Algebra and Trigonometry 5th Edition Blitzer Solutions Manual
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Section 1.6

Check Point Exercises

1.
$$4x^4 = 12x^2$$
$$4x^4 - 12x^2 = 0$$
$$4x^2\left(x^2 - 3\right) = 0$$
$$4x^2 = 0 \quad \text{or} \quad x^2 - 3 = 0$$
$$x^2 = 0 \qquad x^2 = 3$$
$$x = \pm\sqrt{0} \qquad x = \pm\sqrt{3}$$
$$x = 0 \qquad x = \pm\sqrt{3}$$
The solution set is $\left\{-\sqrt{3}, 0, \sqrt{3}\right\}$.

2.
$$2x^3 + 3x^2 = 8x + 12$$
$$x^2(2x+3) - 4(2x+3) = 10$$
$$(2x+3)(x^2-4) = 0$$
$$2x + 3 = 0 \quad \text{or} \quad x^2 - 4 = 0$$
$$2x = -3 \qquad x^2 = 4$$
$$x = -\frac{3}{2} \qquad x = \pm 2$$
The solution set is $\left\{-2, -\frac{3}{2}, 2\right\}$.

3.
$$\sqrt{x+3} + 3 = x$$
$$\sqrt{x+3} = x - 3$$
$$\left(\sqrt{x+3}\right)^2 = (x-3)^2$$
$$x + 3 = x^2 - 6x + 9$$
$$0 = x^2 - 7x + 6$$
$$0 = (x-6)(x-1)$$
$$x - 6 = 0 \quad \text{or} \quad x - 1 = 0$$
$$x = 6 \qquad x = 1$$
1 does not check and must be rejected.
The solution set is $\{6\}$.

4.
$$\sqrt{x+5} - \sqrt{x-3} = 2$$
$$\sqrt{x+5} = 2 + \sqrt{x-3}$$
$$\left(\sqrt{x+5}\right)^2 = \left(2 + \sqrt{x-3}\right)^2$$
$$x + 5 = (2)^2 + 2(2)\left(\sqrt{x-3}\right) + \left(\sqrt{x-3}\right)^2$$
$$x + 5 = 4 + 4\sqrt{x-3} + x - 3$$
$$4 = 4\sqrt{x-3}$$
$$\frac{4}{4} = \frac{4\sqrt{x-3}}{4}$$
$$1 = \sqrt{x-3}$$
$$(1)^2 = \left(\sqrt{x-3}\right)^2$$
$$1 = x - 3$$
$$4 = x$$
The check indicates that 4 is a solution.
The solution set is $\{4\}$.

5. **a.**
$$5x^{3/2} - 25 = 0$$
$$5x^{3/2} = 25$$
$$x^{3/2} = 5$$
$$\left(x^{3/2}\right)^{2/3} = (5)^{2/3}$$
$$x = 5^{2/3} \quad \text{or} \quad \sqrt[3]{25}$$

Check:
$$5\left(5^{2/3}\right)^{3/2} - 25 = 0$$
$$5(5) - 25 = 0$$
$$25 - 25 = 0$$
$$0 = 0$$
The solution set is $\left\{5^{2/3}\right\}$ or $\left\{\sqrt[3]{25}\right\}$.

b.
$$x^{\frac{2}{3}} - 8 = -4$$
$$x^{2/3} = 4$$
$$\left(x^{2/3}\right)^{3/2} = 4^{3/2} \quad \text{or}$$
$$x = \left(2^2\right)^{3/2} \qquad x = (-2)^3$$
$$x = 2^3 \qquad x = -8$$
$$x = 8$$
The solution set is $\{-8, 8\}$.

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

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

Let $t = x^2$.

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

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

$t - 3 = 0$ or $t - 2 = 0$

$t = 3$ or $t = 2$

$x^2 = 3$ or $x^2 = 2$

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

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

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

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

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

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

$3t + 1 = 0$ or $t - 4 = 0$

$3t = -1$

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

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

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

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

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

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

$2x - 1 = 5$ or $2x - 1 = -5$

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

$x = 3$ $\qquad x = -2$

The solution set is {–2, 3}.

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

$4|1 - 2x| = 20$

$|1 - 2x| = 5$

$1 - 2x = 5$ or $1 - 2x = -5$

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

$x = -2$ $\qquad x = 3$

The solution set is {–2, 3}.

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

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

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

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

$15 = \sqrt{I}$

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

$225 = I$

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 8*x* 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. $5^{\frac{4}{3}}$

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

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

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

10. c; $-c$

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

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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 $\left\{-2, \frac{1}{2}, -\frac{1}{2}\right\}$.

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8.
$$9y^3 + 8 = 4y + 18y^2$$
$$9y^3 - 18y^2 - 4y + 8 = 0$$
$$9y^2(y-2) - 4(y-2) = 0$$
$$(y-2)(9y^2-4) = 0$$
$$y - 2 = 0 \qquad 9y^2 - 4 = 0$$
$$y = 2 \qquad 9y^2 = 4$$
$$y^2 = \frac{4}{9}$$
$$y = \pm\frac{2}{3}$$
The solution set is $\left\{-\frac{2}{3}, \frac{2}{3}, 2\right\}$.

9.
$$2x^4 = 16x$$
$$2x^4 - 16x = 0$$
$$2x\left(x^3 - 8\right) = 0$$
$$2x = 0 \qquad x^3 - 8 = 0$$
$$x = 0 \qquad (x-2)(x^2+2x+2) = 0$$
$$x - 2 = 0 \qquad x^2 + 2x + 4 = 0$$
$$x = 2 \qquad x = \frac{-2 \pm \sqrt{2^2 - 4(1)(4)}}{2(1)}$$
$$x = \frac{-2 \pm \sqrt{-12}}{2}$$
$$x = \frac{-2 \pm 2i\sqrt{3}}{2}$$
$$x = -1 \pm i\sqrt{3}$$
The solution set is $\left\{0, 2, -1 \pm i\sqrt{3}\right\}$.

10.
$$3x^4 = 81x$$
$$3x^4 - 81x = 0$$
$$3x(x^3 - 27) = 0$$
$$3x = 0 \qquad x^3 - 27 = 0$$
$$x = 0;$$
$$(x-3)(x^2+3x+9) = 0$$
$$x - 3 = 0 \qquad x^2 + 3x + 9 = 0$$
$$x = 3 \qquad x = \frac{-3 \pm \sqrt{3^2 - 4(1)(9)}}{2(1)}$$
$$x = \frac{-3 \pm \sqrt{9-36}}{2}$$
$$x = \frac{-3 \pm \sqrt{-27}}{2}$$
$$x = \frac{-3 \pm 3i\sqrt{3}}{2}$$
The solution set is $\left\{0, 3, \frac{-3 \pm 3i\sqrt{3}}{2}\right\}$.

11.
$$\sqrt{3x+18} = x$$
$$3x + 18 = x^2$$
$$x^2 - 3x - 18 = 0$$
$$(x+3)(x-6) = 0$$
$$x + 3 = 0 \qquad x - 6 = 0$$
$$x = -3 \qquad x = 6$$
$$\sqrt{3(-3)+18} = -3 \qquad \sqrt{3(6)+18} = 6$$
$$\sqrt{-9+18} = -3 \qquad \sqrt{18+18} = 6$$
$$\sqrt{9} = -3 \ \text{False} \qquad \sqrt{36} = 6$$
The solution set is $\{6\}$.

12.
$$\sqrt{20-8x} = x$$
$$20 - 8x = x^2$$
$$x^2 + 8x - 20 = 0$$
$$(x+10)(x-2) = 0$$
$$x + 10 = 0 \qquad x - 2 = 0$$
$$x = -10 \qquad x = 2$$
$$\sqrt{20-8(-10)} = -10 \qquad \sqrt{20-8(2)} = 2$$
$$\sqrt{20+80} = -10 \qquad \sqrt{20-16} = 2$$
$$\sqrt{100} = -10 \ \text{False} \qquad \sqrt{4} = 2$$
The solution set is $\{2\}$.

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

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

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

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

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

$x=1 \qquad x=6$

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

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

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

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

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

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

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

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

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

$x=-1 \qquad x=6$

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

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

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

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

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

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

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

$(x+6)^2=0$

$x+6=0$

$x=-6$

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

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

$\sqrt{1} = 1$

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

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

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

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

$x^2-8x=0$

$x(x-8)=0$

$x-8=0 \qquad x=0$

$x=8$

$\sqrt{6(0)+1} = 0-1 \qquad \sqrt{6(8)+1} = 8-1$

$\sqrt{0+1} = -1 \qquad \sqrt{48+1} = 7$

$\sqrt{1} = -1$ False $\quad \sqrt{49} = 7$

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

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

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

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

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

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

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

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

$x=2 \qquad x=10$

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

$2-\sqrt{9} = 5 \qquad 10-\sqrt{25} = 5$

$2-3=5$ False $\quad 10-5=5$

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

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

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

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

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

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

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

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

$x=-2 \qquad x=5$

$-2-\sqrt{-2+11} = 1 \qquad 5-\sqrt{5+11} = 1$

$-2-\sqrt{9} = 1 \qquad 5-\sqrt{16} = 1$

$-2-3=1$ False $\quad 5-4=1$

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

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19. $\sqrt{2x+19}-8=x$

$\sqrt{2x+19}=x+8$

$\left(\sqrt{2x+19}\right)^2=\left(x+8\right)^2$

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

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

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

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

$x=-9 \qquad x=-5$

–9 does not check and must be rejected.
The solution set is {–5}.

20. $\sqrt{2x+15}-6=x$

$\sqrt{2x+15}=x+6$

$\left(\sqrt{2x+15}\right)^2=\left(x+6\right)^2$

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

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

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

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

$x=-3 \qquad x=-7$

–7 does not check and must be rejected.
The solution set is {–3}.

21. $\sqrt{3x}+10=x+4$

$\sqrt{3x}=x-6$

$3x=(x-6)^2$

$3x=x^2-12x+36$

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

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

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

$x=12 \qquad x=3$

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

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

$6+10=16 \qquad 3+10=7$ False

The solution set is {12}.

22. $\sqrt{x}-3=x-9$

$\sqrt{x}=x-6$

$x=(x-6)^2$

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

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

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

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

$x=9 \qquad x=4$

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

$3-3=9-9 \qquad 2-3=4-9$ False

The solution set is {9}.

23. $\sqrt{x+8}-\sqrt{x-4}=2$

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

$x+8=(\sqrt{x-4}+2)^2$

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

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

$8=4\sqrt{x-4}$

$2=\sqrt{x-4}$

$4=x-4$

$x=8$

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

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

$4-2=2$

The solution set is {8}.

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

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

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

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

$x+5=x+1+4\sqrt{x-3}$

$5=1+4\sqrt{x-3}$

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

$1=\sqrt{x-3}$

$1=x-3$

$x=4$

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

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

$3-1=2$

The solution set is {4}.

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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, $\varnothing$.

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

$$\sqrt{2x-3}=\sqrt{x-2}+1$$
$$2x-3=(\sqrt{x-2}+1)^2$$
$$2x-3=x-2+2\sqrt{x-2}+1$$
$$2x-3=x-1+2\sqrt{x-2}$$
$$x-2=2\sqrt{x-2}$$
$$\frac{x}{2}-1=\sqrt{x-2}$$
$$\left(\frac{x}{2}-1\right)^2=x-2$$
$$\frac{x^2}{4}-x+1=x-2$$
$$x^2-4x+4=4x-8$$
$$x^2-8x+12=0$$
$$(x-6)(x-2)=0$$
$$x-6=0 \quad x-2=0$$
$$x=6 \quad x=2$$
$$\sqrt{2(6)-3}-\sqrt{6-2}=1 \qquad \sqrt{2(2)-3}-\sqrt{2-2}=1$$
$$\sqrt{12-3}-\sqrt{4}=1 \qquad \sqrt{4-3}-\sqrt{0}=1$$
$$\sqrt{9}-\sqrt{4}=1 \qquad \sqrt{1}-0=1$$
$$3-2=1 \qquad 1-0=1$$

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, $\varnothing$.

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 $\{-2\}$.

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29. $\sqrt{3\sqrt{x+1}} = \sqrt{3x-5}$

$3\sqrt{x+1} = 3x-5$

$9(x+1) = 9x^2 - 30x + 25$

$9x^2 - 39x + 16 = 0$

$x = \frac{39 \pm \sqrt{945}}{18} = \frac{13 \pm \sqrt{105}}{6}$

Check proposed solutions.

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

30. $\sqrt{1+4\sqrt{x}} = 1+\sqrt{x}$

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

$2\sqrt{x} = x$

$4x = x^2$

$x^2 - 4x = 0$

$x(x-4) = 0$

$x = 0$ or $x = 4$

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

31. $x^{3/2} = 8$

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

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

$x = 2^2$

$x = 4$

$4^{3/2} = 8$

$\sqrt{4}^3 = 8$

$2^3 = 8$

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

32. $x^{3/2} = 27$

$(x^{3/2})^{2/3} = 27^{2/3}$

$x = \sqrt[3]{27}^2$

$x = 3^2$

$x = 9$

$9^{3/2} = 27$

$\sqrt{9}^3 = 27$

$3^3 = 27$

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

33. $(x-4)^{3/2} = 27$

$((x-4)^{3/2})^{2/3} = 27^{2/3}$

$x-4 = \sqrt[3]{27}^2$

$x-4 = 3^2$

$x-4 = 9$

$x = 13$

$(13-4)^{3/2} = 27$

$9^{3/2} = 27$

$\sqrt{9}^3 = 27$

$3^3 = 27$

The solution set is $\{13\}$.

34. $(x+5)^{3/2} = 8$

$((x+5)^{3/2})^{2/3} = 8^{2/3}$

$x+5 = \sqrt[3]{8}^2$

$x+5 = 2^2$

$x+5 = 4$

$x = -1$

$(-1+5)^{3/2} = 8$

$4^{3/2} = 8$

$\sqrt{4}^3 = 8$

$2^3 = 8$

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

35. $6x^{5/2} - 12 = 0$

$6x^{5/2} = 12$

$x^{5/2} = 2$

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

$x = \sqrt[5]{2^2}$

$x = \sqrt[5]{4}$

$6(\sqrt[5]{4})^{5/2} - 12 = 0$

$6(4^{1/5})^{5/2} - 12 = 0$

$6(4^{1/2}) - 12 = 0$

$6(2) - 12 = 0$

The solution set is $\left\{\sqrt[5]{4}\right\}$.

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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 $\left\{\sqrt[5]{27}\right\}$.

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

$$\left[(x-4)^{2/3}\right]^{3/2} = (16)^{3/2}$$
$$x - 4 = \left(2^4\right)^{3/2}$$
$$x - 4 = 4^3 \qquad x - 4 = (-4)^3$$
$$x - 4 = 64 \qquad x - 4 = -64$$
$$x = 68 \qquad x = -60$$

The solution set is {– 60, 68}.

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

$$\left[(x+5)\frac{2}{3}\right]^{\frac{3}{2}} = (4)^{\frac{3}{2}}$$
$$x + 5 = \left(2^2\right)^{\frac{3}{2}}$$
$$x + 5 = 2^3 \quad \text{or} \quad x + 5 = (-2)^3$$
$$x + 5 = 8 \qquad x + 5 = -8$$
$$x = 3 \qquad x = -13$$

The solution set is {–13, 3}.

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

$$(x^2 - x - 4)^{3/4} = 8$$
$$((x^2 - x - 4)^{3/4})^{4/3} = 8^{4/3}$$
$$x^2 - x - 4 = \sqrt[3]{8}^4$$
$$x^2 - x - 4 = 2^4$$
$$x^2 - x - 4 = 16$$
$$x^2 - x - 20 = 0$$
$$(x-5)(x+4) = 0$$
$$x - 5 = 0 \qquad x + 4 = 0$$
$$x = 5 \qquad x = -4$$
$$(5^2 - 5 - 4)^{3/4} - 2 = 6$$
$$(25 - 9)^{3/4} - 2 = 6$$
$$16^{3/4} - 2 = 6$$
$$\sqrt[4]{16}^3 - 2 = 6$$
$$2^3 - 2 = 6$$
$$8 - 2 = 6$$
$$((-4)^2 - (-4) - 4)^{3/4} - 2 = 6$$
$$(16 + 4 - 4)^{3/4} - 2 = 6$$
$$16^{3/4} - 2 = 6$$
$$\sqrt[4]{16}^3 - 2 = 6$$
$$2^3 - 2 = 6$$
$$8 - 2 = 6$$

The solution set is {5, –4}.

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

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

The solution set is {1, 2}.

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

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

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

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

$t=1 \quad t=4$

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

$x=\pm1 \quad x=\pm2$

The solution set is {1, –1, 2, –2}.

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

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

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

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

$t=4 \quad t=9$

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

$x=\pm2 \quad x=\pm3$

The solution set is {–3, –2, 2, 3}.

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

$9x^4 - 25x^2 + 16 = 0$ let $t = x^2$

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

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

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

$9t=16 \quad t=1$

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

$x=\pm1$

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

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

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

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

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

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

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

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

$4t=9 \quad t=1$

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

$x^2=\frac{9}{4} \quad x=\pm1$

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

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 $t=\sqrt{x}$.

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

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

$2t+5=0$

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

$t=6$

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

$x=36$

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

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

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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}.

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

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

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

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

$2t = 1$

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

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

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

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

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

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

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

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

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

$t = 1 \qquad t = -4$

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

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

$x = 1 \qquad x = 16$

The solution set is {1}.

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

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

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

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

$t = -3 \qquad t = 7$

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

$x = 2 \qquad x = 12$

The solution set is {2, 12}.

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

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

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

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

$t = -9 \qquad t = 2$

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

$x = -12 \qquad x = -1$

The solution set is {–12, –1}.

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

Let $t = x^2 - x$.

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

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

$t = 2$ or $t = 12$

$x^2 - x = 2 \qquad$ or $\qquad x^2 - x = 12$

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

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

The solution set is {–3, –1, 2, 4}.

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

Let $t = x^2 - 2x$

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

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

$t = 3$ or $t = 8$

$x^2 - 2x = 3 \qquad$ or $\qquad x^2 - 2x = 8$

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

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

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

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

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

$t = -7$ or $t = 2$

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

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

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

The solution set is {–8, –2, 1, 4}.

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

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

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

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

$t=-9$ or $t=3$

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

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

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

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

$|2x-1|=7$

$2x-1=7$ or $2x-1=-7$

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

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

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

$7|3x|=14$

$|3x|=2$

$3x=2$ or $3x=-2$

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

The solution set is {–2/3, 2/3}.

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

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

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

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

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

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

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

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

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

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

$$1-\frac{3}{4}x=\frac{3}{4} \quad \text{or} \quad 1-\frac{3}{4}x=-\frac{3}{4}$$
$$-\frac{3}{4}x=-\frac{1}{4} \qquad -\frac{3}{4}x=-\frac{7}{4}$$
$$-\frac{4}{3}\left(-\frac{3}{4}\right)x=-\frac{4}{3}\left(-\frac{1}{4}\right) \qquad -\frac{4}{3}\left(-\frac{3}{4}\right)x=-\frac{4}{3}\left(-\frac{7}{4}\right)$$
$$x=\frac{1}{3} \qquad x=\frac{7}{3}$$

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

73. $|x+1|+5=3$
$|x+1|=-2$
No solution
The solution set is { }.

74. $|x+1|+6=2$
$|x+1|=-4$
No solution
The solution set is { }.

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

$$|2x-1|=0$$
$$2x-1=0$$
$$2x=1$$
$$x=\frac{1}{2}$$

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

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

$$|3x-2|=0$$
$$3x-2=0$$
$$3x=2$$
$$x=\frac{2}{3}$$

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

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

$$3x-1=x+5 \qquad 3x-1=-x-5$$
$$2x-1=5 \qquad 4x-1=-5$$
$$2x=6 \qquad 4x=-4$$
$$x=3 \qquad x=-1$$

The solution set is {3, −1}.

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

$$2x-7=x+3 \quad \text{or} \quad 2x-7=-(x+3)$$
$$x=10 \qquad 2x-7=-x-3$$
$$3x=4$$
$$x=\frac{4}{3}$$

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

79. Set $y = 0$ to find the x–intercept(s).

$$0=\sqrt{x+2}+\sqrt{x-1}-3$$
$$-\sqrt{x+2}=\sqrt{x-1}-3$$
$$\left(-\sqrt{x+2}\right)^2=\left(\sqrt{x-1}-3\right)^2$$
$$x+2=\left(\sqrt{x-1}\right)^2-2\left(\sqrt{x-1}\right)(3)+(3)^2$$
$$x+2=x-1-6\sqrt{x-1}+9$$
$$x+2=x-1-6\sqrt{x-1}+9$$
$$2=8-6\sqrt{x-1}$$
$$-6=-6\sqrt{x-1}$$
$$\frac{-6}{-6}=\frac{-6\sqrt{x-1}}{-6}$$
$$1=\sqrt{x-1}$$
$$(1)^2=\left(\sqrt{x-1}\right)^2$$
$$1=x-1$$
$$2=x$$

The x-intercept is 2.
The corresponding graph is graph (c).

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

$$0 = \sqrt{x-4} + \sqrt{x+4} - 4$$
$$-\sqrt{x-4} = \sqrt{x+4} - 4$$
$$\left(-\sqrt{x-4}\right)^2 = \left(\sqrt{x+4} - 4\right)^2$$
$$x - 4 = \left(\sqrt{x+4}\right)^2 - 2\left(\sqrt{x+4}\right)(4) + (4)^2$$
$$x - 4 = x + 4 - 8\sqrt{x+4} + 16$$
$$-4 = 20 - 8\sqrt{x+4}$$
$$-24 = -8\sqrt{x+4}$$
$$\frac{-24}{-8} = \frac{-8\sqrt{x+4}}{-8}$$
$$3 = \sqrt{x+4}$$
$$(3)^2 = \left(\sqrt{x+4}\right)^2$$
$$9 = x + 4$$
$$5 = x$$

The x-intercept is 5.
The corresponding graph is graph (a).

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

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

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

$$x^{\frac{1}{3}} + 2x^{\frac{1}{6}} - 3 = 0$$
$$\left(x^{\frac{1}{6}}\right)^2 + 2x^{\frac{1}{6}} - 3 = 0$$
$$t^2 + 2t - 3 = 0$$
$$(t+3)(t-1) = 0$$
$$t + 3 = 0 \quad \text{or} \quad t - 1 = 0$$
$$t = -3 \qquad t = 1$$

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

$$x^{\frac{1}{6}} = -3 \quad \text{or} \quad x^{\frac{1}{6}} = 1$$
$$\left(x^{\frac{1}{6}}\right)^6 = (-3)^6 \qquad \left(x^{\frac{1}{6}}\right)^6 = (1)^6$$
$$x = 729 \qquad x = 1$$

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).

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

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

$$x^{-2} - x^{-1} - 6 = 0$$
$$\left(x^{-1}\right)^2 - x^{-1} - 6 = 0$$
$$t^2 - t - 6 = 0$$
$$(t+2)(t-3) = 0$$
$$t + 2 = 0 \quad \text{or} \quad t - 3 = 0$$
$$t = -2 \qquad t = 3$$

Substitute x^{-1} for t.

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

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).

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

Let $t = x + 2$.

$$(x+2)^2 - 9(x+2) + 20 = 0$$
$$t^2 - 9t + 20 = 0$$
$$(t-5)(t-4) = 0$$
$$t - 5 = 0 \quad \text{or} \quad t - 4 = 0$$
$$t = 5 \qquad t = 4$$

Substitute $x + 2$ for t.

$$x + 2 = 5 \quad \text{or} \quad x + 2 = 4$$
$$x = 3 \qquad x = 2$$

The x-intercepts are 2 and 3.
The corresponding graph is graph (f).

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

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

Let $t = x+2$.

$$2(x+2)^2 + 5(x+2) - 3 = 0$$
$$2t^2 + 5t - 3 = 0$$
$$(2t-1)(t+3) = 0$$

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

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

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

Substitute $x+2$ for t.

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

$x = \frac{1}{2} - 2$ $\quad x = -5$

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

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

The corresponding graph is graph (d).

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

$5 - 4x = 11$ or $5 - 4x = -11$

$-4x = 6$ $\quad -4x = -16$

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

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

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

$2 - 3x = 13$ or $2 - 3x = -13$

$-3x = 11$ $\quad -3x = -15$

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

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

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

$$\sqrt{x+5} = 7 - x$$
$$\left(\sqrt{x+5}\right)^2 = (7-x)^2$$
$$x + 5 = 49 - 14x + x^2$$
$$0 = x^2 - 15x + 44$$
$$0 = (x-4)(x-11)$$

$x - 4 = 0$ or $x - 11 = 0$

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

11 does not check and must be rejected.

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

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

$$-\sqrt{x-2} = 4 - x$$
$$\left(-\sqrt{x-2}\right)^2 = (4-x)^2$$
$$x - 2 = 16 - 8x + x^2$$
$$0 = x^2 - 9x + 18$$
$$0 = (x-6)(x-3)$$

$x - 6 = 0$ or $x - 3 = 0$

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

3 does not check and must be rejected.

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

89.
$$2x^3 + x^2 - 8x + 2 = 6$$
$$2x^3 + x^2 - 8x - 4 = 0$$
$$x^2(2x+1) - 4(2x+1) = 0$$
$$(2x+1)(x^2-4) = 0$$
$$(2x+1)(x+2)(x-2) = 0$$

$2x + 1 = 0$ or $x + 2 = 0$ or $x - 2 = 0$

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

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

90.
$$x^3 + 4x^2 - x + 6 = 10$$
$$x^3 + 4x^2 - x - 4 = 0$$
$$x^2(x+4) - 1(x+4) = 0$$
$$(x+4)(x^2-1) = 0$$
$$(x+4)(x+1)(x-1) = 0$$

$x + 4 = 0$ or $x + 1 = 0$ or $x - 1 = 0$

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

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

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

$$\left((x+4)^{\frac{3}{2}}\right)^{\frac{2}{3}} = (8)^{\frac{2}{3}}$$
$$x+4 = \left(\sqrt[3]{8}\right)^2$$
$$x+4 = (2)^2$$
$$x+4 = 4$$
$$x = 0$$

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

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

$$\left((x-5)^{\frac{3}{2}}\right)^{\frac{2}{3}} = (125)^{\frac{2}{3}}$$
$$x-5 = \left(\sqrt[3]{125}\right)^2$$
$$x-5 = (5)^2$$
$$x-5 = 25$$
$$x = 30$$

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

93. $y_1 = y_2 + 3$

$$\left(x^2-1\right)^2 = 2\left(x^2-1\right)+3$$
$$\left(x^2-1\right)^2 - 2\left(x^2-1\right) - 3 = 0$$

Let $t = x^2 - 1$ and substitute.

$$t^2 - 2t - 3 = 0$$
$$(t+1)(t-3) = 0$$
$$t+1 = 0 \quad \text{or} \quad t-3 = 0$$
$$t = -1 \qquad t = 3$$

Substitute $x^2 - 1$ for t.

$$x^2 - 1 = -1 \quad \text{or} \quad x^2 - 1 = 3$$
$$x^2 = 0 \qquad x^2 = 4$$
$$x = 0 \qquad x = \pm 2$$

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.

$$6t^2 - 5t - 6 = 0$$
$$(3t+2)(2t-3) = 0$$
$$3t+2 = 0 \quad \text{or} \quad 2t-3 = 0$$
$$t = -\frac{2}{3} \qquad t = \frac{3}{2}$$

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. $\left|x^2 + 2x - 36\right| = 12$

$$x^2 + 2x - 36 = 12 \qquad x^2 + 2x - 36 = -12$$
$$x^2 + 2x - 48 = 0 \quad \text{or} \quad x^2 + 2x - 24 = 0$$
$$(x+8)(x-6) = 0 \qquad (x+6)(x-4) = 0$$

Setting each of the factors above equal to zero gives $x = -8$, $x = 6$, $x = -6$, and $x = 4$.

The solution set is $\{-8, -6, 4, 6\}$.

96. $\left|x^2 + 6x + 1\right| = 8$

$$x^2 + 6x + 1 = 8 \quad \text{or} \quad x^2 + 6x + 1 = -8$$
$$x^2 + 6x - 7 = 0 \qquad x^2 + 6x + 9 = 0$$
$$(x+7)(x-1) = 0 \qquad (x+3)(x+3) = 0$$

Setting each of the factors above equal to zero gives $x = -7$, $x = -3$, and $x = 1$.

The solution set is $\{-7, -3, 1\}$.

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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 $x=-7$, $x=-1$, and $x=6$.

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 $x=-5$, $x=2$, and $x=7$.

The solution set is $\{-5, 2, 7\}$.

99. Let x = the number.

$\sqrt{5x-4} = x-2$

$\left(\sqrt{5x-4}\right)^2 = (x-2)^2$

$5x-4 = x^2-4x+4$

$0 = x^2-9x+8$

$0 = (x-8)(x-1)$

$x-8=0$ or $x-1=0$

$x=8$ $\quad$ $x=1$

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.

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

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

$x-3 = x^2-10x+25$

$0 = x^2-11x+28$

$0 = (x-7)(x-4)$

$x-7=0$ or $x-4=0$

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

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.

$$r = \sqrt{\frac{A}{4\pi}}$$

$$r^2 = \left(\sqrt{\frac{A}{4\pi}}\right)^2$$

$$r^2 = \frac{A}{4\pi}$$

$$4\pi r^2 = A \quad \text{or} \quad A = 4\pi r^2$$

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103. Exclude any value that causes the denominator to equal zero.

$$|x+2|-14=0$$
$$|x+2|=14$$
$$x+2=14 \quad \text{or} \quad x+2=-14$$
$$x=12 \qquad\qquad x=-16$$

–16 and 12 must be excluded from the domain.

104. Exclude any value that causes the denominator to equal zero.

$$x^3+3x^2-x-3=0$$
$$x^2(x+3)-1(x+3)=0$$
$$(x+3)\left(x^2-1\right)=0$$
$$(x+3)(x+1)(x-1)=0$$

Setting each of the factors above equal to zero gives $x=-3, \quad x=-1, \quad \text{and } x=1.$

–3, –1, and 1 must be excluded from the domain.

105.
$$t=\frac{\sqrt{d}}{2}$$
$$1.16=\frac{\sqrt{d}}{2}$$
$$2.32=\sqrt{d}$$
$$2.32^2=\left(\sqrt{d}\right)^2$$
$$d\approx 5.4$$

The vertical distance was about 5.4 feet.

106.
$$t=\frac{\sqrt{d}}{2}$$
$$0.85=\frac{\sqrt{d}}{2}$$
$$1.7=\sqrt{d}$$
$$1.7^2=\left(\sqrt{d}\right)^2$$
$$d\approx 2.9$$

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. $p=2.2\sqrt{t}+36.2$

$$52=2.2\sqrt{t}+36.2$$
$$15.8=2.2\sqrt{t}$$
$$\frac{15.8}{2.2}=\frac{2.2\sqrt{t}}{2.2}$$
$$\frac{15.8}{2.2}=\sqrt{t}$$
$$\left(\frac{15.8}{2.2}\right)^2=\left(\sqrt{t}\right)^2$$
$$52\approx t$$

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. $p=-2.2\sqrt{t}+63.8$

$$48=-2.2\sqrt{t}+63.8$$
$$-15.8=2.2\sqrt{t}$$
$$\frac{-15.8}{2.2}=\frac{2.2\sqrt{t}}{2.2}$$
$$\frac{-15.8}{2.2}=\sqrt{t}$$
$$\left(\frac{-15.8}{2.2}\right)^2=\left(\sqrt{t}\right)^2$$
$$52\approx t$$

According to the formula, 48% of U.S. men will participate in the labor force 52 years after 1972, or 2024.

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111.
$$365 = 0.2x^{3/2}$$
$$\frac{365}{0.2} = \frac{0.2x^{3/2}}{0.2}$$
$$1825 = x^{3/2}$$
$$1825^2 = \left(x^{3/2}\right)^2$$
$$3,330,625 = x^3$$
$$\sqrt[3]{3,330,625} = \sqrt[3]{x^3}$$
$$149.34 \approx x$$
The average distance of the Earth from the sun is approximately 149 million kilometers.

112.
$$f(x) = 0.2x^{3/2}$$
$$88 = 0.2x^{3/2}$$
$$\frac{88}{0.2} = \frac{0.2x^{3/2}}{0.2}$$
$$440 = x^{3/2}$$
$$440^2 = \left(x^{3/2}\right)^2$$
$$193,600 = x^3$$
$$\sqrt[3]{193,600} = \sqrt[3]{x^3}$$
$$58 \approx x$$
The average distance of Mercury from the sun is approximately 58 million kilometers.

113. $\sqrt{6^2 + x^2} + \sqrt{8^2 + (10-x)^2} = 18$
$$\sqrt{36 + x^2} = 18 - \sqrt{64 + 100 - 20x + x^2}$$
$$36 + x^2 = 324 - 36\sqrt{x^2 - 20x + 164} + x^2 - 20x + 164$$
$$36\sqrt{x^2 - 20x + 164} = -20x + 452$$
$$9\sqrt{x^2 - 20x + 164} = -5x + 113$$
$$81(x^2 - 20x + 164) = 25x^2 - 1130x + 12769$$
$$81x^2 - 1620x + 13284 = 25x^2 - 1130x + 12769$$
$$56x^2 - 490x + 515 = 0$$
$$x = \frac{490 \pm \sqrt{(-490)^2 - 4(56)(515)}}{2(56)}$$
$$x = \frac{490 \pm 353.19}{112}$$
$$x \approx 1.2 \qquad x \approx 7.5$$
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 $A = \sqrt{x^2 + 36} + \sqrt{(12-x)^2 + 9}$.

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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.

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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. $\sqrt{6x-2} = \sqrt{2x+3} - \sqrt{4x-1}$

$$6x-2 = 2x+3-2\sqrt{(2x+3)(4x-1)}+4x-1$$
$$-4 = -2\sqrt{(2x+3)(4x-1)}$$
$$2 = \sqrt{8x^2+10x-3}$$
$$4 = 8x^2+10x-3$$
$$8x^2+10x-7=0$$
$$x = \frac{-10 \pm \sqrt{10^2-4(8)(-7)}}{2(8)}$$
$$x = \frac{-10 \pm \sqrt{100+224}}{16}$$
$$x = \frac{-10 \pm \sqrt{324}}{16}$$
$$x = \frac{-10 \pm 18}{16}$$
$$x = \frac{-28}{26}, \frac{8}{16}$$
$$x = \frac{1}{2}$$

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

134. $5-\frac{2}{x} = \sqrt{5-\frac{2}{x}}$

or

$$5-\frac{2}{x}=0 \qquad 5-\frac{2}{x}=1$$
$$5=\frac{2}{x} \qquad -\frac{2}{x}=-4$$
$$5x=2 \qquad -4x=-2$$
$$x=\frac{2}{5} \qquad x=\frac{1}{2}$$

The solution set is $\left\{\frac{2}{5}, \frac{1}{2}\right\}$.

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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. $x^{5/6} + x^{2/3} - 2x^{1/2} = 0$

$x^{1/2}(x^{2/6} + x^{1/6} - 2) = 0$ let $t = x^{1/6}$

$$x^{1/2}(t^2 + t - 2) = 0$$
$$x^{1/2} = 0 \quad t^2 + t - 2 = 0$$
$$(t-1)(t+2) = 0$$
$$t - 1 = 0 \qquad t + 2 = 0$$
$$t = 1 \qquad t = -2$$
$$x^{1/6} = 1 \qquad x^{1/6} = -2$$
$$x = 1^6 \qquad x = (-2)^6$$
$$x = 0 \qquad x = 1 \qquad x = 64$$

64 does not check and must be rejected.
The solution set is {0, 1}.

137. $3 - 2x \le 11$

$$3 - 2(-1) \le 11$$
$$3 + 2 \le 11$$
$$5 \le 11, \text{ true}$$

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. $\dfrac{x+3}{4} = \dfrac{x-2}{3} + \dfrac{1}{4}$

$$12\left(\frac{x+3}{4}\right) = 12\left(\frac{x-2}{3} + \frac{1}{4}\right)$$
$$3(x+3) = 4(x-2) + 3$$
$$3x + 9 = 4x - 8 + 3$$
$$3x + 9 = 4x - 5$$
$$3x - 4x = -5 - 9$$
$$-x = -14$$
$$x = 14$$

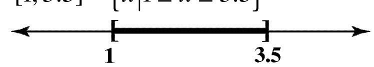
The solution set is {14}.

Section 1.7

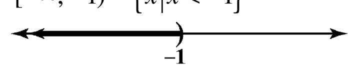
Check Point Exercises

1. **a.** $[-2, 5) = \{x \mid -2 \le x < 5\}$

b. $[1, 3.5] = \{x \mid 1 \le x \le 3.5\}$



c. $[-\infty, -1) = \{x \mid x < -1\}$



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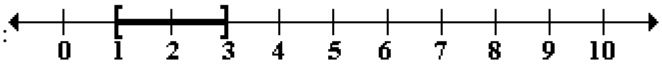
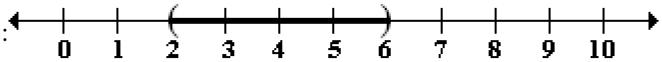
2. a. Graph $[1,3]$:

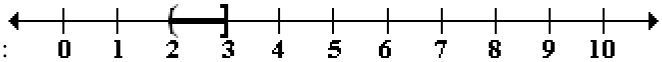


Graph $(2,6)$:



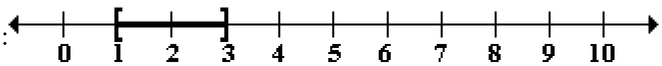
To find the intersection, take the portion of the number line that the two graphs have in common.

Numbers in both $[1,3]$ and $(2,6)$:

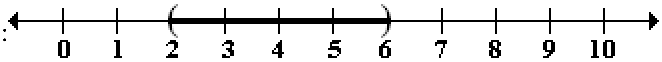


Thus, $[1,3] \cap (2,6) = (2,3]$.

b. Graph $[1,3]$:

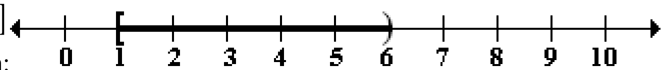


Graph $(2,6)$:



To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

Numbers in either $[1,3]$ or $(2,6)$ or both:

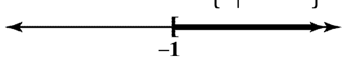


Thus, $[1,3] \cup (2,6) = [1,6)$.

3.

$$2-3x \le 5$$
$$-3x \le 3$$
$$x \ge -1$$

The solution set is $\{x | x \ge -1\}$ or $[-1, \infty)$.



4.

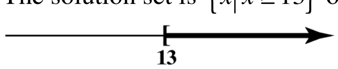
$$3x+1 > 7x-15$$
$$-4x > -16$$
$$\frac{-4x}{-4} < \frac{-16}{-4}$$
$$x < 4$$

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

5.

$$\frac{x-4}{2} \ge \frac{x-2}{3} + \frac{5}{6}$$
$$6\left(\frac{x-4}{2}\right) \ge 6\left(\frac{x-2}{3} + \frac{5}{6}\right)$$
$$3(x-4) \ge 2(x-2)+5$$
$$3x-12 \ge 2x-4+5$$
$$3x-12 \ge 2x+1$$
$$3x-2x \ge 1+12$$
$$x \ge 13$$

The solution set is $\{x | x \ge 13\}$ or $[13, \infty)$.



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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 $\Re$ or $(-\infty.\infty)$.

b. $x+1 \le x-1$

$1 \le -1$

$1 \le -1$ is false for all values of x.

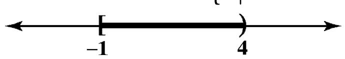
The solution set is $\varnothing$.

7. $1 \le 2x+3 < 11$

$-2 \le 2x < 8$

$-1 \le x < 4$

The solution set is $\{x \mid -1 \le x < 4\}$ 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. $-3|5x-2| + 20 \ge -19$

$-3|5x-2| \ge -39$

$\dfrac{-3|5x-2|}{-3} \le \dfrac{-39}{-3}$

$|5x-2| \le 13$

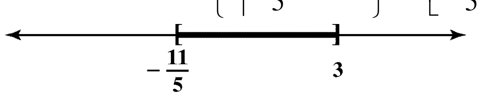
$-13 \le 5x-2 \le 13$

$-11 \le 5x \le 15$

$\dfrac{-11}{5} \le \dfrac{5x}{5} \le \dfrac{15}{5}$

$-\dfrac{11}{5} \le x \le 3$

The solution set is $\left\{x \,\middle|\, -\dfrac{11}{5} \le x \le 3\right\}$ or $\left[-\dfrac{11}{5}, 3\right]$.



10. $18 < |6-3x|$

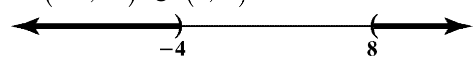
$6-3x < -18$ or $6-3x > 18$

$-3x < -24$ $\quad$ $-3x > 12$

$\dfrac{-3x}{-3} > \dfrac{-24}{-3}$ $\quad$ $\dfrac{-3x}{-3} < \dfrac{12}{-3}$

$x > 8$ $\quad$ $x < -4$

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

1. 2; 5; 2; 5

2. greater than

3. less than or equal to

4. $(-\infty, 9)$; intersection

5. $(-\infty, 12)$; union

6. adding 4; dividing; -3; direction; $>$; $<$

7. $\varnothing$

8. $(-\infty, \infty)$

9. middle

10. $-c$; c

11. $-c$; c

12. $-2 < x-7 < 2$

13. $x-7 < -2$ or $-7 > 2$

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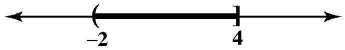
Exercise Set 1.7

1. $1 < x \le 6$

2. $-2 < x \le 4$



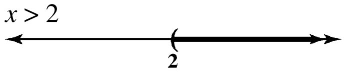
3. $-5 \le x < 2$

4. $-4 \le x < 3$

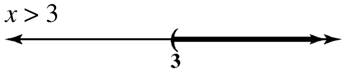
5. $-3 \le x \le 1$

6. $-2 \le x \le 5$

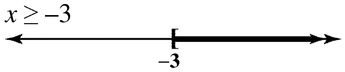
7. $x > 2$



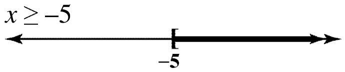
8. $x > 3$



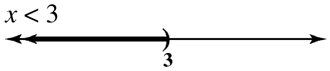
9. $x \ge -3$



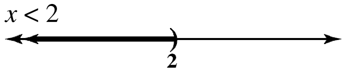
10. $x \ge -5$



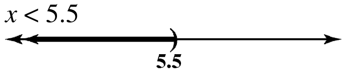
11. $x < 3$



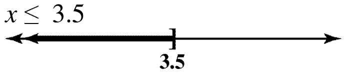
12. $x < 2$



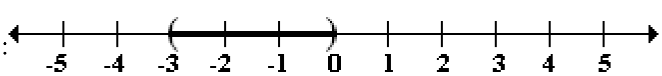
13. $x < 5.5$



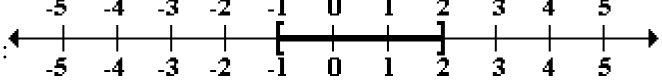
14. $x \le 3.5$



15. Graph $(-3,0)$:

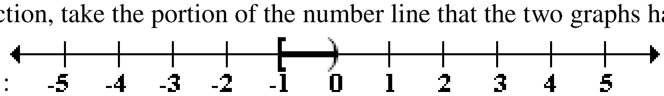


Graph $[-1,2]$:



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, $(-3,0) \cap [-1,2] = [-1,0)$.

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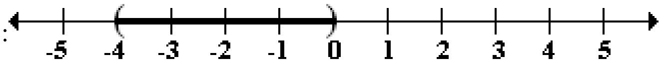
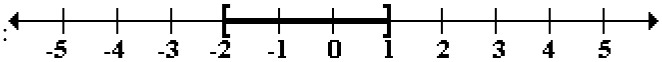
16. Graph $(-4,0)$:

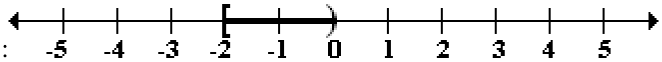


Graph $[-2,1]$:



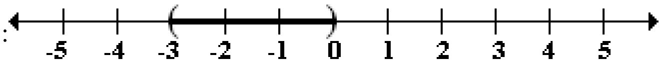
To find the intersection, take the portion of the number line that the two graphs have in common.

Numbers in both $(-4,0)$ and $[-2,1]$:

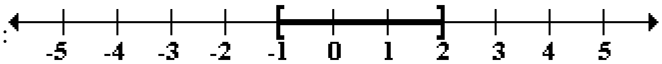


Thus, $(-4,0) \cap [-2,1] = [-2,0)$.

17. Graph $(-3,0)$:

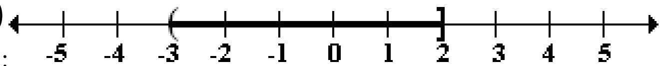


Graph $[-1,2]$:



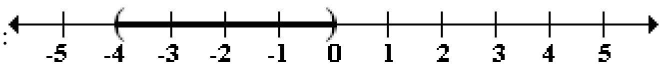
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

Numbers in either $(-3,0)$ or $[-1,2]$ or both:

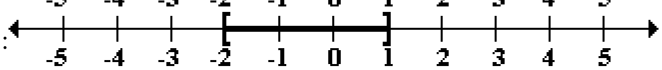


Thus, $(-3,0) \cup [-1,2] = (-3,2]$.

18. Graph $(-4,0)$:

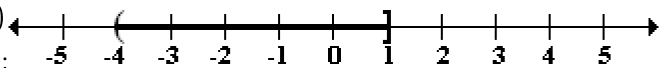


Graph $[-2,1]$:



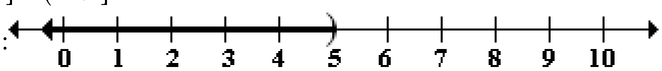
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

Numbers in either $(-4,0)$ or $[-2,1]$ or both:

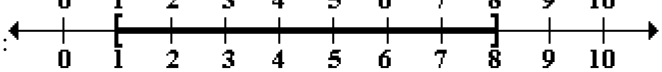


Thus, $(-4,0) \cup [-2,1] = (-4,1]$.

19. Graph $(-\infty,5)$:

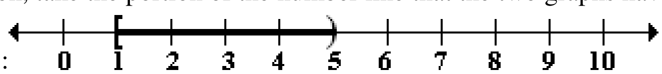


Graph $[1,8]$:



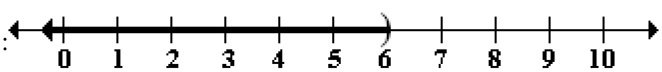
To find the intersection, take the portion of the number line that the two graphs have in common.

Numbers in both $(-\infty,5)$ and $[1,8]$:

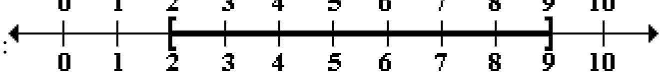


Thus, $(-\infty,5) \cap [1,8] = [1,5)$.

20. Graph $(-\infty,6)$:

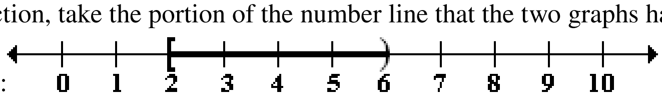


Graph $[2,9]$:



To find the intersection, take the portion of the number line that the two graphs have in common.

Numbers in both $(-\infty,6)$ and $[2,9]$:



Thus, $(-\infty,6) \cap [2,9] = [2,6)$.

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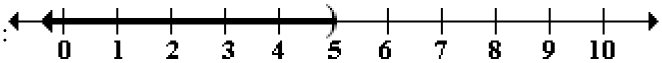
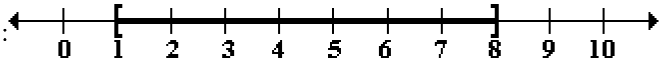
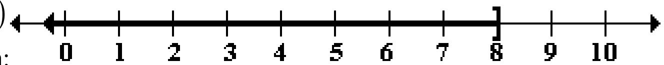
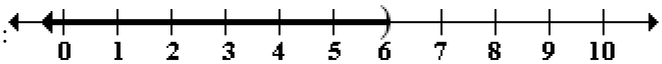
21. Graph $(-\infty,5)$: 

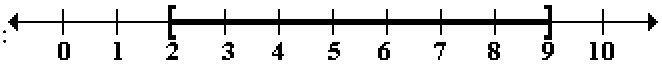
Graph $[1,8]$: 

To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

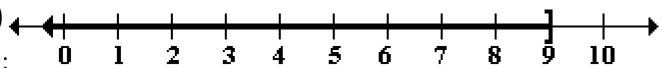
Numbers in either $(-\infty,5)$ or $[1,8]$ or both: 

Thus, $(-\infty,5)\cup[1,8]=(-\infty,8]$.

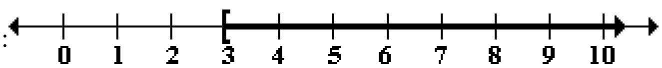
22. Graph $(-\infty,6)$: 

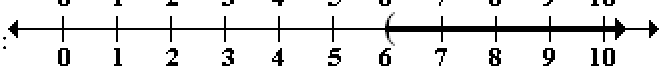
Graph $[2,9]$: 

To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

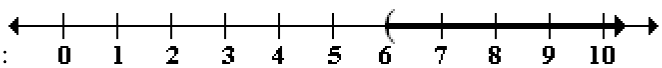
Numbers in either $(-\infty,6)$ or $[2,9]$ or both: 

Thus, $(-\infty,6)\cup[2,9]=(-\infty,9]$.

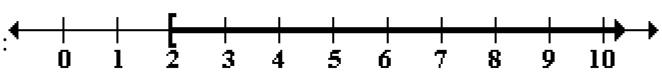
23. Graph $[3,\infty)$: 

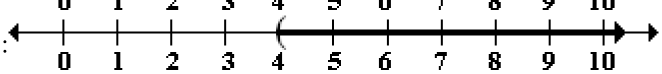
Graph $(6,\infty)$: 

To find the intersection, take the portion of the number line that the two graphs have in common.

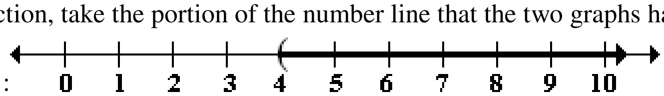
Numbers in both $[3,\infty)$ and $(6,\infty)$: 

Thus, $[3,\infty)\cap(6,\infty)=(6,\infty)$.

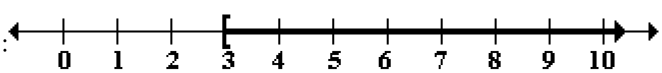
24. Graph $[2,\infty)$: 

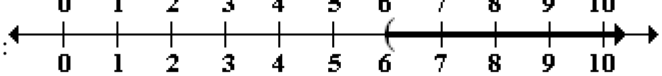
Graph $(4,\infty)$: 

To find the intersection, take the portion of the number line that the two graphs have in common.

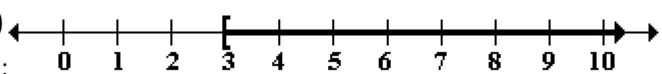
Numbers in both $[2,\infty)$ and $(4,\infty)$: 

Thus, $[2,\infty)\cap(4,\infty)=(4,\infty)$.

25. Graph $[3,\infty)$: 

Graph $(6,\infty)$: 

To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

Numbers in either $[3,\infty)$ or $(6,\infty)$ or both: 

Thus, $[3,\infty)\cup(6,\infty)=[3,\infty)$.

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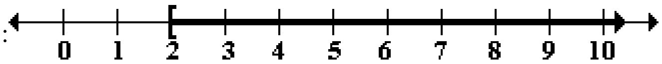
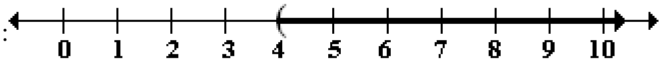
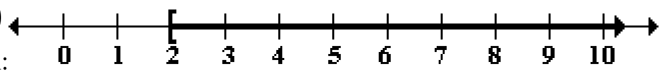
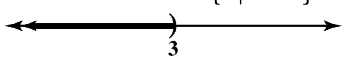
26. Graph $[2, \infty)$:


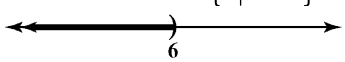
Graph $(4, \infty)$:


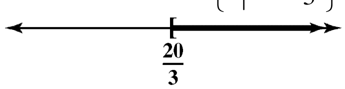
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

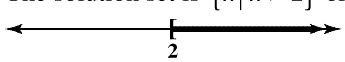
Numbers in either $[2, \infty)$ or $(4, \infty)$ or both:


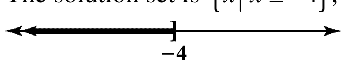
Thus, $[2, \infty) \cup (4, \infty) = [2, \infty)$.

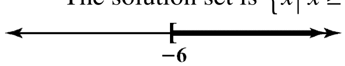
27. $5x + 11 < 26$
$5x < 15$
$x < 3$
The solution set is $\{x \mid x < 3\}$, or $(-\infty, 3)$.


28. $2x + 5 < 17$
$2x < 12$
$x < 6$
The solution set is $\{x \mid x < 6\}$ or $(-\infty, 6)$.


29. $3x - 7 \geq 13$
$3x \geq 20$
$x \geq \dfrac{20}{3}$
The solution set is $\left\{x \,\middle|\, x > \dfrac{20}{3}\right\}$, or $\left[\dfrac{20}{3}, \infty\right)$.


30. $8x - 2 \geq 14$
$8x \geq 16$
$x \geq 2$
The solution set is $\{x \mid x > 2\}$ 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 $[-6, \infty)$.


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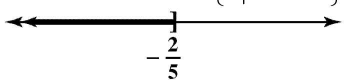
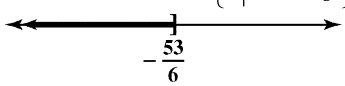
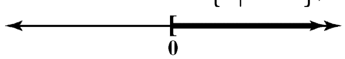
33. $8x - 11 \le 3x - 13$
$8x - 3x \le -13 + 11$
$5x \le -2$
$x \le -\frac{2}{5}$
The solution set is $\left\{x \middle| x \le -\frac{2}{5}\right\}$, or $\left(-\infty, -\frac{2}{5}\right]$.



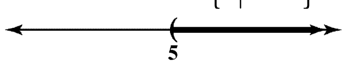
34. $18x + 45 \le 12x - 8$
$18x - 12x \le -8 - 45$
$6x \le -53$
$x \le -\frac{53}{6}$
The solution set is $\left\{x \middle| x \le -\frac{53}{6}\right\}$ or $\left(-\infty, -\frac{53}{6}\right]$.



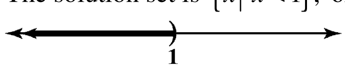
35. $4(x + 1) + 2 \ge 3x + 6$
$4x + 4 + 2 \ge 3x + 6$
$4x + 6 \ge 3x + 6$
$4x - 3x \ge 6 - 6$
$x \ge 0$
The solution set is $\{x | x > 0\}$, or $[0, \infty)$.



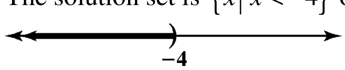
36. $8x + 3 > 3(2x + 1) + x + 5$
$8x + 3 > 6x + 3 + x + 5$
$8x + 3 > 7x + 8$
$8x - 7x > 8 - 3$
$x > 5$
The solution set is $\{x | x > 5\}$ or $(5, \infty)$.



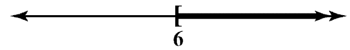
37. $2x - 11 < -3(x + 2)$
$2x - 11 < -3x - 6$
$5x < 5$
$x < 1$
The solution set is $\{x | x < 1\}$, or $(-\infty, 1)$.



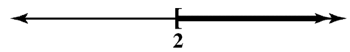
38. $-4(x + 2) > 3x + 20$
$-4x - 8 > 3x + 20$
$-7x > 28$
$x < -4$
The solution set is $\{x | x < -4\}$ or $(-\infty, -4)$.



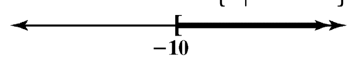
39. $1 - (x + 3) \ge 4 - 2x$
$1 - x - 3 \ge 4 - 2x$
$-x - 2 \ge 4 - 2x$
$x \ge 6$
The solution set is $\{x | x \ge 6\}$, or $[6, \infty)$.



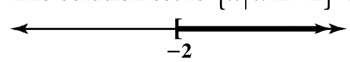
40. $5(3 - x) \le 3x - 1$
$15 - 5x \le 3x - 1$
$-8x \le -16$
$x \ge 2$
The solution set is $\{x | x \ge 2\}$ or $[2, \infty)$.



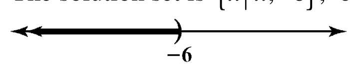
41. $\frac{x}{4} - \frac{3}{2} \le \frac{x}{2} + 1$
$\frac{4x}{4} - \frac{4 \cdot 3}{2} \le \frac{4 \cdot x}{2} + 4 \cdot 1$
$x - 6 \le 2x + 4$
$-x \le 10$
$x \ge -10$
The solution set is $\{x | x \ge -10\}$, or $[-10, \infty)$.



42. $\frac{3x}{10} + 1 \ge \frac{1}{5} - \frac{x}{10}$
$10\left(\frac{3x}{10} + 1\right) \ge 10\left(\frac{1}{5} - \frac{x}{10}\right)$
$3x + 10 \ge 2 - x$
$4x \ge -8$
$x \ge -2$
The solution set is $\{x | x \ge -2\}$ or $[-2, \infty)$.



43. $1 - \frac{x}{2} > 4$
$-\frac{x}{2} > 3$
$x < -6$
The solution set is $\{x | x, -6\}$, or $(-\infty, -6)$.



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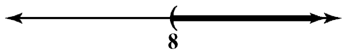
44. $7-\frac{4}{5}x<\frac{3}{5}$

$-\frac{4}{5}x<-\frac{32}{5}$

$x>8$

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



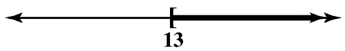
45. $\frac{x-4}{6}\ge\frac{x-2}{9}+\frac{5}{18}$

$3(x-4)\ge 2(x-2)+5$

$3x-12\ge 2x-4+5$

$x\ge 13$

The solution set is $\{x\mid x\ge 13\}$, or $[13,\infty)$.



46.

$\frac{4x-3}{6}+2\ge\frac{2x-1}{12}$

$2(4x-3)+24\ge 2x-1$

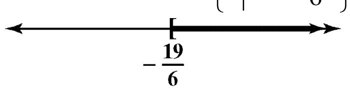
$8x-6+24\ge 2x-1$

$6x+18\ge -1$

$6x\ge -19$

$x\ge -\frac{19}{6}$

The solution set is $\left\{x\,\middle|\,x\ge\frac{-19}{6}\right\}$ or $\left[\frac{-19}{6},\infty\right)$.



47. $4(3x-2)-3x<3(1+3x)-7$

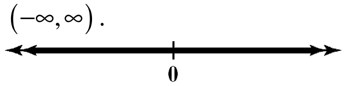
$12x-8-3x<3+9x-7$

$9x-8<-4+9x$

$-8<-4$

True for all x

The solution set is $\{x\mid x \text{ is any real number}\}$, or $(-\infty,\infty)$.



48. $3(x-8)-2(10-x)>5(x-1)$

$3x-24-20+2x>5x-5$

$5x-44>5x-5$

$-44>-5$

Not true for any x.

The solution set is the empty set, $\varnothing$.

49. $5(x-2)-3(x+4)\ge 2x-20$

$5x-10-3x-12\ge 2x-20$

$2x-22\ge 2x-20$

$-22\ge -20$

Not true for any x.

The solution set is the empty set, $\varnothing$.

50. $6(x-1)-(4-x)\ge 7x-8$

$6x-6-4+x\ge 7x-8$

$7x-10\ge 7x-8$

$-10\ge -8$

Not true for any x.

The solution set is the empty set, $\varnothing$.

51. $6<x+3<8$

$6-3<x+3-3<8-3$

$3<x<5$

The solution set is $\{x\mid 3<x<5\}$, or $(3, 5)$.

52. $7<x+5<11$

$7-5<x+5-5<11-5$

$2<x<6$

The solution set is $\{x\mid 2<x<6\}$ or $(2, 6)$.

53. $-3\le x-2<1$

$-1\le x<3$

The solution set is $\{x\mid -1\le x<3\}$, or $[-1, 3)$.

54. $-6<x-4\le 1$

$-2<x\le 5$

The solution set is $\{x\mid -2<x\le 5\}$ or $(-2, 5]$.

55. $-11<2x-1\le -5$

$-10<2x\le -4$

$-5<x\le -2$

The solution set is $\{x\mid -5<x\le -2\}$, or $(-5, -2]$.

56. $3\le 4x-3<19$

$6\le 4x<22$

$\frac{6}{4}\le x<\frac{22}{4}$

$\frac{3}{2}\le x<\frac{11}{2}$

The solution set is $\left\{x\,\middle|\,\frac{3}{2}\le x<\frac{11}{2}\right\}$ or $\left[\frac{3}{2},\frac{11}{2}\right)$.

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57. $-3 \le \frac{2}{3}x - 5 < -1$

$2 \le \frac{2}{3}x < 4$

$3 \le x < 6$

The solution set is $\{x | 3 \le x < 6\}$, or [3, 6).

58. $-6 \le \frac{1}{2}x - 4 < -3$

$-2 \le \frac{1}{2}x < 1$

$-4 \le x < 2$

The solution set is $\{x | -4 \ge x < 2\}$ or $[-4, 2)$.

59. $|x| < 3$

$-3 < x < 3$

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

60. $|x| < 5$

$-5 < x < 5$

The solution set is $\{x | -5 < x < 5\}$ or (–5, 5).

61. $|x - 1| \le 2$

$-2 \le x - 1 \le 2$

$-1 \le x \le 3$

The solution set is $\{x | -1 \le x \le 3\}$, or [–1, 3].

62. $|x + 3| \le 4$

$-4 \le x + 3 \le 4$

$-7 \le x \le 1$

The solution set is $\{x | -7 \le x \le 1\}$ or [–7, 1].

63. $|2x - 6| < 8$

$-8 < 2x - 6 < 8$

$-2 < 2x < 14$

$-1 < x < 7$

The solution set is $\{x | -1 < x < 7\}$, or (–1, 7).

64. $|3x + 5| < 17$

$-17 < 3x + 5 < 17$

$-22 < 3x < 12$

The solution set is $\left\{x \middle| -\frac{22}{3} < x < 4\right\}$ or $\left(-\frac{22}{3}, 4\right)$.

65. $|2(x - 1) + 4| \le 8$

$-8 \le 2(x - 1) + 4 \le 8$

$-8 \le 2x - 2 + 4 \le 8$

$-8 \le 2x + 2 \le 8$

$-10 \le 2x \le 6$

$-5 \le x \le 3$

The solution set is $\{x | -5 \le x \le 3\}$, or [–5, 3].

66. $|3(x - 1) + 2| \le 20$

$-20 \le 3(x - 1) + 2 \le 20$

$-20 \le 3x - 1 \le 20$

$-19 \le 3x \le 21$

$-\frac{19}{3} \le x \le 7$

The solution set is $\left\{x \middle| -\frac{19}{3} \le x \le 7\right\}$ 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 $\{x | -6 < y < 0\}$, 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 $\{x | -7 < x < 9\}$ or (–7, 9).

69. $|x| > 3$

$x > 3$ or $x < -3$

The solution set is $\{x | x > 3 \text{ or } x < -3\}$, that is,

$(-\infty, -3)$ or $(3, \infty)$.

70. $|x| > 5$

$x > 5$ or $x < -5$

The solution set is $\{x | x < -5 \text{ or } x > 5\}$, that is,

all x in $(-\infty, -5)$ or $(5, \infty)$.

71. $|x - 1| \ge 2$

$x - 1 \ge 2$ or $x - 1 \le -2$

$x \ge 3$ $\quad$ $x \le -1$

The solution set is $\{x | x \le -1 \text{ or } x \ge 3\}$, that is,

$(-\infty, -1]$ or $[3, \infty)$.

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72. $|x+3| \ge 4$

$x+3 \ge 4$ or $x+3 \le -4$

$x \ge 1$ $\quad$ $x \le -7$

The solution set is $\{x \mid x \le -7 \text{ or } x \ge 1\}$ that is, $(-\infty,-7)$ or $(1,\infty)$.

73. $|3x-8| > 7$

$3x-8 > 7$ or $3x-8 < -7$

$3x > 15$ $\quad$ $3x < 1$

$x > 5$ $\quad$ $x < \frac{1}{3}$

The solution set is $\left\{x \middle| x < \frac{1}{3} \text{ or } x > 5\right\}$, that is, $\left(-\infty, \frac{1}{3}\right)$ or $(5,\infty)$.

74. $|5x-2| > 13$

$5x-2 > 13$ or $5x-2 < -13$

$5x > 15$ $\quad$ $5x < -11$

$x > 3$ $\quad$ $x < -\frac{11}{5}$

The solution set is $\left\{x \middle| x < \frac{-11}{5} \text{ or } x > 3\right\}$, that is, all x in $\left(-\infty, \frac{-11}{5}\right)$ or $(3,\infty)$

75. $\left|\frac{2x+2}{4}\right| \ge 2$

$\frac{2x+2}{4} \ge 2$ or $\frac{2x+2}{4} \le -2$

$2x+2 \ge 8$ $\quad$ $2x+2 \le -8$

$2x \ge 6$ $\quad$ $2x \le -10$

$x \ge 3$ $\quad$ $x \le -5$

The solution set is $\{x \mid x \le -5 \text{ or } x \ge 3\}$, that is, $(-\infty,-5]$ or $[3,\infty)$.

76. $\left|\frac{3x-3}{9}\right| \ge 1$

$\frac{3x-3}{9} \ge 1$ or $\frac{3x-3}{9} \le -1$

$3x-3 \ge 9$ $\quad$ $3x-3 \le -9$

$3x \ge 12$ $\quad$ $3x \le -6$

$x \ge 4$ $\quad$ $x \le -2$

The solution set is $\{x \mid x \le -2 \text{ or } x \ge 4\}$, or $(-\infty,-2]$ or $[4,\infty)$.

77. $\left|3-\frac{2}{3}x\right| > 5$

$3-\frac{2}{3}x > 5$ or $3-\frac{2}{3}x < -5$

$-\frac{2}{3}x > 2$ $\quad$ $-\frac{2}{3}x < -8$

$x < -3$ $\quad$ $x > 12$

The solution set is $\{x \mid x < -3 \text{ or } x > 12\}$, that is, $(-\infty,-3)$ or $(12,\infty)$.

78. $\left|3-\frac{3}{4}x\right| > 9$

$3-\frac{3}{4}x > 9$ or $3-\frac{3}{4}x < -9$

$-\frac{3}{4}x > 6$ $\quad$ $-\frac{3}{4}x < -12$

$x < -8$ $\quad$ $x > 16$

$\{x \mid x < -8 \text{ or } x > 16\}$, that is all x in $(-\infty,-8)$ or $(16,\infty)$.

79. $3|x-1|+2 \ge 8$

$3|x-1| \ge 6$

$|x-1| \ge 2$

$x-1 \ge 2$ or $x-1 \le -2$

$x \ge 3$ $\quad$ $x \le -1$

The solution set is $\{x \mid x \le 1 \text{ or } x \ge 3\}$, that is, $(-\infty,-1]$ or $[3,\infty)$.

80. $5|2x+1|-3 \ge 9$

$5|2x+1| \ge 12$

$|2x+1| \ge \frac{12}{5}$

$2x+1 \ge \frac{12}{5}$ $\quad$ $2x+1 \le -\frac{12}{5}$

$2x \ge \frac{7}{5}$ or $2x \le -\frac{17}{5}$

$x \ge \frac{7}{10}$ $\quad$ $x \le -\frac{17}{10}$

The solution set is $\left\{x \middle| x \le -\frac{17}{10} \text{ or } x \ge \frac{7}{10}\right\}$.

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81. $-2|x-4| \ge -4$

$$\frac{-2|x-4|}{-2} \le \frac{-4}{-2}$$
$$|x-4| \le 2$$
$$-2 \le x-4 \le 2$$
$$2 \le x \le 6$$

The solution set is $\{x|2 \le x \le 6\}$.

82. $-3|x+7| \ge -27$

$$\frac{-3|x+7|}{-3} \le \frac{-27}{-3}$$
$$|x+7| \le 9$$
$$-9 \le x+7 \le 9$$
$$-16 \le x \le 2$$

The solution set is $\{x|-16 \le x \le 2\}$.

83. $-4|1-x| < -16$

$$\frac{-4|1-x|}{-4} > \frac{-16}{-4}$$
$$|1-x| > 4$$

$1-x > 4$ or $1-x < -4$

$-x > 3$ or $-x < -5$

$x < -3$ or $x > 5$

The solution set is $\{x|\ x < -3 \text{ or } x > 5\}$.

84. $-2|5-x| < -6$

$$-2|5-x| < -6$$
$$\frac{-2|5-x|}{-2} > \frac{-6}{-2}$$
$$|5-x| > 3$$

$5-x > 3$ or $5-x < -3$

$-x > -2$ or $-x < -8$

$x < 2$ or $x > 8$

The solution set is $\{x|\ x < 2 \text{ or } x > 8\}$.

85. $3 \le |2x-1|$

$2x-1 \ge 3$ or $2x-1 \le -3$

$2x \ge 4$ or $2x \le -2$

$x \ge 2$ or $x \le -1$

The solution set is $\{x|\ x \le -1 \text{ or } x \ge 2\}$.

86. $9 \le |4x+7|$

$4x+7 \ge 9$ or $4x+7 \le -9$

$4x \ge 2$ or $4x \le -16$

$x \ge \frac{2}{4}$ or $x \le -4$

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

The solution set is $\left\{x \middle| x \le -4 \text{ or } x \ge \frac{1}{2}\right\}$.

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 $|2-3x| > 1$.

$2-3x > 1$ or $2-3x < -1$

$-3x > -1$ or $-3x < -3$

$\frac{-3x}{-3} < \frac{-1}{-3}$ or $\frac{-3x}{-3} > \frac{-3}{-3}$

$x < \frac{1}{3}$ or $x > 1$

The solution set is $\left\{x \middle| x < \frac{1}{3} \text{ or } x > 1\right\}$.

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90. $4 < |2-x|$ is equivalent to $|2-x| > 4$.

$$2-x>4 \quad \text{or} \quad 2-x<-4$$
$$-x>2 \qquad -x<-6$$
$$\frac{-x}{-1}<\frac{2}{-1} \qquad \frac{-x}{-1}>\frac{-6}{-1}$$
$$x<-2 \qquad x>6$$

The solution set is $\{x \mid x<-2 \text{ or } x>6\}$.

91. $12<\left|-2x+\frac{6}{7}\right|+\frac{3}{7}$

$$\frac{81}{7}<\left|-2x+\frac{6}{7}\right|$$
$$-2x+\frac{6}{7}>\frac{81}{7} \quad \text{or} \quad -2x+\frac{6}{7}<-\frac{81}{7}$$
$$-2x>\frac{75}{7} \qquad -2x<-\frac{87}{7}$$
$$x<-\frac{75}{14} \qquad x>\frac{87}{14}$$

The solution set is $\left\{x \,\middle|\, x<-\frac{75}{14} \text{ or } x>\frac{87}{14}\right\}$, that is, $\left(-\infty,-\frac{75}{14}\right)$ 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. $4+\left|3-\frac{x}{3}\right|\ge 9$

$$\left|3-\frac{x}{3}\right|\ge 5$$
$$3-\frac{x}{3}\ge 5 \quad \text{or} \quad 3-\frac{x}{3}\le -5$$
$$-\frac{x}{3}\ge 2 \qquad -\frac{x}{3}\le -8$$
$$x\le -6 \qquad x\ge 24$$

The solution set is $\{x \mid x\le -6 \text{ or } x\ge 24\}$, that is, $(-\infty,-6]$ or $[24,\infty)$.

94. $\left|2-\frac{x}{2}\right|-1\le 1$

$$\left|2-\frac{x}{2}\right|\le 2$$
$$-2\le 2-\frac{x}{2}\le 2$$
$$-4\le -\frac{x}{2}\le 0$$
$$8\ge x\ge 0$$

The solution set is $\{x \mid 0\le x\le 8\}$ or $[0,8]$.

95.
$$y_1\le y_2$$
$$\frac{x}{2}+3\le \frac{x}{3}+\frac{5}{2}$$
$$6\left(\frac{x}{2}+3\right)\le 6\left(\frac{x}{3}+\frac{5}{2}\right)$$
$$\frac{6x}{2}+6(3)\le \frac{6x}{3}+\frac{6(5)}{2}$$
$$3x+18\le 2x+15$$
$$x\le -3$$

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.
$$y\ge 4$$
$$1-(x+3)+2x\ge 4$$
$$1-x-3+2x\ge 4$$
$$x-2\ge 4$$
$$x\ge 6$$

The solution set is $[6,\infty)$.

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98.
$$\begin{aligned} y &\le 0 \\ 2x-11+3(x+2) &\le 0 \\ 2x-11+3x+6 &\le 0 \\ 5x-5 &\le 0 \\ 5x &\le 5 \\ x &\le 1 \end{aligned}$$
The solution set is $(-\infty,1]$.

99.
$$\begin{aligned} y &< 8 \\ |3x-4|+2 &< 8 \\ |3x-4| &< 6 \end{aligned}$$
$$-6 < 3x-4 < 6$$
$$-2 < 3x < 10$$
$$\frac{-2}{3} < \frac{3x}{3} < \frac{10}{3}$$
$$\frac{-2}{3} < x < \frac{10}{3}$$
The solution set is $\left(\frac{-2}{3}, \frac{10}{3}\right)$.

100.
$$\begin{aligned} y &> 9 \\ |2x-5|+1 &> 9 \\ |2x-5| &> 8 \end{aligned}$$
$$\begin{array}{lcl} 2x-5 < -8 & \text{or} & 2x-5 > 8 \\ 2x < -3 & & 2x > 13 \\ x < -\frac{3}{2} & & x > \frac{13}{2} \end{array}$$
The solution set is $\left(-\infty,-\frac{3}{2}\right)\cup\left(\frac{13}{2},\infty\right)$.

101.
$$\begin{aligned} y &\le 4 \\ 7-\left|\frac{x}{2}+2\right| &\le 4 \\ -\left|\frac{x}{2}+2\right| &\le -3 \\ \left|\frac{x}{2}+2\right| &\ge 3 \end{aligned}$$
$$\begin{array}{lcl} \frac{x}{2}+2 \ge 3 & \text{or} & \frac{x}{2}+2 \le -3 \\ x+4 \ge 6 & & x+4 \le -6 \\ x \ge 2 & & x \le -10 \end{array}$$
The solution set is $(-\infty,-10]\cup[2,\infty)$.

102.
$$\begin{aligned} y &\ge 6 \\ 8-|5x+3| &\ge 6 \\ -|5x+3| &\ge -2 \\ -\left(-|5x+3|\right) &\le -(-2) \\ |5x+3| &\le 2 \end{aligned}$$
$$-2 \le 5x+3 \le 2$$
$$-5 \le 5x \le -1$$
$$\frac{-5}{5} \le \frac{5x}{5} \le \frac{-1}{5}$$
$$-1 \le x \le -\frac{1}{5}$$
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 $\{x\,|\,-1 \le x < 2\}$ or $[-1,2)$.

106. The solution set is $\{x\,|\,1 < x \le 4\}$ or $(1,4]$.

107. Let x be the number.
$$\begin{array}{lcl} |4-3x| \ge 5 & \text{or} & |3x-4| \ge 5 \\ 3x-4 \ge 5 & & 3x-4 \le -5 \\ 3x \ge 9 & \text{or} & 3x \le -1 \\ x \ge 3 & & x \le -\frac{1}{3} \end{array}$$
The solution set is $\left\{x\,\middle|\,x \le -\frac{1}{3} \text{ or } x \ge 3\right\}$ or $\left(-\infty,-\frac{1}{3}\right]\cup[3,\infty)$.

108. Let x be the number.
$$\begin{array}{lcl} |5-4x| \le 13 & \text{or} & |4x-5| \le 13 \end{array}$$
$$-13 \le 4x-5 \le 13$$
$$-8 \le 4x \le 18$$
$$-2 \le x \le \frac{9}{2}$$
The solution set is $\left\{x\,\middle|\,-2 \le x \le \frac{9}{2}\right\}$ or $\left[-2,-\frac{2}{9}\right]$.

109. $(0,4)$

110. $[0,5]$

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111. passion $\le$ intimacy or intimacy $\ge$ passion

112. commitment $\ge$ intimacy or
intimacy $\le$ commitment

113. passion<commitment or
commitment > passion

114. commitment > passion or
passion < 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. $28 \le 20 + 0.40(x - 60) \le 40$

$28 \le 20 + 0.40x - 24 \le 40$

$28 \le 0.40x - 4 \le 40$

$32 \le 0.40x \le 44$

$80 \le x \le 110$

Between 80 and 110 ten minutes, inclusive.

120. $$15 \le \frac{5}{9}(F - 32) \le 35$$

$$\frac{9}{5}(15) \le \frac{9}{5}\left(\frac{5}{9}(F - 32)\right) \le \frac{9}{5}(35)$$

$$9(3) \le F - 32 \le 9(7)$$

$$27 \le F - 32 \le 63$$

$$59 \le F \le 95$$

The range for Fahrenheit temperatures is $59°\text{F}$ to $95°\text{F}$, inclusive or $[59°\text{F}, 95°\text{F}]$.

121. $$\left|\frac{h - 50}{5}\right| \ge 1.645$$

$\frac{h - 50}{5} \ge 1.645$ or $\frac{h - 50}{5} \le -1.645$

$h - 50 \ge 8.225$ $\quad$ $h - 50 \le -8.225$

$h \ge 58.225$ $\quad$ $h \le 41.775$

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.

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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 then 1200 packets of stationary need to be sold each week to make a profit.

128. $265+65x\le 2800$

$65x\le 2535$

$x\le 39$

39 bags or fewer can be lifted safely.

129. $245+95x\le 3000$

$95x\le 2755$

$x\le 29$

29 bags or less can be lifted safely.

130. Let $x=$ the grade on the final exam.

$\frac{86+88+92+84+x+x}{6}\ge 90$

$86+88+92+84+x+x\ge 540$

$2x+350\ge 540$

$2x\ge 190$

$x\ge 95$

You must receive at least a 95% to earn an A.

131. a. $\frac{86+88+x}{3}\ge 90$

$\frac{174+x}{3}\ge 90$

$174+x\ge 270$

$x\ge 96$

You must get at least a 96.

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. Let $x=$ the number of hours the mechanic works on the car.

$226\le 175+34x\le 294$

$51\le 34x\le 119$

$1.5\le x\le 3.5$

The man will be working on the job at least 1.5 and at most 3.5 hours.

133. Let $x=$ the number of times the bridge is crossed per three month period

The cost with the 3-month pass is $C_3=7.50+0.50x.$

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.

$3x>7.50+0.50x$

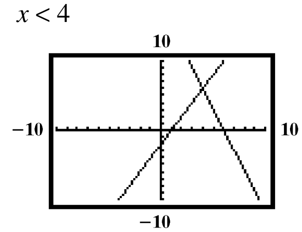
$2.50x>7.50$

$x>3$

The 3-month pass is the best deal when making more than 3 but less than 15 crossings per 3-month period.

134. – 141. Answers will vary.

142. $x<4$



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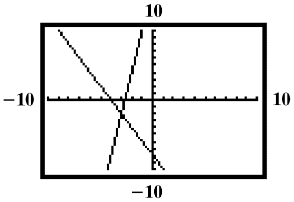
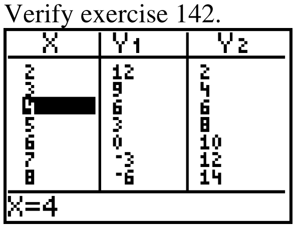
143. $x < -3$



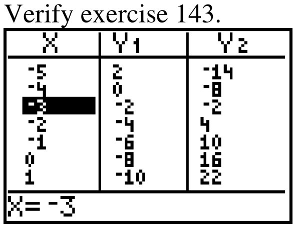
144. Verify exercise 142.



X	Y_1	Y_2
2	12	2
3	9	4
4	6	6
5	3	8
6	0	10
7	-3	12
8	-6	14

X=4

Verify exercise 143.

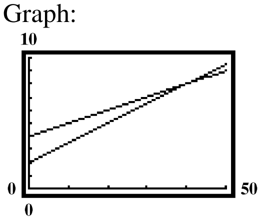


X	Y_1	Y_2
-5	2	-14
-4	0	-8
-3	-2	-2
-2	-4	4
-1	-6	10
0	-8	16
1	-10	22

X= -3

145. a. The cost of Plan A is 4 + 0.10*x*;
The cost of Plan B is 2 + 0.15*x*.

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. $|x - 4| \geq 3$

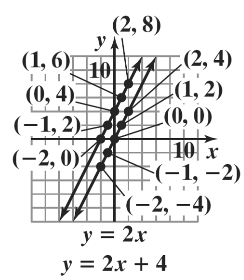
156. Answers will vary.

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	$y = 2(2) + 4 = 8$	$(2, 8)$



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159. **a.** When the x-coordinate is 2, the y-coordinate is 3.

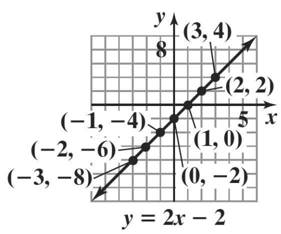
b. When the y-coordinate is 4, the x-coordinates are –3 and 3.

c. The x-coordinates are all real numbers.

d. The y-coordinates are all real numbers greater than or equal to 1.

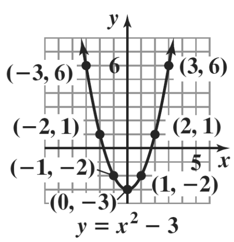
Chapter 1 Review Exercises

1.



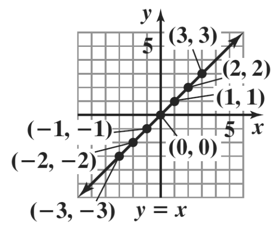
$x = -3, y = -8$
$x = -2, y = -6$
$x = -1, y = -4$
$x = 0, y = -2$
$x = 1, y = 0$
$x = 2, y = 2$
$x = 3, y = 4$

2.



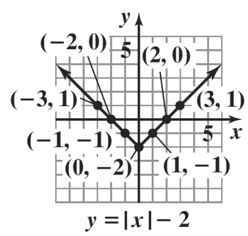
$x = -3, y = 6$
$x = -2, y = 1$
$x = -1, y = -2$
$x = 0, y = -3$
$x = 1, y = -2$
$x = 2, y = 1$
$x = 3, y = 6$

3.



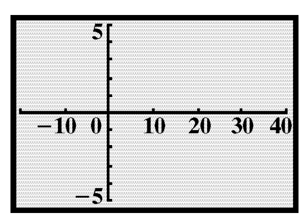
$x = -3, y = -3$
$x = -2, y = -2$
$x = -1, y = -1$
$x = 0, y = 0$
$x = 1, y = 1$
$x = 2, y = 2$
$x = 3, y = 3$

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 intercepts 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 $\varnothing$.
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.

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24. $\frac{x}{2}-\frac{1}{10}=\frac{x}{5}+\frac{1}{2}$

$5x-1=2x+5$

$3x=6$

$x=2$

The solution set is $\{2\}$.
This is a conditional equation.

25. $\frac{2x}{3}=6-\frac{x}{4}$

$4(2x)=12(6)-3x$

$8x=72-3x$

$11x=72$

$x=\frac{72}{11}$

The solution set is $\left\{\frac{72}{11}\right\}$.

This is a conditional equation.

26. $\frac{x}{4}=2-\frac{x-3}{3}$

$\frac{12\cdot x}{4}=12(2)-\frac{12(x-3)}{3}$

$3x=24-4x+12$

$7x=36$

$x=\frac{36}{7}$

The solution set is $\left\{\frac{36}{7}\right\}$.

This is a conditional equation.

27. $\frac{3x+1}{3}-\frac{13}{2}=\frac{1-x}{4}$

$4(3x+1)-6(13)=3(1-x)$

$12x+4-78=3-3x$

$12x-74=3-3x$

$15x=77$

$x=\frac{77}{15}$

The solution set is $\left\{\frac{77}{15}\right\}$.

This is a conditional equation.

28. $\frac{9}{4}-\frac{1}{2x}=\frac{4}{x}$

$9x-2=16$

$9x=18$

$x=2$

The solution set is $\{2\}$.
This is a conditional equation.

29. $\frac{7}{x-5}+2=\frac{x+2}{x-5}$

$7+2(x-5)=x+2$

$7+2x-10=x+2$

$2x-3=x+2$

$x=5$

5 does not check and must be rejected.
The solution set is the empty set, $\varnothing$.
This is an inconsistent equation.

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

$\frac{1}{x-1}-\frac{1}{x+1}=\frac{2}{(x+1)(x-1)}$

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

$x+1-x+1=2$

$2=2$

The solution set is all real numbers except –1 and 1.
This is a conditional equation.

31. $\frac{5}{x+3}+\frac{1}{x-2}=\frac{8}{x^2+x-6}$

$\frac{5}{x+3}+\frac{1}{x-2}=\frac{8}{(x+3)(x-2)}$

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

$5(x-2)+1(x+3)=8$

$5x-10+x+3=8$

$6x-7=8$

$6x=15$

$x=\frac{15}{6}$

$x=\frac{5}{2}$

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

This is a conditional equation.

32. $$\frac{1}{x+5}=0$$
$$(x+5)\frac{1}{x+5}=(x+5)(0)$$
$$1=0$$
The solution set is the empty set, $\varnothing$.
This is an inconsistent equation.

33. $$\frac{4}{x+2}+\frac{3}{x}=\frac{10}{x^2+2x}$$
$$\frac{4}{x+2}+\frac{3}{x}=\frac{10}{x(x+2)}$$
$$\frac{4\cdot x(x+2)}{x+2}+\frac{3\cdot x(x+2)}{x}=\frac{10\cdot x(x+2)}{x(x+2)}$$
$$4x+3(x+2)=10$$
$$4x+3x+6=10$$
$$7x+6=10$$
$$7x=4$$
$$x=\frac{4}{7}$$
The solution set is $\left\{\frac{4}{7}\right\}$.
This is a conditional equation.

34. $$3-5(2x+1)-2(x-4)=0$$
$$3-5(2x+1)-2(x-4)=0$$
$$3-10x-5-2x+8=0$$
$$-12x+6=0$$
$$-12x=-6$$
$$x=\frac{-6}{-12}$$
$$x=\frac{1}{2}$$
The solution set is $\left\{\frac{1}{2}\right\}$.
This is a conditional equation.

35. $$\frac{x+2}{x+3}+\frac{1}{x^2+2x-3}-1=0$$
$$\frac{x+2}{x+3}+\frac{1}{(x+3)(x-1)}-1=0$$
$$\frac{x+2}{x+3}+\frac{1}{(x+3)(x-1)}=1$$
$$\frac{(x+2)(x+3)(x-1)}{x+3}+1=(x+3)(x-1)$$
$$(x+2)(x-1)+1=(x+3)(x-1)$$
$$x^2+x-2+1=x^2+2x-3$$
$$x-1=2x-3$$
$$-x=-2$$
$$x=2$$
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. $$15+.05x=5+.07x$$
$$10=.02x$$
$$500=x$$
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.

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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%

$$\begin{aligned} x + \quad y &= 9000 \\ 0.04x + 0.07y &= 555 \end{aligned}$$

Multiply the first equation by –0.04 and add.

$$\begin{aligned} -0.04x - 0.04y &= -360 \\ 0.04x + 0.07y &= 555 \\ \hline 0.03y &= 195 \\ y &= 6500 \end{aligned}$$

Back-substitute 6500 for y in one of the original equations to find x.

$$\begin{aligned} x + y &= 9000 \\ x + 6500 &= 9000 \\ x &= 2500 \end{aligned}$$

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%.

$$\begin{aligned} 0.05(8000 - x) &= 0.02x + 85 \\ 400 - 0.05x &= 0.02x + 85 \\ -0.05x - 0.02x &= 85 - 400 \\ -0.07x &= -315 \\ \frac{-0.07x}{-0.07} &= \frac{-315}{-0.07} \\ x &= 4500 \\ 8000 - x &= 3500 \end{aligned}$$

\$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

$$\begin{aligned} P &= 2(\text{length}) + 2(\text{width}) \\ 340 &= 2(3w - 6) + 2w \\ 340 &= 6w - 12 + 2w \\ 340 &= 8w - 12 \\ 352 &= 8w \\ 44 &= w \end{aligned}$$

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.

$$\begin{aligned} vt + gt^2 &= s \\ gt^2 &= s - vt \\ \frac{gt^2}{t^2} &= \frac{s - vt}{t^2} \\ g &= \frac{s - vt}{t^2} \end{aligned}$$

46.

$$\begin{aligned} T &= gr + gvt \\ T &= g(r + vt) \\ \frac{T}{r + vt} &= \frac{g(r + vt)}{r + vt} \\ \frac{T}{r + vt} &= g \\ g &= \frac{T}{r + vt} \end{aligned}$$

47.

$$\begin{aligned} T &= \frac{A - P}{\text{Pr}} \\ Pr(T) &= Pr\frac{A - P}{\text{Pr}} \\ PrT &= A - P \\ PrT + P &= A \\ P(rT + 1) &= A \\ P &= \frac{A}{1 + rT} \end{aligned}$$

48. $(8 – 3i) – (17 – 7i) = 8 – 3i – 17 + 7i$
$= –9 + 4i$

49.

$$\begin{aligned} 4i(3i - 2) &= (4i)(3i) + (4i)(-2) \\ &= 12i^2 - 8i \\ &= -12 - 8i \end{aligned}$$

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50. $(7-i)(2+3i)$
$= 7\cdot 2+7(3i)+(-i)(2)+(-i)(3i)$
$= 14+21i-2i+3$
$= 17+19i$

51. $(3-4i)^2 = 3^2+2\cdot 3(-4i)+(-4i)^2$
$= 9-24i-16$
$= -7-24i$

52. $(7+8i)(7-8i) = 7^2+8^2 = 49+64 = 113$

53. $\dfrac{6}{5+i} = \dfrac{6}{5+i}\cdot\dfrac{5-i}{5-i}$
$= \dfrac{30-6i}{25+1}$
$= \dfrac{30-6i}{26}$
$= \dfrac{15-3i}{13}$
$= \dfrac{15}{13}-\dfrac{3}{13}i$

54. $\dfrac{3+4i}{4-2i} = \dfrac{3+4i}{4-2i}\cdot\dfrac{4+2i}{4+2i}$
$= \dfrac{12+6i+16i+8i^2}{16-4i^2}$
$= \dfrac{12+22i-8}{16+4}$
$= \dfrac{4+22i}{20}$
$= \dfrac{1}{5}+\dfrac{11}{10}i$

55. $\sqrt{-32}-\sqrt{-18} = i\sqrt{32}-i\sqrt{18}$
$= i\sqrt{16\cdot 2}-i\sqrt{9\cdot 2}$
$= 4i\sqrt{2}-3i\sqrt{2}$
$= (4i-3i)\sqrt{2}$
$= i\sqrt{2}$

56. $(-2+\sqrt{-100})^2 = (-2+i\sqrt{100})^2$
$= (-2+10i)^2$
$= 4-40i+(10i)^2$
$= 4-40i-100$
$= -96-40i$

57. $\dfrac{4+\sqrt{-8}}{2} = \dfrac{4+i\sqrt{8}}{2} = \dfrac{4+2i\sqrt{2}}{2} = 2+i\sqrt{2}$

58. $2x^2+15x = 8$
$2x^2+15x-8 = 0$
$(2x-1)(x+8) = 0$
$2x-1 = 0 \quad x+8 = 0$
$x = \dfrac{1}{2}$ or $x = -8$
The solution set is $\left\{\dfrac{1}{2}, -8\right\}$.

59. $5x^2+20x = 0$
$5x(x+4) = 0$
$5x = 0 \quad x+4 = 0$
$x = 0$ or $x = -4$
The solution set is $\{0, -4\}$.

60. $2x^2-3 = 125$
$2x^2 = 128$
$x^2 = 64$
$x = \pm 8$
The solution set is $\{8, -8\}$.

61. $\dfrac{x^2}{2}+5 = -3$
$\dfrac{x^2}{2} = -8$
$x^2 = -16$
$\sqrt{x^2} = \pm\sqrt{-16}$
$x = \pm 4i$

62. $(x+3)^2 = -10$
$\sqrt{(x+3)^2} = \pm\sqrt{-10}$
$x+3 = \pm i\sqrt{10}$
$x = -3\pm i\sqrt{10}$

63. $(3x-4)^2 = 18$
$\sqrt{(3x-4)^2} = \pm\sqrt{18}$
$3x-4 = \pm 3\sqrt{2}$
$3x = 4\pm 3\sqrt{2}$
$\dfrac{3x}{3} = \dfrac{4\pm 3\sqrt{2}}{3}$
$x = \dfrac{4\pm 3\sqrt{2}}{3}$

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64. x^2+20x

$$\left(\frac{20}{2}\right)^2=10^2=100$$

$$x^2+20x+100=(x+10)^2$$

65. x^2-3x

$$\left(\frac{3}{2}\right)^2=\frac{9}{4}$$

$$x^2-3x+\frac{9}{4}=\left(x-\frac{3}{2}\right)^2$$

66.

$$x^2-12x=-27$$
$$x^2-12x+36=-27+36$$
$$(x-6)^2=9$$
$$x-6=\pm3$$
$$x=6\pm3$$
$$x=9,3$$

The solution set is {9, 3}.

67. $3x^2-12x+11=0$

$$x^2-4x=-\frac{11}{3}$$
$$x^2-4x+4=-\frac{11}{3}+4$$
$$(x-2)^2=\frac{1}{3}$$
$$x-2=\pm\sqrt{\frac{1}{3}}$$
$$x=2\pm\frac{\sqrt{3}}{3}$$

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

68.

$$x^2=2x+4$$
$$x^2-2x-4=0$$
$$x=\frac{2\pm\sqrt{(-2)^2-4(1)(-4)}}{2(1)}$$
$$x=\frac{2\pm\sqrt{4+16}}{2}$$
$$x=\frac{2\pm\sqrt{20}}{2}$$
$$x=\frac{2\pm2\sqrt{5}}{2}$$
$$x=1\pm\sqrt{5}$$

The solution set is $\left\{1+\sqrt{5},1-\sqrt{5}\right\}$.

69. $x^2-2x+19=0$

$$x=\frac{2\pm\sqrt{(-2)^2-4(1)(19)}}{2(1)}$$
$$x=\frac{2\pm\sqrt{4-76}}{2}$$
$$x=\frac{2\pm\sqrt{-72}}{2}$$
$$x=\frac{2\pm6i\sqrt{2}}{2}$$
$$x=1\pm3i\sqrt{2}$$

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

70.

$$2x^2=3-4x$$
$$2x^2+4x-3=0$$
$$x=\frac{-4\pm\sqrt{4^2-4(2)(-3)}}{2(2)}$$
$$x=\frac{-4\pm\sqrt{16+24}}{4}$$
$$x=\frac{-4\pm\sqrt{40}}{4}$$
$$x=\frac{-4\pm2\sqrt{10}}{4}$$
$$x=\frac{-2\pm\sqrt{10}}{2}$$

The solution set is $\left\{\frac{-2+\sqrt{10}}{2},\frac{-2-\sqrt{10}}{2}\right\}$.

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71. $x^2 - 4x + 13 = 0$

$(-4)^2 - 4(1)(13)$

$= 16 - 52$

$= -36$; 2 complex imaginary solutions

72. $9x^2 = 2 - 3x$

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

$3^2 - 4(9)(-2)$

$= 9 + 72$

$= 81$; 2 unequal real solutions

73. $2x^2 - 11x + 5 = 0$

$(2x - 1)(x - 5) = 0$

$2x - 1 = 0 \quad x - 5 = 0$

$x = \frac{1}{2}$ or $x = 5$

The solution set is $\left\{5, \frac{1}{2}\right\}$.

74. $(3x+5)(x-3) = 5$

$3x^2 + 5x - 9x - 15 = 5$

$3x^2 - 4x - 20 = 0$

$$x = \frac{4 \pm \sqrt{(-4)^2 - 4(3)(-20)}}{2(3)}$$

$$x = \frac{4 \pm \sqrt{16 + 240}}{6}$$

$$x = \frac{4 \pm \sqrt{256}}{6}$$

$$x = \frac{4 \pm 16}{6}$$

$$x = \frac{20}{6}, \frac{-12}{6}$$

$$x = \frac{10}{3}, -2$$

The solution set is $\left\{-2, \frac{10}{3}\right\}$.

75. $3x^2 - 7x + 1 = 0$

$$x = \frac{7 \pm \sqrt{(-7)^2 - 4(3)(1)}}{2(3)}$$

$$x = \frac{7 \pm \sqrt{49 - 12}}{6}$$

$$x = \frac{7 \pm \sqrt{37}}{6}$$

The solution set is $\left\{\frac{7 + \sqrt{37}}{6}, \frac{7 - \sqrt{37}}{6}\right\}$.

76. $x^2 - 9 = 0$

$x^2 = 9$

$x = \pm 3$

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

77. $(x-3)^2 - 25 = 0$

$(x-3)^2 = 25$

$x - 3 = \pm 5$

$x = 3 \pm 5$

$x = 8, -2$

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

78. $3x^2 - x + 2 = 0$

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

$$x = \frac{1 \pm \sqrt{1 - 24}}{6}$$

$$x = \frac{1 \pm \sqrt{-23}}{6}$$

$$x = \frac{1 \pm i\sqrt{23}}{6}$$

The solution set is $\left\{\frac{1 + i\sqrt{23}}{6}, \frac{1 - i\sqrt{23}}{6}\right\}$.

79. $3x^2 - 10x = 8$

$3x^2 - 10x - 8 = 0$

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

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

$3x = -2 \qquad x = 4$

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

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

80. $(x+2)^2 + 4 = 0$

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

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

$x + 2 = \pm 2i$

$x = -2 \pm 2i$

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

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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 $\left\{4+\sqrt{5},\, 4-\sqrt{5}\right\}$.

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. $B=1.7x^2+6x+26$

$$826=1.7x^2+6x+26$$
$$0=1.7x^2+6x-800$$
$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$
$$x=\frac{-(6)\pm\sqrt{(6)^2-4(1.7)(-800)}}{2(1.7)}$$
$$=\frac{-6\pm\sqrt{36+5440}}{2(1.7)}$$
$$=\frac{-6\pm\sqrt{5476}}{3.4}$$
$$=\frac{-6\pm 74}{3.4}$$
$$x=20 \text{ or } -23\tfrac{9}{17}$$

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. $2x^4=50x^2$

$$2x^4-50x^2=0$$
$$2x^2\left(x^2-25\right)=0$$
$$x=0$$
$$x=\pm 5$$

The solution set is {–5, 0, 5}.

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87. $2x^3 - x^2 - 18x + 9 = 0$

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

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

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

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

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

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

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

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

$x^2 - 8x = -12$

$x^2 - 8x + 16 = -12 + 16$

$(x-4)^2 = 4$

$x - 4 = \pm 2$

$x = 4 + 2$

$x = 6, 2$

The solution set is {2}.

89. $\sqrt{x-4} + \sqrt{x+1} = 5$

$\sqrt{x-4} = 5 - \sqrt{x+1}$

$x - 4 = 25 - 10\sqrt{x+1} + (x+1)$

$x - 4 = 26 + x - 10\sqrt{x+1}$

$-30 = -10\sqrt{x+1}$

$3 = \sqrt{x+1}$

$9 = x + 1$

$x = 8$

The solution set is {8}.

90. $3x^{\frac{3}{4}} - 24 = 0$

$3x^{\frac{3}{4}} = 24$

$x^{\frac{3}{4}} = 8$

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

$x = 16$

The solution set is {16}.

91. $(x-7)^{\frac{2}{3}} = 25$

$\left[(x-7)^{\frac{2}{3}}\right]^{\frac{3}{2}} = 25^{\frac{3}{2}}$

$x - 7 = \left(5^2\right)^{\frac{3}{2}}$

$x - 7 = 5^3$

$x - 7 = 125$

$x = 132$

The solution set is {132}.

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

Let $t = x^2$

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

$t = 4$ or $t = 1$

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

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

The solution set is {–2, –1, 1, 2}.

93. $x^{1/2} + 3x^{1/4} - 10 = 0$

Let $t = x^{1/4}$

$t^2 + 3t - 10 = 0$

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

$t = -5$ or $t = 2$

$x^{\frac{1}{4}} = -5$ $\quad x^{\frac{1}{4}} = 2$

$\left(x^{\frac{1}{4}}\right)^4 = (-5)^4$ $\quad \left(x^{\frac{1}{4}}\right)^4 = (2)^4$

$x = 625$ $\quad x = 16$

625 does not check and must be rejected.
The solution set is {16}.

94. $|2x+1| = 7$

$2x + 1 = 7$ or $2x + 1 = -7$

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

$x = 3$ $\quad x = -8$

The solution set is {–4, 3}.

95. $2|x-3| - 6 = 10$

$2|x-3| = 16$

$|x-3| = 8$

$x - 3 = 8$ or $x - 3 = -8$

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

The solution set is {–5, 11}.

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96. $3x^{4/3} - 5x^{2/3} + 2 = 0$

Let $t = x^{\frac{2}{3}}$.

$$3t^2 - 5t + 2 = 0$$
$$(3t-2)(t-1) = 0$$

$$3t - 2 = 0 \quad \text{or} \quad t - 1 = 0$$
$$3t = 2 \qquad t = 1$$
$$t = \frac{2}{3} \qquad x^{\frac{2}{3}} = 1$$
$$x^{\frac{2}{3}} = \frac{2}{3} \qquad \left(x^{\frac{2}{3}}\right)^{\frac{3}{2}} = \pm(1)^{\frac{3}{2}}$$
$$\left(x^{\frac{2}{3}}\right)^{\frac{3}{2}} = \pm\left(\frac{2}{3}\right)^{\frac{3}{2}} \qquad x = \pm 1$$
$$x = \pm\sqrt[2]{\left(\frac{2}{3}\right)^3}$$
$$x = \pm\frac{2}{3}\sqrt{\frac{2}{3}}$$
$$x = \pm\frac{2}{3}\cdot\frac{\sqrt{2}}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}}$$
$$x = \pm\frac{2\sqrt{6}}{9}$$

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. $|2x-5| - 3 = 0$

$$2x - 5 = 3 \quad \text{or} \quad 2x - 5 = -3$$
$$2x = 8 \qquad 2x = 2$$
$$x = 4 \qquad x = 1$$

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. $\sqrt{8-2x} - x = 0$

$$\sqrt{8-2x} = x$$
$$\left(\sqrt{8-2x}\right)^2 = (x)^2$$
$$8 - 2x = x^2$$
$$0 = x^2 + 2x - 8$$
$$0 = (x+4)(x-2)$$
$$x + 4 = 0 \quad \text{or} \quad x - 2 = 0$$
$$x = -4 \qquad x = 2$$

–4 does not check.

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

101. $x^3 + 3x^2 - 2x - 6 = 0$

$$x^2(x+3) - 2(x+3) = 0$$
$$(x+3)(x^2-2) = 0$$
$$x + 3 = 0 \quad \text{or} \quad x^2 - 2 = 0$$
$$x = -3 \qquad x^2 = 2$$
$$x = \pm\sqrt{2}$$

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

102. $-4|x+1| + 12 = 0$

$$-4|x+1| = -12$$
$$|x+1| = 3$$
$$x + 1 = 3 \quad \text{or} \quad x + 1 = -3$$
$$x = 2 \qquad x = -4$$

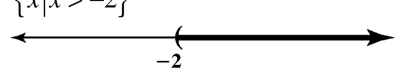
The solution set is $\{-4, 2\}$.

103.
$$p = -2.5\sqrt{t} + 17$$
$$7 = -2.5\sqrt{t} + 17$$
$$-10 = -2.5\sqrt{t}$$
$$4 = \sqrt{t}$$
$$16 = t$$

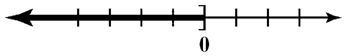
The percentage will drop to 7% 16 years after 1993, or 2009.

104. $\{x | -3 \le x < 5\}$

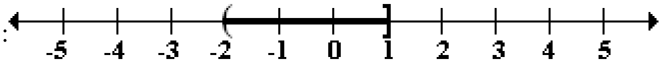
105. $\{x | x > -2\}$



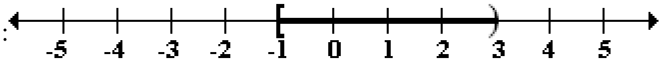
106. $\{x \mid x \le 0\}$



107. Graph $(-2,1]$:

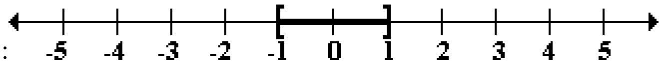


Graph $[-1,3)$:



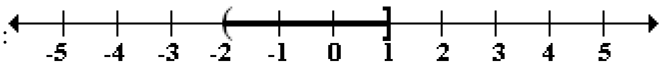
To find the intersection, take the portion of the number line that the two graphs have in common.

Numbers in both $(-2,1]$ and $[-1,3)$:

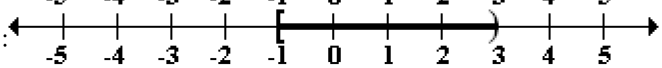


Thus, $(-2,1] \cap [-1,3) = [-1,1]$.

108. Graph $(-2,1]$:

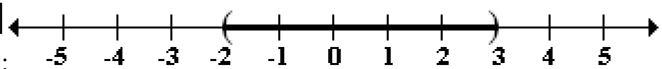


Graph $[-1,3)$:



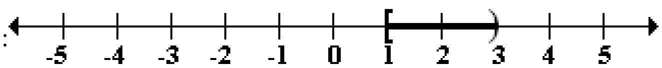
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

Numbers in either $(-2,1]$ or $[-1,3)$ or both:

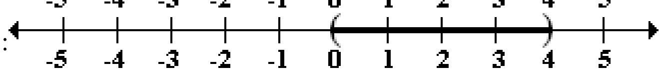


Thus, $(-2,1] \cup [-1,3) = (-2,3)$.

109. Graph $[1,3)$:

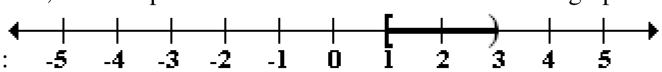


Graph $(0,4)$:



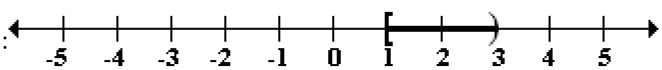
To find the intersection, take the portion of the number line that the two graphs have in common.

Numbers in both $[1,3)$ and $(0,4)$:

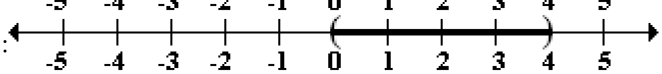


Thus, $[1,3) \cap (0,4) = [1,3)$.

110. Graph $[1,3)$:

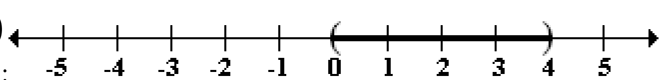


Graph $(0,4)$:



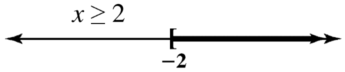
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

Numbers in either $[1,3)$ or $(0,4)$ or both:



Thus, $[1,3) \cup (0,4) = (0,4)$.

111.
$$
\begin{aligned}
-6x + 3 &\le 15 \\
-6x &\le 12 \\
x &\ge 2
\end{aligned}
$$



The solution set is $[-2,\infty)$.

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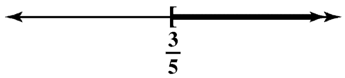
112. $6x - 9 \geq -4x - 3$

$10x \geq 6$

$x \geq \frac{3}{5}$



The solution set is $\left[\frac{3}{5}, \infty\right)$.

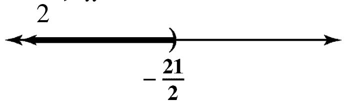
113. $\frac{x}{3} - \frac{3}{4} - 1 > \frac{x}{2}$

$12\left(\frac{x}{3} - \frac{3}{4} - 1\right) > 12\left(\frac{x}{2}\right)$

$4x - 9 - 12 > 6x$

$-21 > 2x$

$-\frac{21}{2} > x$



The solution set is $\left(-\infty, -\frac{21}{2}\right)$.

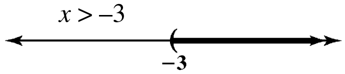
114. $6x + 5 > -2(x - 3) - 25$

$6x + 5 > -2x + 6 - 25$

$8x + 5 > -19$

$8x > -24$

$x > -3$



The solution set is $(-3, \infty)$.

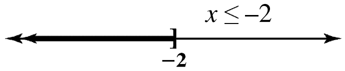
115. $3(2x - 1) - 2(x - 4) \geq 7 + 2(3 + 4x)$

$6x - 3 - 2x + 8 \geq 7 + 6 + 8x$

$4x + 5 \geq 8x + 13$

$-4x \geq 8$

$x \leq -2$



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 $\varnothing$.

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 $[-9, 6]$.

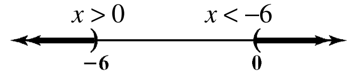
119. $\left|\frac{2x+6}{3}\right| > 2$

$\frac{2x+6}{3} > 2 \quad \frac{2x+6}{3} < -2$

$2x + 6 > 6 \quad 2x + 6 < -6$

$2x > 0 \quad 2x < -12$

$x > 0 \quad x < -6$



The solution set is $(-\infty, -6)$ or $(0, \infty)$.

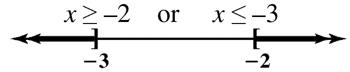
120. $|2x + 5| - 7 \geq -6$

$|2x + 5| \geq 1$

$2x + 5 \geq 1$ or $2x + 5 \leq -1$

$2x \geq -4 \quad 2x \leq -6$

$x \geq -2$ or $x \leq -3$



The solution set is $(-\infty, -3]$ or $[-2, \infty)$.

121. $-4|x + 2| + 5 \leq -7$

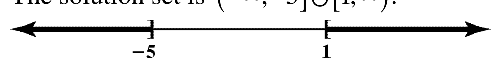
$-4|x + 2| \leq -12$

$|x + 2| \geq 3$

$x + 2 \geq 3$ or $x + 2 \leq -3$

$x \geq 1 \quad x \leq -5$

The solution set is $(-\infty, -5] \cup [1, \infty)$.



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122.
$$\begin{aligned} y_1 &> y_2 \\ -10-3(2x+1) &> 8x+1 \\ -10-6x-3 &> 8x+1 \\ -6x-13 &> 8x+1 \\ -14x &> 14 \\ \frac{-14x}{-14} &< \frac{14}{-14} \\ x &< -1 \end{aligned}$$
The solution set is $(-\infty,-1)$.

123.
$$\begin{aligned} 3-|2x-5| &\ge -6 \\ -|2x-5| &\ge -9 \\ \frac{-|2x-5|}{-1} &\le \frac{-9}{-1} \\ |2x-5| &\le 9 \\ -9 \le 2x-5 &\le 9 \\ -4 \le 2x &\le 14 \\ -2 \le x &\le 7 \end{aligned}$$
The solution set is $[-2,7]$.

124.
$$\begin{aligned} 0.20x+24 &\le 40 \\ 0.20x &\le 16 \\ \frac{0.20x}{0.20} &\le \frac{16}{0.20} \\ x &\le 80 \end{aligned}$$
A customer can drive no more than 80 miles.

125.
$$\begin{aligned} 80 \le \frac{95+79+91+86+x}{5} &< 90 \\ 400 \le 95+79+91+86+x &< 450 \\ 400 \le 351+x &< 450 \\ 49 \le x &< 99 \end{aligned}$$
A grade of at least 49% but less than 99% will result in a B.

126.
$$\begin{aligned} 0.075x &\ge 9000 \\ \frac{0.075x}{0.075} &\ge \frac{9000}{0.075} \\ x &\ge 120{,}000 \end{aligned}$$
The investment must be at least $120,000.

Chapter 1 Test

1.
$$\begin{aligned} 7(x-2) &= 4(x+1)-21 \\ 7x-14 &= 4x+4-21 \\ 7x-14 &= 4x-17 \\ 3x &= -3 \\ x &= -1 \end{aligned}$$
The solution set is $\{-1\}$.

2.
$$\begin{aligned} -10-3(2x+1)-8x-1 &= 0 \\ -10-6x-3-8x-1 &= 0 \\ -14x-14 &= 0 \\ -14x &= 14 \\ x &= -1 \end{aligned}$$
The solution set is $\{-1\}$.

3.
$$\begin{aligned} \frac{2x-3}{4} &= \frac{x-4}{2}-\frac{x+1}{4} \\ 2x-3 &= 2(x-4)-(x+1) \\ 2x-3 &= 2x-8-x-1 \\ 2x-3 &= x-9 \\ x &= -6 \end{aligned}$$
The solution set is $\{-6\}$.

4.
$$\begin{aligned} \frac{2}{x-3}-\frac{4}{x+3} &= \frac{8}{(x-3)(x+3)} \\ 2(x+3)-4(x-3) &= 8 \\ 2x+6-4x+12 &= 8 \\ -2x+18 &= 8 \\ -2x &= -10 \\ x &= 5 \end{aligned}$$
The solution set is $\{5\}$.

5.
$$2x^2-3x-2=0$$
$$(2x+1)(x-2)=0$$
$$2x+1=0 \quad \text{or} \quad x-2=0$$
$$x=-\frac{1}{2} \quad \text{or} \quad x=2$$
The solution set is $\left\{-\frac{1}{2}, 2\right\}$.

6.
$$\begin{aligned} (3x-1)^2 &= 75 \\ 3x-1 &= \pm\sqrt{75} \\ 3x &= 1\pm 5\sqrt{3} \\ x &= \frac{1\pm 5\sqrt{3}}{3} \end{aligned}$$
The solution set is $\left\{\frac{1-5\sqrt{3}}{3}, \frac{1+5\sqrt{3}}{3}\right\}$.

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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. $x(x-2)=4$

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

$x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$

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

$x=\dfrac{2\pm 2\sqrt{5}}{2}$

$x=1\pm\sqrt{5}$

The solution set is $\{1-\sqrt{5}, 1+\sqrt{5}\}$.

9. $4x^2=8x-5$

$4x^2-8x+5=0$

$x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}$

$x=\dfrac{8\pm\sqrt{(-8)^2-4(4)(5)}}{2(4)}$

$x=\dfrac{8\pm\sqrt{-16}}{8}$

$x=\dfrac{8\pm 4i}{8}$

$x=1\pm\dfrac{1}{2}i$

The solution set is $\left\{1+\dfrac{1}{2}i, 1-\dfrac{1}{2}i\right\}$.

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

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

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

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

$x=1$ or $x=-1$ or $x=4$

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

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

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

$x-3=x^2-10x+25$

$x^2-11x+28=0$

$x=\dfrac{11\pm\sqrt{11^2-4(1)(28)}}{2(1)}$

$x=\dfrac{11\pm\sqrt{121-112}}{2}$

$x=\dfrac{11\pm\sqrt{9}}{2}$

$x=\dfrac{11\pm 3}{2}$

$x=7$ or $x=4$

4 does not check and must be rejected.

The solution set is $\{7\}$.

12. $\sqrt{8-2x}-x=0$

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

$\left(\sqrt{8-2x}\right)^2=(x)^2$

$8-2x=x^2$

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

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

$x+4=0$ or $x-2=0$

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

–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 $\{\sqrt[3]{4}\}$.

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15. $x^{2/3} - 9x^{1/3} + 8 = 0$ let $t = x^{1/3}$

$$t^2 - 9t + 8 = 0$$
$$(t-1)(t-8) = 0$$
$$t = 1 \qquad t = 8$$
$$x^{1/3} = 1 \quad x^{1/3} = 8$$
$$x = 1 \qquad x = 512$$

The solution set is $\{1, 512\}$.

16. $\left|\frac{2}{3}x - 6\right| = 2$

$$\frac{2}{3}x - 6 = 2 \qquad \frac{2}{3}x - 6 = -2$$
$$\frac{2}{3}x = 8 \qquad \frac{2}{3}x = 4$$
$$x = 12 \qquad x = 6$$

The solution set is $\{6, 12\}$.

17. $-3|4x - 7| + 15 = 0$

$$-3|4x - 7| = -15$$
$$|4x - 7| = 5$$
$$4x - 7 = 5 \quad \text{or} \quad 4x - 7 = -5$$
$$4x = 12 \qquad 4x = 2$$
$$x = 3 \qquad x = \frac{1}{2}$$

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

18. $\frac{1}{x^2} - \frac{4}{x} + 1 = 0$

$$\frac{x^2}{x^2} - \frac{4x^2}{x} + x^2 = 0$$
$$1 - 4x + x^2 = 0$$
$$x^2 - 4x + 1 = 0$$
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$
$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(1)}}{2(1)}$$
$$x = \frac{4 \pm \sqrt{12}}{2}$$
$$x = \frac{4 \pm 2\sqrt{3}}{2}$$
$$x = 2 \pm \sqrt{3}$$

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

19. $\frac{2x}{x^2 + 6x + 8} + \frac{2}{x+2} = \frac{x}{x+4}$

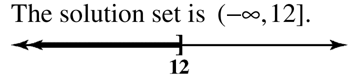
$$\frac{2x}{(x+4)(x+2)} + \frac{2}{x+2} = \frac{x}{x+4}$$
$$\frac{2x(x+4)(x+2)}{(x+4)(x+2)} + \frac{2(x+4)(x+2)}{x+2} = \frac{x(x+4)(x+2)}{x+4}$$
$$2x + 2(x+4) = x(x+2)$$
$$2x + 2x + 8 = x^2 + 2x$$
$$2x + 8 = x^2$$
$$0 = x^2 - 2x - 8$$
$$0 = (x-4)(x+2)$$
$$x - 4 = 0 \quad \text{or} \quad x + 2 = 0$$
$$x = 4 \qquad x = -2 \text{ (rejected)}$$

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

20. $3(x + 4) \geq 5x - 12$

$$3x + 12 \geq 5x - 12$$
$$-2x \geq -24$$
$$x \leq 12$$

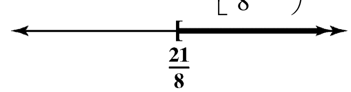
The solution set is $(-\infty, 12]$.



21. $\frac{x}{6} + \frac{1}{8} \leq \frac{x}{2} - \frac{3}{4}$

$$4x + 3 \leq 12x - 18$$
$$-8x \leq -21$$
$$x \geq \frac{21}{8}$$

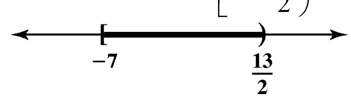
The solution set is $\left[\frac{21}{8}, \infty\right)$.



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 $\left[-7, \frac{13}{2}\right)$.



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23. $|3x+2| \geq 3$

$3x+2 \geq 3 \quad \text{or} \quad 3x+2 \leq -3$

$3x \geq 1 \qquad\qquad 3x \leq -5$

$x \geq \frac{1}{3} \qquad\qquad x \leq -\frac{5}{3}$

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. $y \geq 1$

$\left|\frac{2-x}{4}\right| \geq 1$

$\frac{2-x}{4} \geq 1 \quad \text{or} \quad \frac{2-x}{4} \leq -1$

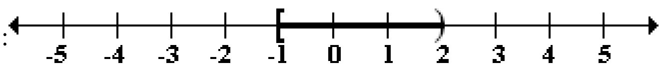
$2-x \geq 4 \qquad\qquad 2-x \leq -4$

$-x \geq 2 \qquad\qquad -x \leq -6$

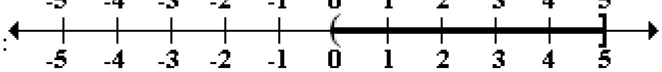
$x \leq -2 \qquad\qquad x \geq 6$

The solution set is $(-\infty,-2] \cup [6,\infty)$.

26. Graph $[-1,2)$:

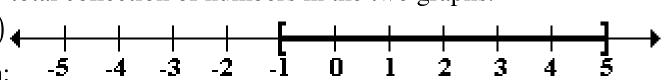


Graph $(0,5]$:



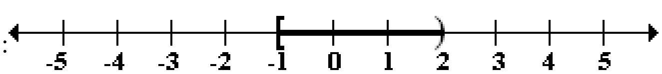
To find the union, take the portion of the number line representing the total collection of numbers in the two graphs.

Numbers in either $[-1,2)$ or $(0,5]$ or both:

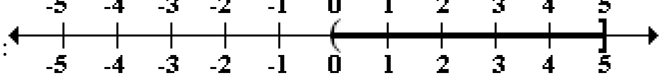


Thus,
$[-1,2) \cup (0,5] = [-1,5]$.

27. Graph $[-1,2)$:

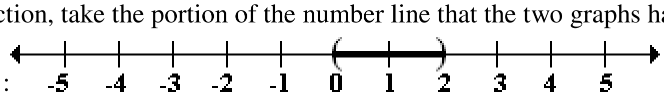


Graph $(0,5]$:



To find the intersection, take the portion of the number line that the two graphs have in common.

Numbers in both $[-1,2)$ and $(0,5]$:



Thus, $[-1,2) \cap (0,5] = (0,2)$.

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28. $V = \frac{1}{3}lwh$

$3V = lwh$

$\frac{3V}{lw} = \frac{lwh}{lw}$

$\frac{3V}{lw} = h$

$h = \frac{3V}{lw}$

29. $y - y_1 = m(x - x_1)$

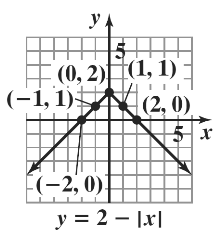
$y - y_1 = mx - mx_1$

$-mx = y_1 - mx_1 - y$

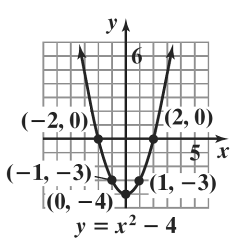
$\frac{-mx}{-m} = \frac{y_1 - mx_1 - y}{-m}$

$x = \frac{y - y_1}{m} + x_1$

30.



31.



32. $(6 - 7i)(2 + 5i) = 12 + 30i - 14i - 35i^2$

$= 12 + 16i + 35$

$= 47 + 16i$

33. $\frac{5}{2 - i} = \frac{5}{2 - i} \cdot \frac{2 + i}{2 + i}$

$= \frac{5(2 + i)}{4 + 1}$

$= \frac{5(2 + i)}{5}$

$= 2 + i$

34. $2\sqrt{-49} + 3\sqrt{-64} = 2(7i) + 3(8i)$

$= 14i + 24i$

$= 38i$

35. $43x + 575 = 1177$

$43x = 602$

$x = 14$

The system's income will be \$1177 billion 14 years after 2004, or 2018.

36. $B = 0.07x^2 + 47.4x + 500$

$1177 = 0.07x^2 + 47.4x + 500$

$0 = 0.07x^2 + 47.4x - 677$

$0 = 0.07x^2 + 47.4x - 677$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-(47.4) \pm \sqrt{(47.4)^2 - 4(0.07)(-677)}}{2(0.07)}$

$x \approx 14, \quad x \approx -691$ (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. $29700 + 150x = 5000 + 1100x$

$24700 = 950x$

$26 = x$

In 26 years, the cost will be \$33,600.

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40. Let x = amount invested at 8%
$10000 - x$ = amount invested at 10%

$$\begin{aligned} 0.08x + 0.1(10000 - x) &= 940 \\ 0.08x + 1000 - 0.1x &= 940 \\ -0.02x &= -60 \\ x &= 3000 \\ 10000 - x &= 7000 \end{aligned}$$

\$3000 at 8%, \$7000 at 10%

41.
$$\begin{aligned} l &= 2w + 4 \\ A &= lw \\ 48 &= (2w+4)w \\ 48 &= 2w^2 + 4w \\ 0 &= 2w^2 + 4w - 48 \\ 0 &= w^2 + 2w - 24 \\ 0 &= (w+6)(w-4) \end{aligned}$$

$w + 6 = 0 \qquad w - 4 = 0$
$w = -6 \qquad w = 4$
$2w + 4 = 2(4) + 4 = 12$
width is 4 feet, length is 12 feet

42.
$$\begin{aligned} 24^2 + x^2 &= 26^2 \\ 576 + x^2 &= 676 \\ x^2 &= 100 \\ x &= \pm 10 \end{aligned}$$

The wire should be attached 10 feet up the pole.

43. Let x = the original selling price
$$\begin{aligned} 20 &= x - 0.60x \\ 20 &= 0.40x \\ 50 &= x \end{aligned}$$
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.
$$\begin{aligned} C_A &< C_B \\ 25 &< 13 + 0.06x \\ 12 &< 0.06x \\ 200 &< x \\ x &> 200 \end{aligned}$$
Plan A is a better deal when more than 200 text messages per month are sent/received.

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