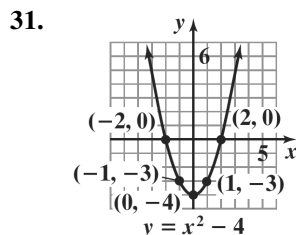
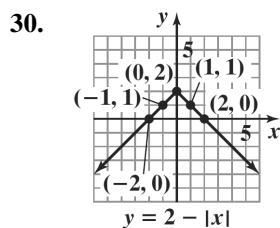
$$29. \quad y - y_1 = m(x - x_1)$$

$$y - y_1 = mx - mx_1$$

$$-mx = y_1 - mx_1 - y$$

$$\frac{-mx}{-m} = \frac{y_1 - mx_1 - y}{-m}$$

$$x = \frac{y - y_1}{m} + x_1$$



$$32. \quad (6 - 7i)(2 + 5i) = 12 + 30i - 14i - 35i^2$$

$$= 12 + 16i + 35$$

$$= 47 + 16i$$

$$33. \quad \frac{5}{2-i} = \frac{5}{2-i} \cdot \frac{2+i}{2+i}$$

$$= \frac{5(2+i)}{4+1}$$

$$= \frac{5(2+i)}{5}$$

$$= 2+i$$

$$34. \quad 2\sqrt{-49} + 3\sqrt{-64} = 2(7i) + 3(8i)$$

$$= 14i + 24i$$

$$= 38i$$

$$35. \quad 43x + 575 = 1177$$

$$43x = 602$$

$$x = 14$$

The system's income will be \$1177 billion 14 years after 2004, or 2018.

$$36. \quad B = 0.07x^2 + 47.4x + 500$$

$$1177 = 0.07x^2 + 47.4x + 500$$

$$0 = 0.07x^2 + 47.4x - 677$$

$$0 = 0.07x^2 + 47.4x - 677$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(47.4) \pm \sqrt{(47.4)^2 - 4(0.07)(-677)}}{2(0.07)}$$

$$x \approx 14, \quad x \approx -691 \text{ (rejected)}$$

The system's income will be \$1177 billion 14 years after 2004, or 2018.

37. The formulas model the data quite well.

38. Let x = the percentage of strikingly-attractive men.
 Let $x + 57$ = the percentage of average-looking men.
 Let $x + 25$ = the percentage of good-looking men.

$$(x) + (x + 57) + (x + 25) = 88$$

$$x + x + 57 + x + 25 = 88$$

$$3x + 82 = 88$$

$$3x = 6$$

$$x = 2$$

$$x + 57 = 59$$

$$x + 25 = 27$$

2% of men are strikingly-attractive.

59% of men are average-looking.

27% of men are good-looking.

$$39. \quad 29700 + 150x = 5000 + 1100x$$

$$24700 = 950x$$

$$26 = x$$

In 26 years, the cost will be \$33,600.

40. Let x = amount invested at 8%
 $10000 - x$ = amount invested at 10%
 $0.08x + 0.1(10000 - x) = 940$
 $0.08x + 1000 - 0.1x = 940$
 $-0.02x = -60$
 $x = 3000$
 $10000 - x = 7000$
 \$3000 at 8%, \$7000 at 10%

41. $l = 2w + 4$
 $A = lw$
 $48 = (2w + 4)w$
 $48 = 2w^2 + 4w$
 $0 = 2w^2 + 4w - 48$
 $0 = w^2 + 2w - 24$
 $0 = (w + 6)(w - 4)$
 $w + 6 = 0$ $w - 4 = 0$
 $w = -6$ $w = 4$
 $2w + 4 = 2(4) + 4 = 12$
 width is 4 feet, length is 12 feet

42. $24^2 + x^2 = 26^2$
 $576 + x^2 = 676$
 $x^2 = 100$
 $x = \pm 10$
 The wire should be attached 10 feet up the pole.

43. Let x = the original selling price
 $20 = x - 0.60x$
 $20 = 0.40x$
 $50 = x$
 The original price is \$50.

44. Let x = the number text messages.
 The monthly cost using Plan A is $C_A = 25$.
 The monthly cost using Plan B is $C_B = 13 + 0.06x$.
 For Plan A to be better deal, it must cost less than Plan B.
 $C_A < C_B$
 $25 < 13 + 0.06x$
 $12 < 0.06x$
 $200 < x$
 $x > 200$
 Plan A is a better deal when more than 200 text messages per month are sent/received.