College Algebra 5th edition Young Solutions Manual

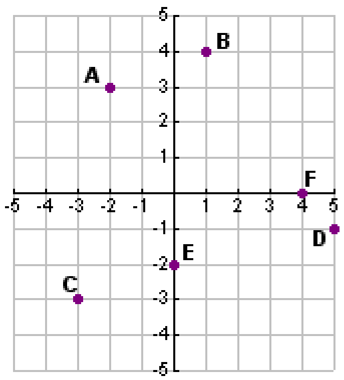
SKU: 9781119742548-SOLUTIONS

CHAPTER 2

Section 2.1 Solutions ---

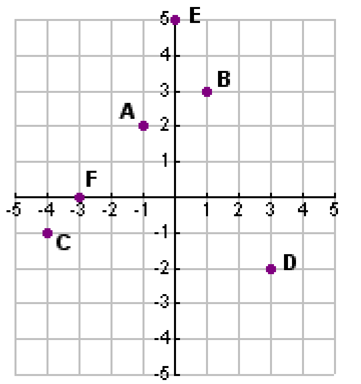
1. $(4,2)$	**2.** $(-2,3)$	**3.** $(-3,0)$
4. $(-4,-2)$	**5.** $(0,-3)$	**6.** $(3,-1)$

7.



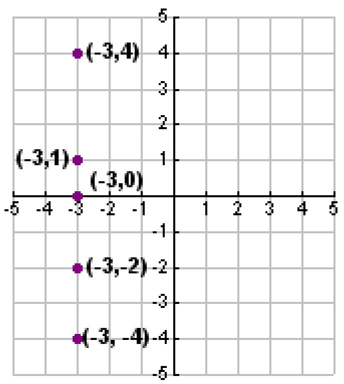
A is in Quadrant II.
B is in Quadrant I.
C is in Quadrant III.
D is in Quadrant IV.
E is on the y-axis.
F is on the x-axis.

8.



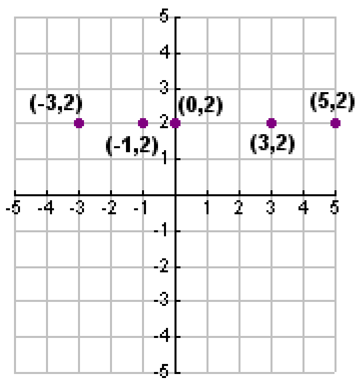
A is in Quadrant II.
B is in Quadrant I.
C is in Quadrant III.
D is in Quadrant IV.
E is on the y-axis.
F is on the x-axis.

9.



The line being described is $x = -3$.

10.



The line being described is $y = 2$.

11.

$$d=\sqrt{(1-5)^2+(3-3)^2}=\sqrt{16}=\boxed{4}$$

$$M=\left(\frac{1+5}{2},\frac{3+3}{2}\right)=\boxed{(3,3)}$$

12.

$$d=\sqrt{(-2-(-2))^2+(4-(-4))^2}=\sqrt{64}=\boxed{8}$$

$$M=\left(\frac{-2+(-2)}{2},\frac{4+(-4)}{2}\right)=\boxed{(-2,0)}$$

13.

$$d=\sqrt{(-1-3)^2+(4-0)^2}=\sqrt{32}=\boxed{4\sqrt{2}}$$

$$M=\left(\frac{-1+3}{2},\frac{4+0}{2}\right)=\boxed{(1,2)}$$

14.

$$d=\sqrt{(-3-1)^2+(-1-3)^2}=\sqrt{32}=\boxed{4\sqrt{2}}$$

$$M=\left(\frac{-3+1}{2},\frac{-1+3}{2}\right)=\boxed{(-1,1)}$$

15.

$$d=\sqrt{(-10-(-7))^2+(8-(-1))^2}$$

$$=\sqrt{90}=\boxed{3\sqrt{10}}$$

$$M=\left(\frac{-10+(-7)}{2},\frac{8+(-1)}{2}\right)$$

$$=\boxed{\left(\frac{-17}{2},\frac{7}{2}\right)}$$

16.

$$d=\sqrt{(-2-7)^2+(12-15)^2}$$

$$=\sqrt{90}=\boxed{3\sqrt{10}}$$

$$M=\left(\frac{-2+7}{2},\frac{12+15}{2}\right)=\boxed{\left(\frac{5}{2},\frac{27}{2}\right)}$$

17.

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

$$=\sqrt{25}=\boxed{5}$$

$$M=\left(\frac{-3+(-7)}{2},\frac{-1+2}{2}\right)=\boxed{\left(-5,\frac{1}{2}\right)}$$

18.

$$d=\sqrt{(-4-(-9))^2+(5-(-7))^2}=\sqrt{169}$$

$$=\boxed{13}$$

$$M=\left(\frac{-4+(-9)}{2},\frac{5+(-7)}{2}\right)=\boxed{\left(-\frac{13}{2},-1\right)}$$

19.

$$d=\sqrt{(-6-(-2))^2+(-4-(-8))^2}$$

$$=\sqrt{32}=\boxed{4\sqrt{2}}$$

$$M=\left(\frac{-6+(-2)}{2},\frac{-4+(-8)}{2}\right)$$

$$=\boxed{(-4,-6)}$$

20.

$$d=\sqrt{(0-(-4))^2+(-7-(-5))^2}$$

$$=\sqrt{20}=\boxed{2\sqrt{5}}$$

$$M=\left(\frac{0+(-4)}{2},\frac{-7+(-5)}{2}\right)$$

$$=\boxed{(-2,-6)}$$

21.

$$d=\sqrt{\left(-\frac{1}{2}-\frac{7}{2}\right)^2+\left(\frac{1}{3}-\frac{10}{3}\right)^2}$$

$$=\sqrt{25}=\boxed{5}$$

$$M=\left(\frac{-\frac{1}{2}+\frac{7}{2}}{2},\ \frac{\frac{1}{3}+\frac{10}{3}}{2}\right)=\boxed{\left(\frac{3}{2},\ \frac{11}{6}\right)}$$

22.

$$d=\sqrt{\left(\frac{1}{5}-\frac{9}{5}\right)^2+\left(\frac{7}{3}-\left(-\frac{2}{3}\right)\right)^2}$$

$$=\sqrt{\frac{289}{25}}=\boxed{\frac{17}{5}}$$

$$M=\left(\frac{\frac{1}{5}+\frac{9}{5}}{2},\ \frac{\frac{7}{3}-\frac{2}{3}}{2}\right)=\boxed{\left(1,\ \frac{5}{6}\right)}$$

23.

$$d=\sqrt{\left(-\frac{2}{3}-\frac{1}{4}\right)^2+\left(-\frac{1}{5}-\frac{1}{3}\right)^2}=\sqrt{\left(-\frac{11}{12}\right)^2+\left(-\frac{8}{15}\right)^2}$$

$$=\sqrt{\frac{11^2\cdot 15^2+8^2\cdot 12^2}{12^2\cdot 15^2}}=\boxed{\frac{\sqrt{4049}}{60}}$$

$$M=\left(\frac{-\frac{2}{3}+\frac{1}{4}}{2},\ \frac{-\frac{1}{5}+\frac{1}{3}}{2}\right)=\boxed{\left(-\frac{5}{24},\ \frac{1}{15}\right)}$$

24.

$$d=\sqrt{\left(\frac{7}{5}-\frac{1}{2}\right)^2+\left(\frac{1}{9}-\left(-\frac{7}{3}\right)\right)^2}=\sqrt{\left(\frac{9}{10}\right)^2+\left(\frac{22}{9}\right)^2}$$

$$=\sqrt{\frac{9^2\cdot 9^2+22^2\cdot 10^2}{10^2\cdot 9^2}}=\boxed{\frac{\sqrt{54,961}}{90}}$$

$$M=\left(\frac{\frac{7}{5}+\frac{1}{2}}{2},\ \frac{\frac{1}{9}+\left(-\frac{7}{3}\right)}{2}\right)=\boxed{\left(\frac{19}{20},\ -\frac{10}{9}\right)}$$

25. $d=\sqrt{(-1.5-2.1)^2+(3.2-4.7)^2}$ $=\sqrt{(-3.6)^2+(-1.5)^2}=\boxed{3.9}$ $M=\left(\frac{-1.5+2.1}{2},\frac{3.2+4.7}{2}\right)$ $=\boxed{(0.3,\ 3.95)}$	**26.** $d=\sqrt{(-1.2-3.7)^2+(-2.5-4.6)^2}$ $=\sqrt{(-4.9)^2+(-7.1)^2}=\sqrt{74.42}$ $\cong\boxed{8.627}$ $M=\left(\frac{-1.2+3.7}{2},\frac{-2.5+4.6}{2}\right)$ $=\boxed{(1.25,\ 1.05)}$
27. $d=\sqrt{(-14.2-16.3)^2+(15.1-(-17.5))^2}$ $=\sqrt{(-30.5)^2+(32.6)^2}=\sqrt{1993.01}$ $\cong\boxed{44.64}$ $M=\left(\frac{-14.2+16.3}{2},\frac{15.1+(-17.5)}{2}\right)$ $=\boxed{(1.05,\ -1.2)}$	**28.** $d=\sqrt{(1.1-3.3)^2+(2.2-4.4)^2}$ $=\sqrt{2(2.2)^2}=\sqrt{9.68}\cong\boxed{3.111}$ $M=\left(\frac{1.1+3.3}{2},\frac{2.2+4.4}{2}\right)$ $=\boxed{(2.2,\ 3.3)}$
29. $d=\sqrt{\left(\sqrt{3}-\sqrt{3}\right)^2+\left(5\sqrt{2}-\sqrt{2}\right)^2}$ $=\sqrt{(0)^2+\left(4\sqrt{2}\right)^2}=\boxed{4\sqrt{2}}$ $M=\left(\frac{\sqrt{3}+\sqrt{3}}{2},\frac{5\sqrt{2}+\sqrt{2}}{2}\right)$ $=\left(\frac{2\sqrt{3}}{2},\frac{6\sqrt{2}}{2}\right)=\boxed{\left(\sqrt{3},3\sqrt{2}\right)}$	**30.** $d=\sqrt{\left(3\sqrt{5}-\left(-\sqrt{5}\right)\right)^2+\left(-3\sqrt{3}-\left(-\sqrt{3}\right)\right)^2}$ $=\sqrt{\left(4\sqrt{5}\right)^2+\left(-2\sqrt{3}\right)^2}=\sqrt{92}=\boxed{2\sqrt{23}}$ $M=\left(\frac{3\sqrt{5}-\sqrt{5}}{2},\frac{-3\sqrt{3}-\sqrt{3}}{2}\right)$ $=\left(\frac{2\sqrt{5}}{2},\frac{-4\sqrt{3}}{2}\right)=\boxed{\left(\sqrt{5},-2\sqrt{3}\right)}$

31.

$$d=\sqrt{\left(1-\left(-\sqrt{2}\right)\right)^2+\left(\sqrt{3}-(-2)\right)^2}$$

$$=\sqrt{\left(1+\sqrt{2}\right)^2+\left(\sqrt{3}+2\right)^2}$$

$$=\boxed{\sqrt{10+2\sqrt{2}+4\sqrt{3}}}$$

$$M=\left(\frac{1+\left(-\sqrt{2}\right)}{2},\frac{\sqrt{3}+(-2)}{2}\right)$$

$$=\boxed{\left(\frac{1-\sqrt{2}}{2},\frac{-2+\sqrt{3}}{2}\right)}$$

32.

$$d=\sqrt{\left(2\sqrt{5}-1\right)^2+\left(4-2\sqrt{3}\right)^2}$$

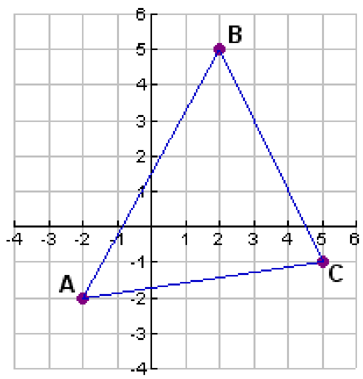
$$=\sqrt{20-4\sqrt{5}+1+16-2\left(8\sqrt{3}\right)+\left(2\sqrt{3}\right)^2}$$

$$=\boxed{\sqrt{49-4\sqrt{5}-16\sqrt{3}}}$$

$$M=\left(\frac{2\sqrt{5}+1}{2},\frac{4+2\sqrt{3}}{2}\right)$$

$$=\boxed{\left(\frac{1+2\sqrt{5}}{2},2+\sqrt{3}\right)}$$

33.



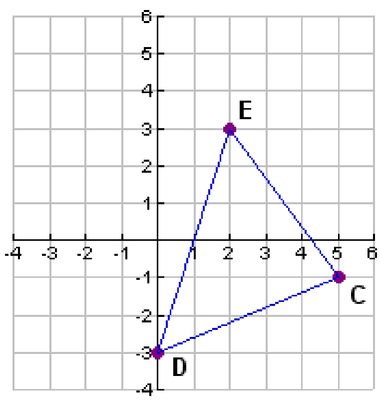
$$d(A,B)=\sqrt{(-2-2)^2+(-2-5)^2}=\sqrt{65}$$

$$d(B,C)=\sqrt{(2-5)^2+(5-(-1))^2}=\sqrt{45}$$

$$d(A,C)=\sqrt{(-2-5)^2+(-2-(-1))^2}=\sqrt{50}$$

The perimeter of the triangle rounded to two decimal places is $\boxed{21.84}$.

34.



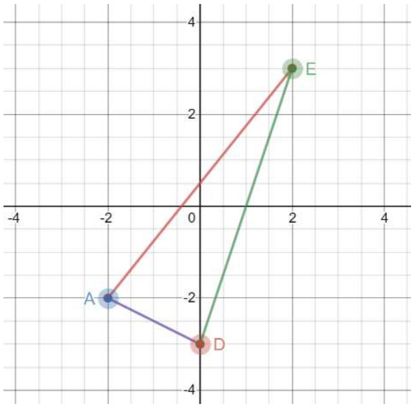
$$d(D,E)=\sqrt{(0-2)^2+(-3-3)^2}=\sqrt{40}$$

$$d(E,C)=\sqrt{(2-5)^2+(3-(-1))^2}=5$$

$$d(D,C)=\sqrt{(0-5)^2+(-3-(-1))^2}=\sqrt{29}$$

The perimeter of the triangle rounded to two decimal places is $\boxed{16.71}$.

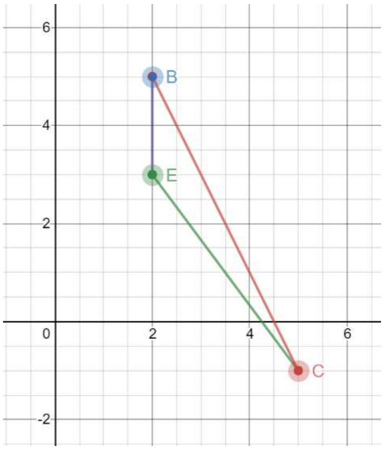
35.



$$d(A,D)=\sqrt{(-2-0)^2+(-2+3)^2}=\sqrt{5}$$
$$d(D,E)=\sqrt{(0-2)^2+(-3-3)^2}=\sqrt{40}$$
$$d(A,E)=\sqrt{(2-(-2))^2+(3-(-2))^2}=\sqrt{41}$$

The perimeter of the triangle rounded to two decimal places is 14.96.

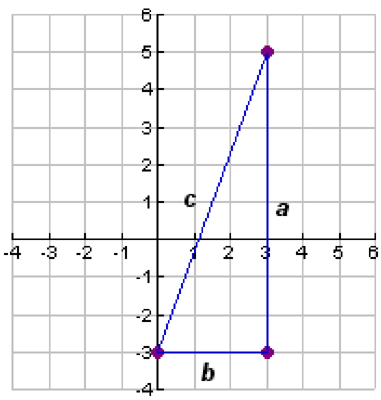
36.



$$d(B,C)=\sqrt{(2-5)^2+(5-(-1))^2}=\sqrt{45}$$
$$d(C,D)=\sqrt{(5-2)^2+(-1-3)^2}=5$$
$$d(B,E)=\sqrt{(2-2)^2+(5-3)^2}=2$$

The perimeter of the triangle rounded to two decimal places is 13.71.

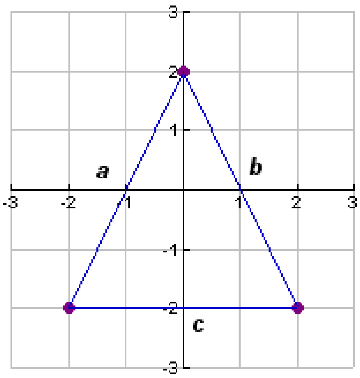
37.



$$a=\sqrt{(3-3)^2+(5-(-3))^2}=8$$
$$b=\sqrt{(0-3)^2+(-3-(-3))^2}=3$$
$$c=\sqrt{(0-3)^2+(-3-5)^2}=\sqrt{8^2+3^2}$$

Observe that $c=\sqrt{a^2+b^2}$ above, so it is a $\boxed{\text{right triangle}}$. It is not isosceles since all sides have different length.

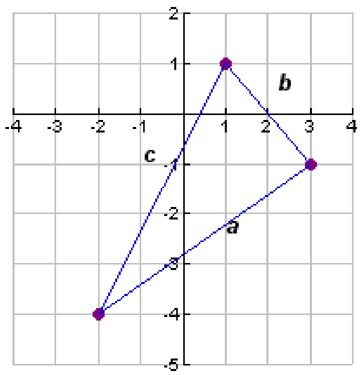
38.



$$a=\sqrt{(-2-0)^2+(-2-2)^2}=\sqrt{20}$$
$$b=\sqrt{(2-0)^2+(-2-2)^2}=\sqrt{20}$$
$$c=\sqrt{(-2-2)^2+(-2-(-2))^2}=4$$

Note that $a^2+b^2 \neq c^2$, $b^2+c^2 \neq a^2$, and $a^2+c^2 \neq b^2$, so this is not a right triangle. It is $\boxed{\text{isosceles}}$ since at least two sides have the same length.

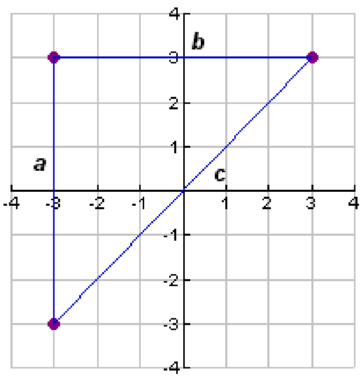
39.



$$a=\sqrt{(3-(-2))^2+(-1-(-4))^2}=\sqrt{34}$$
$$b=\sqrt{(1-3)^2+(1-(-1))^2}=\sqrt{8}$$
$$c=\sqrt{(1-(-2))^2+(1-(-4))^2}=\sqrt{34}$$

Note that $a^2+b^2 \neq c^2$, $b^2+c^2 \neq a^2$, and $a^2+c^2 \neq b^2$, so this is not a right triangle. It is $\boxed{\text{isosceles}}$ since at least two sides have the same length.

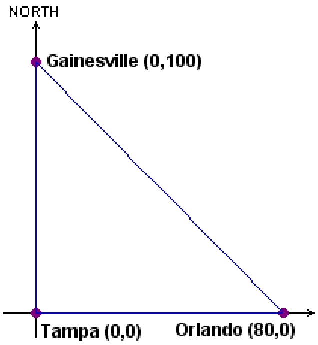
40.



$$a=\sqrt{(-3-(-3))^2+(3-(-3))^2}=6$$
$$b=\sqrt{(-3-3)^2+(3-3)^2}=6$$
$$c=\sqrt{(-3-3)^2+(-3-3)^2}=6\sqrt{2}$$

Observe that $c=\sqrt{a^2+b^2}$ above, so it is a $\boxed{\text{right triangle}}$. Also, it is $\boxed{\text{isosceles}}$ since at least two sides have the same length.

41.



The distance from Gainesville to Orlando is:

$$\sqrt{(0-80)^2+(100-0)^2} = \sqrt{16,400}$$

$$= 20\sqrt{41} \cong \boxed{128.06 \text{ miles}}$$

42. Since $d(\text{Tampa, Orlando}) = 80,$ a town midway between is 40 miles from Tampa. Also, since $d(\text{Tampa, Gainesville}) = 100,$ a town midway between is 50 miles from Tampa. The third tower would be 64.03 miles from Tampa.

43. Assume that Columbia is located at (0,0). Then, Atlanta is located at $(-215,0)$ and Savannah is located at $(0,-160)$. So, $d(\text{Atlanta, Savannah})$ is:

$$\sqrt{(-215-0)^2+(0-(-160))^2} \cong \boxed{268 \text{ miles}}$$

44.

$$d = \sqrt{(-7-15)^2+(-20-50)^2}$$

$$d = \sqrt{5384} \approx 73.4\ yards$$

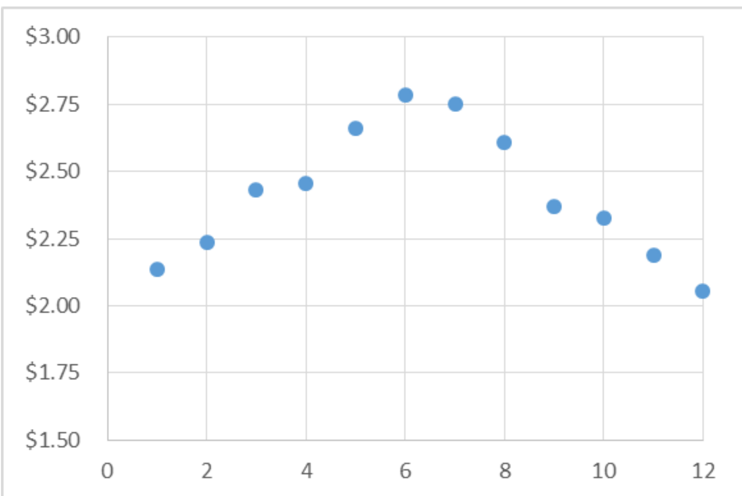
45.

$$(x_m, y_m) = \left(\frac{-9+6}{2}, \frac{3+(-4)}{2}\right) = \left(-\frac{3}{2}, -\frac{1}{2}\right)$$

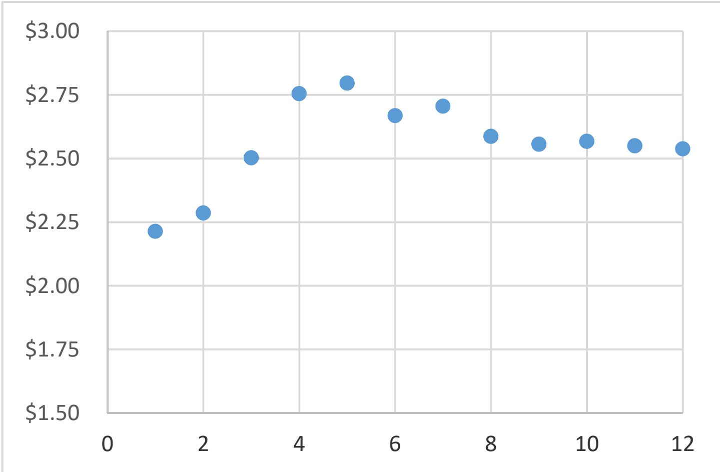
46.

$$(x_m, y_m) = \left(\frac{-3+1}{2}, \frac{2+4}{2}\right) = (-1, 3)$$

47.



48.



49. Substituted the values incorrectly. It should have been $\sqrt{(9-2)^2+(10-7)^2}$. So, $d=\sqrt{58}$.

50. The value of x_1 is incorrect. The quantity $(3-(-2))^2$ should be $(3+2)^2$.

51. Substituted the values incorrectly. It should have been

$$\left(\frac{-3+7}{2},\frac{4+9}{2}\right)=\left(2,\tfrac{13}{2}\right).$$

52. The midpoint formula is incorrect. It should be $\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$. So, $M=(-2,-3)$.

53. True. Follows directly from the distance formula.

54. True. Follows directly from the midpoint formula.

55. True. If (x_1,y_1) and (x_2,y_2) are in Quadrant I, then x_1,y_1,x_2,y_2 are all positive. So, $\frac{x_1+x_2}{2}$ and $\frac{y_1+y_2}{2}$ are both positive, thereby placing the midpoint $\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$ in Quadrant I.

56. False. Observe that the midpoint of the segment joining $(3,0)$ and $(0,-3)$ is $(0,0)$, which does not lie in any of the four quadrants.

57.

$$d=\sqrt{(a-b)^2+(b-a)^2}=\sqrt{2(a-b)^2}$$

$$=\boxed{\sqrt{2}\,|a-b|}$$

$$\boxed{M=\left(\frac{a+b}{2},\frac{b+a}{2}\right)}$$

58.

$$d=\sqrt{(a-(-a))^2+(b-(-b))^2}$$

$$=\sqrt{4(a^2+b^2)}=\boxed{2\sqrt{a^2+b^2}}$$

$$M=\left(\frac{a+(-a)}{2},\frac{b+(-b)}{2}\right)=\boxed{(0,0)}$$

59. Since the midpoint is given by $M=\left(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2}\right)$, the distance from (x_1,y_1) to M is as follows:

$$d=\sqrt{\left(x_1-\frac{x_1+x_2}{2}\right)^2+\left(y_1-\frac{y_1+y_2}{2}\right)^2}$$

$$=\sqrt{\left(\frac{2x_1-x_1-x_2}{2}\right)^2+\left(\frac{2y_1-y_1-y_2}{2}\right)^2}$$

$$=\sqrt{\left(\frac{x_1-x_2}{2}\right)^2+\left(\frac{y_1-y_2}{2}\right)^2}$$

$$=\frac{1}{2}\sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$$

Similarly, the distance from (x_2,y_2) to M is as follows:

$$d=\sqrt{\left(x_2-\frac{x_1+x_2}{2}\right)^2+\left(y_2-\frac{y_1+y_2}{2}\right)^2}$$

$$=\sqrt{\left(\frac{2x_2-x_1-x_2}{2}\right)^2+\left(\frac{2y_2-y_1-y_2}{2}\right)^2}$$

$$=\sqrt{\left(\frac{x_2-x_1}{2}\right)^2+\left(\frac{y_2-y_1}{2}\right)^2}$$

$$=\frac{1}{2}\sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$$

60. Let: D_1 be the diagonal connecting $(0,0)$ to $(a+b,c)$

D_2 be the diagonal connecting (a,c) to $(b,0)$

The midpoint of D_1 is $\left(\frac{a+b}{2},\frac{c}{2}\right)$, which coincides with the midpoint of D_2.

Hence, D_1 and D_2 intersect at their midpoints.

61. Let $P_1 = (a,b)$, $P_2 = (c,d)$, $d_1 =$ distance from P_1 to P_2, and $d_2 =$ distance from P_2 to P_1. Observe that

$$d_1 = \sqrt{(a-c)^2 + (b-d)^2} \quad d_2 = \sqrt{(c-a)^2 + (d-b)^2}.$$

Since

$$(c-a)^2 = \left(-(a-c)\right)^2 = (a-c)^2$$
$$(d-b)^2 = \left(-(b-d)\right)^2 = (b-d)^2$$

we see that $d_1 = d_2$, so that it does not matter what point is labeled "first" in the distance formula.

62. Let

$d_1 =$ distance between $(-1,-1)$ and $(0,0)$, $\quad d_2 =$ distance between $(0,0)$ and $(2,2)$

$d_3 =$ distance between $(2,2)$ and $(-1,-1)$

Using the distance formula yields

$$d_1 = \sqrt{(-1-0)^2 + (-1-0)^2} = \sqrt{2}$$
$$d_2 = \sqrt{(0-2)^2 + (0-2)^2} = 2\sqrt{2}$$
$$d_3 = \sqrt{(-1-2)^2 + (-1-2)^2} = 3\sqrt{2}$$

Observe that $d_1 + d_2 = d_3$.

63.

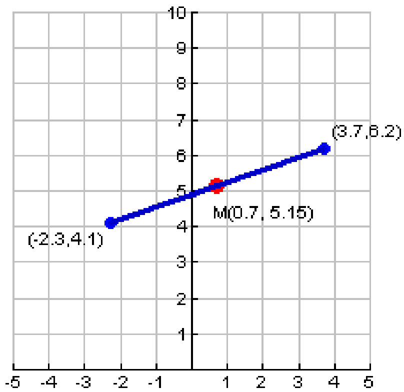
$$(x_m, y_m, z_m) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right)$$
$$\left(\frac{-1+1}{2}, \frac{2+(-4)}{2}, \frac{7+(-3)}{2}\right)$$
$$(0,-1,2)$$

64.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$
$$d = \sqrt{[1-(-1)]^2 + [(-4)-2]^2 + [(-3)-7]^2}$$
$$d = \sqrt{(2)^2 + (-6)^2 + (-10)^2}$$
$$d = \sqrt{4+36+100} = \sqrt{140} = 2\sqrt{35}$$

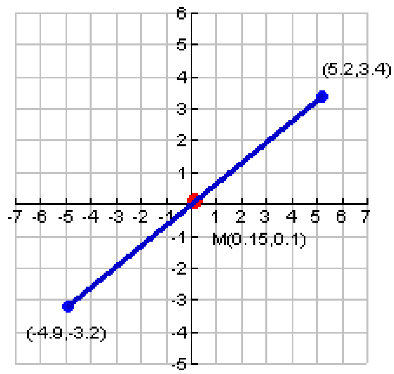
65.

$$d=\sqrt{(3.7-(-2.3))^2+(6.2-4.1)^2}$$
$$\cong \boxed{6.357}$$
$$M=\left(\frac{3.7-2.3}{2},\frac{6.2+4.1}{2}\right)$$
$$=\boxed{(0.7,5.15)}$$



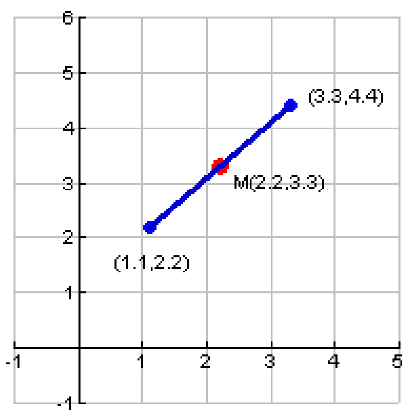
66.

$$d=\sqrt{(5.2-(-4.9))^2+(3.4-(-3.2))^2}$$
$$\cong \boxed{12.065}$$
$$M=\left(\frac{5.2-4.9}{2},\frac{3.4-3.2}{2}\right)$$
$$=\boxed{(0.15,0.1)}$$



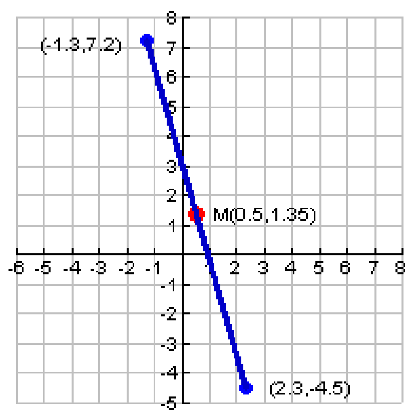
67.

$$d=\sqrt{(3.3-1.1)^2+(4.4-2.2)^2}$$
$$=\sqrt{2(2.2)^2}\cong \boxed{3.111}$$
$$M=\left(\frac{3.3+1.1}{2},\frac{4.4+2.2}{2}\right)=\boxed{(2.2,3.3)}$$



68.

$$d=\sqrt{(-1.3-2.3)^2+(7.2-(-4.5))^2}$$
$$\cong \boxed{12.241}$$
$$M=\left(\frac{-1.3+2.3}{2},\frac{7.2-4.5}{2}\right)=\boxed{(0.5,1.35)}$$

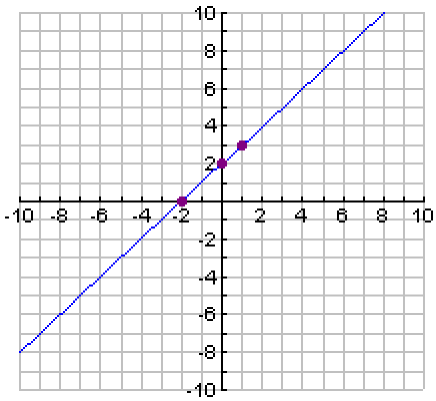


Section 2.2 Solutions ---

1. **a.** $3(1)-5 \neq 2$ No **b.** $3(-2)-5=-11$ Yes	**2.** **a.** $-2(-1)+7=9$ Yes **b.** $-2(2)+7 \neq -4$ No
3. **a.** $\frac{2}{5}(5)-4=-2$ Yes **b.** $\frac{2}{5}(-5)-4 \neq 6$ No	**4.** **a.** $-\frac{3}{4}(8)+1 \neq 5$ No **b.** $-\frac{3}{4}(-4)+1=4$ Yes
5. **a.** $-(-2+1)^2-2=-3$ Yes **b.** $-(2+1)^2-2 \neq 8$ No	**6.** **a.** $\frac{1}{2}(-3)^3+2 \neq -10$ No **b.** $\frac{1}{2}(2)^3+2=6$ Yes
7. **a.** $y=-\sqrt{4}+4=2$ Yes **b.** $y=-\sqrt{(-4)}+4 \neq 2$ No	**8.** **a.** $\lvert -1+3 \rvert -4=-2$ Yes **b.** $\lvert -2+3 \rvert -4 \neq 1$ No
9. **a.** $(-1)^2-2(-1)+1=4$ Yes **b.** $(0)^2-2(0)+1=1 \neq -1$ No	**10.** **a.** $(-1)^3-1=-2 \neq 0$ No **b.** $(-2)^3-1=-9$ Yes
11. **a.** $\sqrt{7+2}=3$ Yes **b.** $\sqrt{-6+2}=2i \neq 4$ No	**12.** **a.** $2+\lvert 3-9 \rvert=8 \neq -4$ No **b.** $2+\lvert 3-(-2) \rvert=7$ Yes

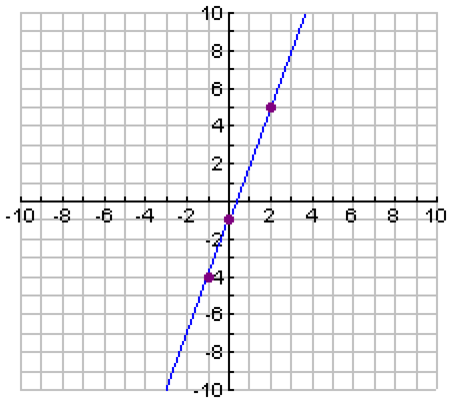
13.

-2	0	$(-2,0)$
0	2	$(0,2)$
1	3	$(1,3)$



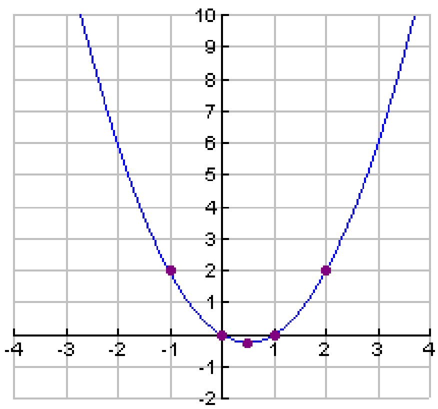
14.

-1	-4	$(-1,-4)$
0	-1	$(0,-1)$
2	5	$(2,5)$



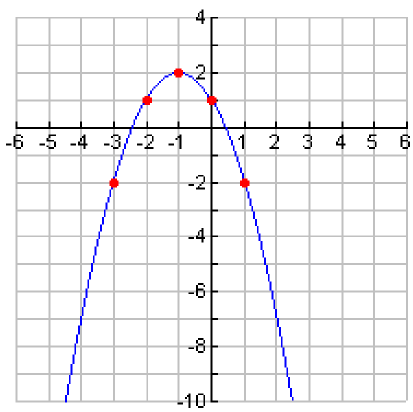
15.

x	$y=x^2-x$	(x,y)
-1	2	$(-1,2)$
0	0	$(0,0)$
$\frac{1}{2}$	$-\frac{1}{4}$	$(\frac{1}{2},-\frac{1}{4})$
1	0	$(1,0)$
2	2	$(2,2)$



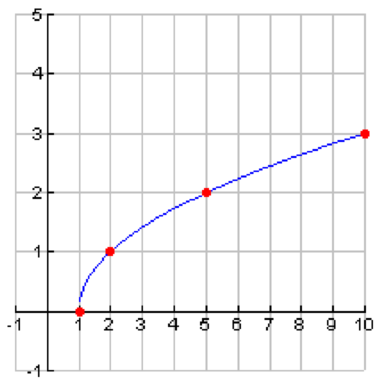
16.

x	$y=1-2x-x^2$	(x,y)
-3	-2	$(-3,-2)$
-2	1	$(-2,1)$
-1	2	$(-1,2)$
0	1	$(0,1)$
1	-2	$(1,-2)$



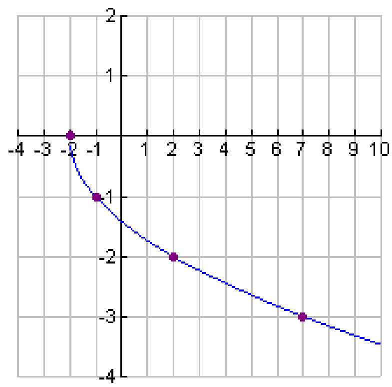
17.

x	$y=\sqrt{x-1}$	(x,y)
1	0	$(1,0)$
2	1	$(2,1)$
5	2	$(5,2)$
10	3	$(10,3)$



18.

x	$y=-\sqrt{x+2}$	(x,y)
-2	0	$(-2,0)$
-1	-1	$(-1,-1)$
2	-2	$(2,-2)$
7	-3	$(7,-3)$



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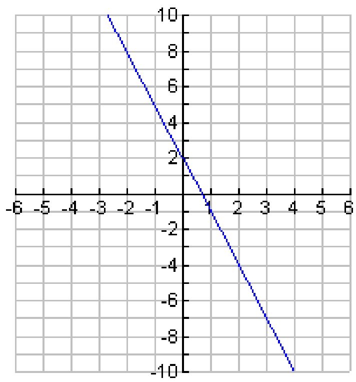

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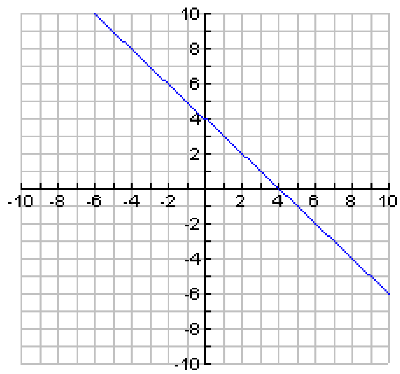

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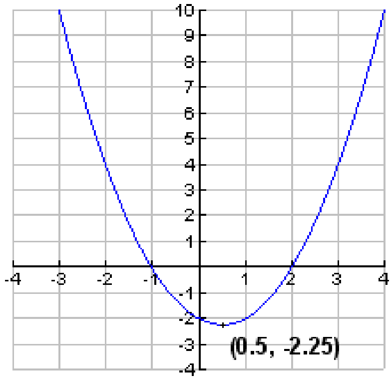

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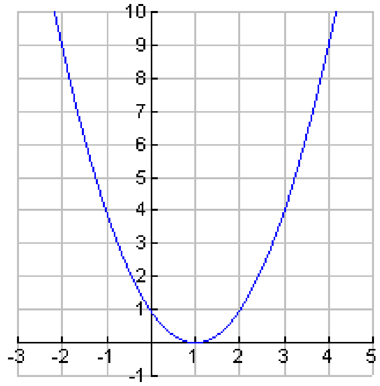

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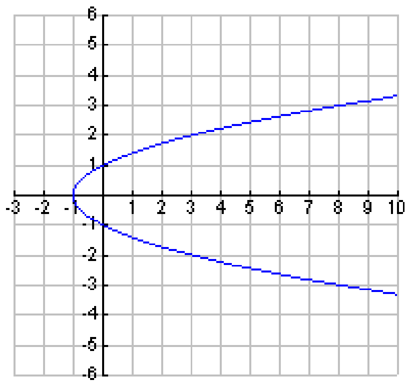

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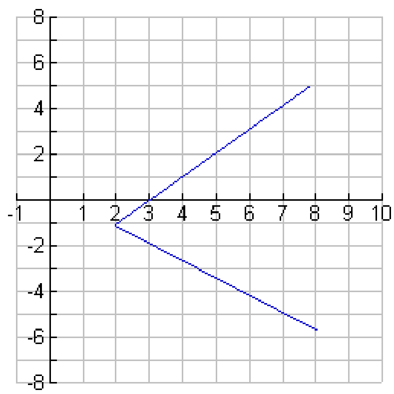

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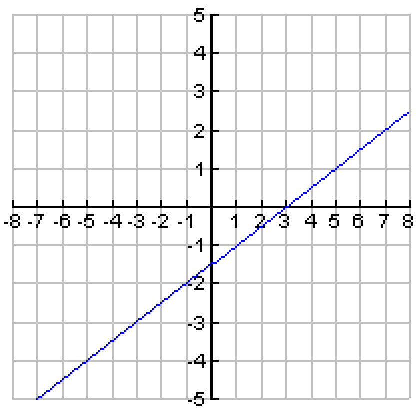

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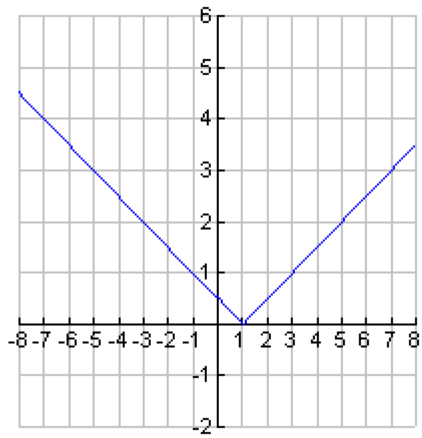


27. x-intercept: $2x-0=6 \Rightarrow x=3$ So, $(3,0)$. y-intercept: $2(0)-y=6 \Rightarrow y=-6$ So, $(0,-6)$.	**28.** x-intercept: $4x+2(0)=10 \Rightarrow x=\frac{5}{2}$ So, $(\frac{5}{2},0)$. y-intercept: $4(0)+2y=10 \Rightarrow y=5$ So, $(0,5)$.
29. x-intercept: $3x+0=7 \Rightarrow x=\frac{7}{3}$ So, $\left(\frac{7}{3},0\right)$. y-intercept: $0+y=7 \Rightarrow y=7$ So, $(0,7)$.	**30.** x-intercept: $3x+0=12 \Rightarrow x=4$ So, $(4,0)$. y-intercept: $0-4y=12 \Rightarrow y=-3$ So, $(0,-3)$.
31. x-intercepts: $x^2-9=0 \Rightarrow (x-3)(x+3)=0$ $\Rightarrow x=\pm 3$. So, $(\pm 3,0)$. y-intercept: $(0)^2-9=y \Rightarrow y=-9$ So, $(0,-9)$.	**32.** x-intercepts: $4x^2-1=0 \Rightarrow (2x-1)(2x+1)=0$ $\Rightarrow x=\pm\frac{1}{2}$. So, $(\pm\frac{1}{2},0)$. y-intercept: $4(0)^2-1=y \Rightarrow y=-1$ So, $(0,-1)$.
33. x-intercept: $\sqrt{x-4}=0 \Rightarrow x=4$ So, $(4,0)$. y-intercept: $\underbrace{\sqrt{0-4}}_{\text{undefined}}=y$. So, no y-intercept.	**34.** x-intercept: $\sqrt[3]{x-8}=0 \Rightarrow x=8$ So, $(8,0)$. y-intercept: $\sqrt[3]{0-8}=y \Rightarrow y=-2$ So, $(0,-2)$.
35. x-intercept: $\frac{1}{x^2+4}=0$ has no solution. So, no x-intercept. y-intercept: $\frac{1}{0^2+4}=y \Rightarrow y=\frac{1}{4}$ So, $(0,\frac{1}{4})$.	**36.** x-intercepts: $\frac{x^2-x-12}{x}=0 \Rightarrow x^2-x-12$ $=(x-4)(x+3)=0$ $\Rightarrow x=4,-3$ So, $(4,0)$, $(-3,0)$. y-intercept: $\frac{0^2-0-12}{0}=y$ is undefined. So, no y-intercept.

37.

x-intercepts:

$$4x^2 + 0 = 16 \Rightarrow x^2 - 4 = 0 \Rightarrow (x-2)(x+2) = 0 \Rightarrow x = \pm 2. \text{ So, } (\pm 2, 0).$$

y-intercept:

$$4(0)^2 + y^2 = 16 \Rightarrow y^2 - 16 = 0 \Rightarrow (y-4)(y+4) = 0 \Rightarrow y = \pm 4. \text{ So, } (0, \pm 4).$$

38.

x-intercepts:

$$x^2 - 0 = 9 \Rightarrow x^2 - 9 = 0 \Rightarrow (x-3)(x+3) = 0 \Rightarrow x = \pm 3. \text{ So, } (\pm 3, 0).$$

y-intercept:

$0 - y^2 = 9$ which has no solution.

So, no y-intercept.

39. d	**40.** e	**41.** a	**42.** c	**43.** b	**44.** d
45. $(-1,-3)$	**46.** $(2,4)$	**47.** $(4,7)$	**48.** $(-12,12)$	**49.** $(-7,10)$	**50.** $(1,1)$

51. $(3,2)$, $(-3,2)$, $(-3,-2)$

52. $(-1,-7)$, $(1,7)$, $(1,-7)$

53. x-axis symmetry (Replace y by $-y$):

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

Yes, since equivalent to the original.

y-axis symmetry (Replace x by $-x$):

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

No, since not equivalent to the original.

symmetry about origin (Replace y by $-y$ and x by $-x$):

$$-x = (-y)^2 + 4 = y^2 + 4$$
$$x = -\left(y^2 + 4\right)$$

No, since not equivalent to the original.

54. x-axis symmetry (Replace y by $-y$):

$$x = 2(-y)^2 + 3$$
$$x = 2y^2 + 3$$

Yes, since equivalent to the original.

y-axis symmetry (Replace x by $-x$):

$$-x = 2y^2 + 3$$
$$x = -(2y^2 + 3)$$

No, since not equivalent to the original.

symmetry about origin (Replace y by $-y$ and x by $-x$):

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

No, since not equivalent to the original.

55. <u>x-axis symmetry</u> (Replace y by $-y$):

$$-y = x^3 + x$$

$$y = -\left(x^3 + x\right)$$

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

$$y = (-x)^3 + (-x)$$

$$y = -\left(x^3 + x\right)$$

No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

$$-y = (-x)^3 + (-x) = -\left(x^3 + x\right)$$

$$y = x^3 + x$$

Yes, since equivalent to the original.

56. <u>x-axis symmetry</u> (Replace y by $-y$):

$$-y = x^5 + 1$$

$$y = -(x^5 + 1)$$

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

$$y = (-x)^5 + 1$$

$$y = -x^5 + 1$$

No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

$$-y = (-x)^5 + 1 = -x^5 + 1$$

$$y = x^5 - 1$$

No, since not equivalent to the original.

57. <u>x-axis symmetry</u> (Replace y by $-y$):

$$x = |-y| = |-1||y|$$

$$x = |y|$$

Yes, since equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

$$-x = |y|$$

$$x = -|y|$$

No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

$$-x = |-y| = |-1||y| = |y|$$

$$x = -|y|$$

No, since not equivalent to the original.

58. x-axis symmetry (Replace y by $-y$):

$$x = |-y| - 2 = |-1||y| - 2$$
$$x = |y| - 2$$

Yes, since equivalent to the original.

y-axis symmetry (Replace x by $-x$):

$$-x = |y| - 2$$
$$x = -(|y| - 2)$$

No, since not equivalent to the original.

symmetry about origin (Replace y by $-y$ and x by $-x$):

$$-x = |-y| - 2 = |-1||y| - 2 = |y| - 2$$
$$x = -(|y| - 2)$$

No, since not equivalent to the original.

59. x-axis symmetry (Replace y by $-y$):

$$x^2 - (-y)^2 = 100$$
$$x^2 - y^2 = 100$$

Yes, since equivalent to the original.

y-axis symmetry (Replace x by $-x$):

$$(-x)^2 - y^2 = 100$$
$$x^2 - y^2 = 100$$

Yes, since equivalent to the original.

symmetry about origin (Replace y by $-y$ and x by $-x$):

$$(-x)^2 - (-y)^2 = 100$$
$$x^2 - y^2 = 100$$

Yes, since equivalent to the original.

60. x-axis symmetry (Replace y by $-y$):

$$x^2 + 2(-y)^2 = 30$$
$$x^2 + 2y^2 = 30$$

Yes, since equivalent to the original.

y-axis symmetry (Replace x by $-x$):

$$(-x)^2 + 2y^2 = 30$$
$$x^2 + 2y^2 = 30$$

Yes, since equivalent to the original.

symmetry about origin (Replace y by $-y$ and x by $-x$):

$$(-x)^2 + 2(-y)^2 = 30$$
$$x^2 + 2y^2 = 30$$

Yes, since equivalent to the original.

61. <u>x-axis symmetry</u> (Replace y by $-y$):

$$-y = x^{2/3}$$
$$y = -x^{2/3}$$

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

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

Yes, since equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

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

No, since not equivalent to the original.

62. <u>x-axis symmetry</u> (Replace y by $-y$):

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

Yes, since equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

$$-x = y^{2/3}$$
$$x = -y^{2/3}$$

No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

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

No, since not equivalent to the original.

63. <u>x-axis symmetry</u> (Replace y by $-y$):

$$x^2 + (-y)^3 = 1$$
$$x^2 - y^3 = 1$$

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

$$(-x)^2 + y^3 = 1$$
$$x^2 + y^3 = 1$$

Yes, since equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

$$(-x)^2 + (-y)^3 = 1$$
$$x^2 - y^3 = 1$$

No, since not equivalent to the original.

64. <u>x-axis symmetry</u> (Replace y by $-y$):

$$-y=\sqrt{1+x^2}$$
$$y=-\sqrt{1+x^2}$$

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

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

Yes, since equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

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

No, since not equivalent to the original.

65. <u>x-axis symmetry</u> (Replace y by $-y$):

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

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

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

No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

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

Yes, since equivalent to the original.

66. <u>x-axis symmetry</u> (Replace y by $-y$):

$$x(-y)=1$$
$$-xy=1$$

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

$$(-x)y=1$$
$$-xy=1$$

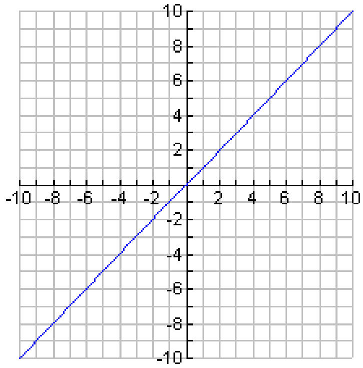
No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

$$(-x)(-y)=1$$
$$xy=1$$

Yes, since equivalent to the original.

67.



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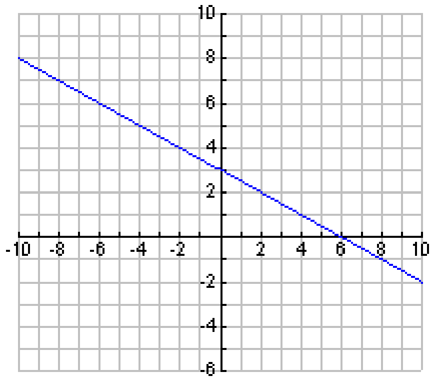

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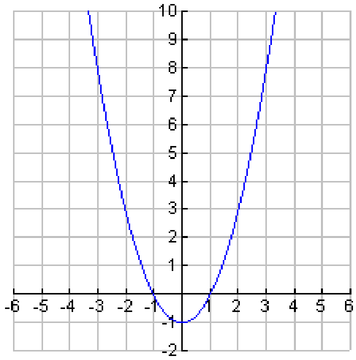

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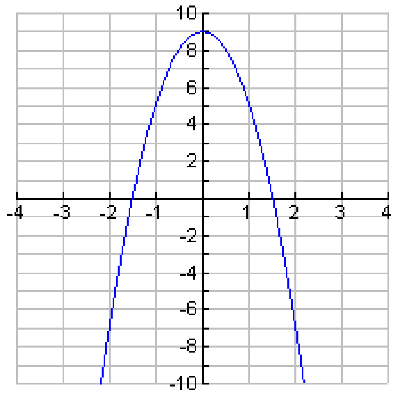

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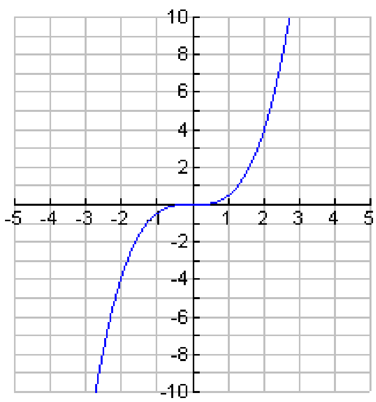

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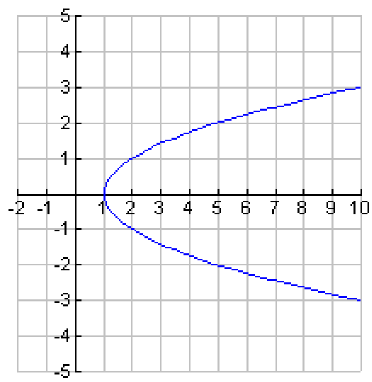

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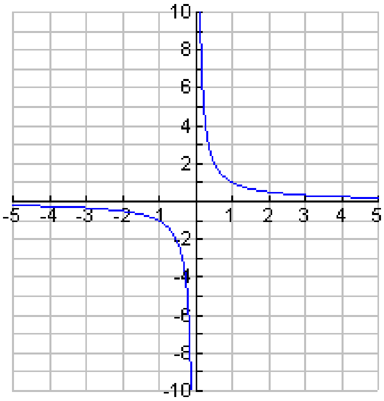

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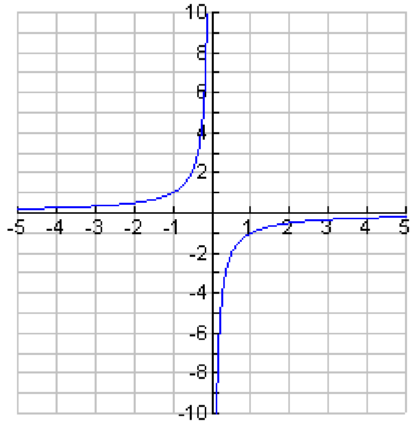

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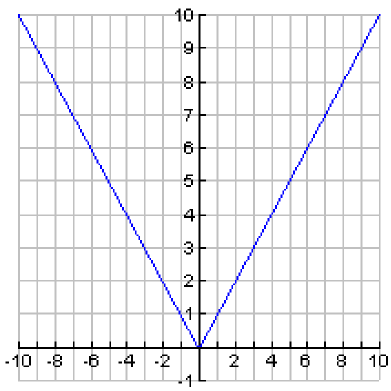

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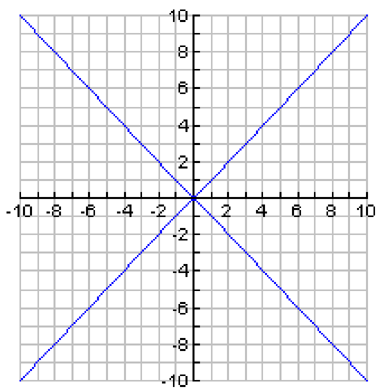

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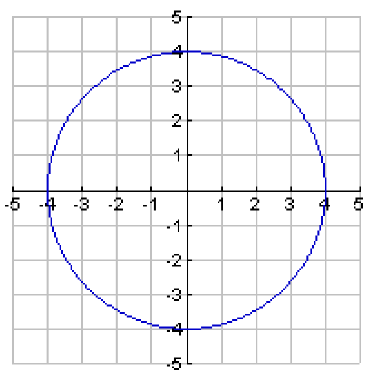

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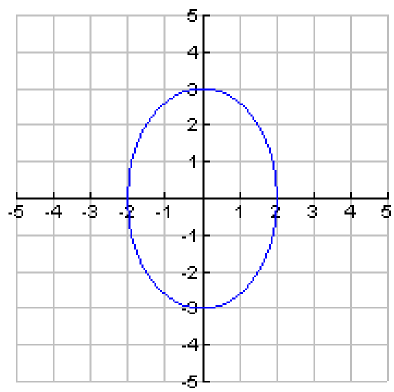

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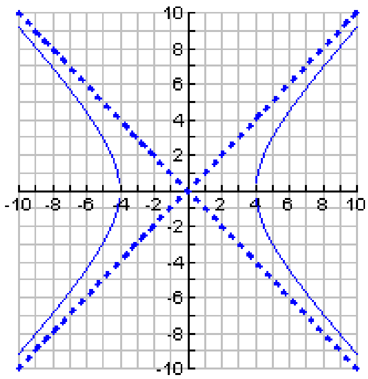

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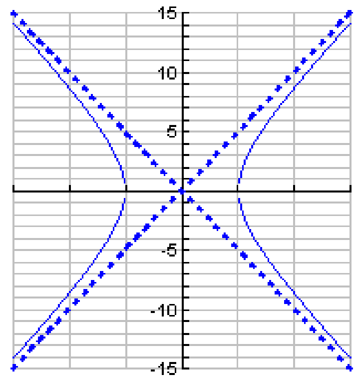

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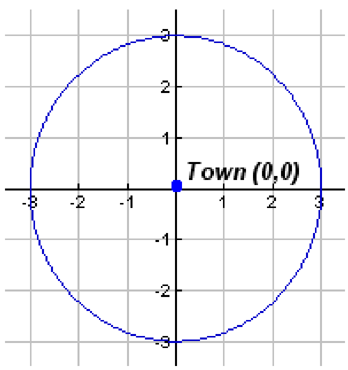
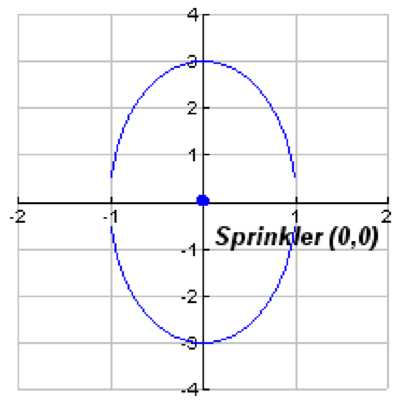


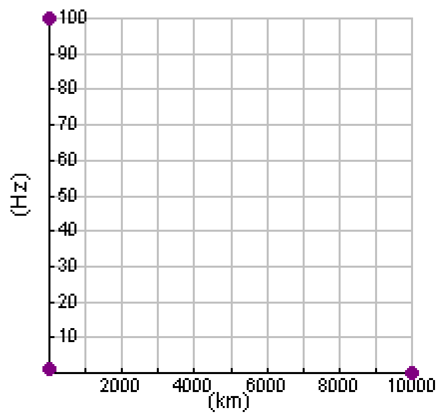
82.



83.

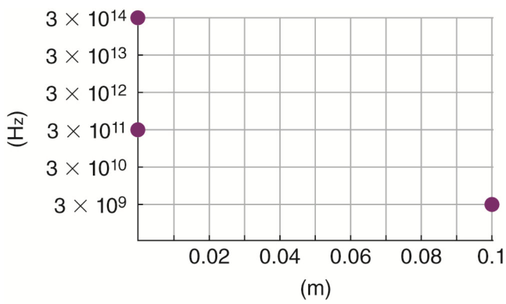
R (in km)	$\frac{1}{R^2}$ (in Hz)	$\left(R, \frac{1}{R^2}\right)$
$0.1 = 10^{-1}$	**10^2**	**$(10^{-1}, 10^2)$**
1	**1**	**$(1, 1)$**
$10{,}000 = 10^4$	**10^{-8}**	**$(10^4, 10^{-8})$**

Note: 1000 m = 1 km



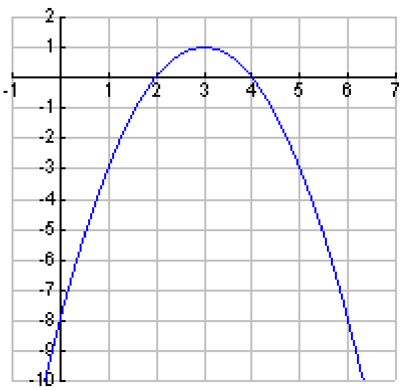
84.

λ (in m)	$f = \dfrac{3.0\times10^8}{\lambda}$ (in Hz)
$\mathbf{10^{-6}}$	$\mathbf{3.0 \times 10^{14}}$
$\mathbf{10^{-3}}$	$\mathbf{3.0 \times 10^{11}}$
$\mathbf{10^{-1}}$	$\mathbf{3.0 \times 10^{9}}$



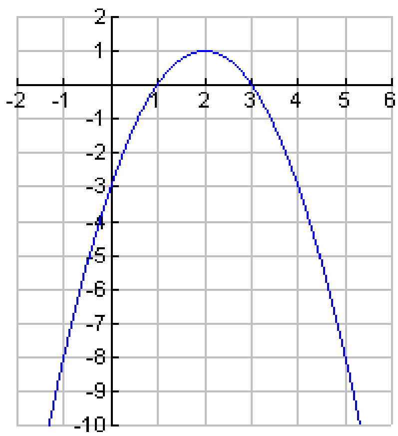
From the plot of the points (λ, f) to the right, note that as wavelength decreases, frequency increases (and vice versa).

85. Consider the following graph:



Either 2000 or 4000 units need to be sold to break even. The range of units that correspond to making a profit correspond to those x-values for which $y > 0$. This occurs for $\boxed{2000 < x < 4000}$.

86. Consider the following graph:



Either 1000 or 3000 units need to be sold to break even. The range of units that correspond to making a profit correspond to those x-values for which $y > 0$. This occurs for $\boxed{1000 < x < 3000}$.

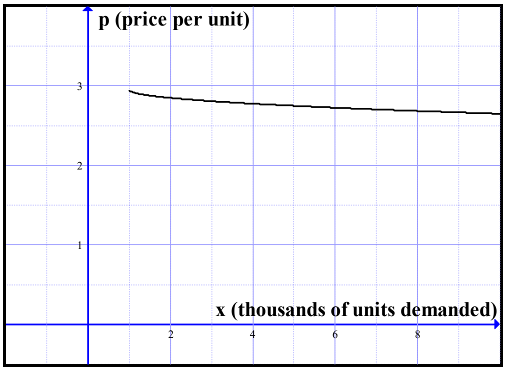
87. a. The domain is the set of x such that $0.01x - 0.01 \geq 0$. Solving this inequality yields

$$0.01x \geq 0.01$$

$$x \geq 1 \text{ or } [1, \infty)$$

This means that the demand model is defined when at least 1,000 units per day are demanded.

b.



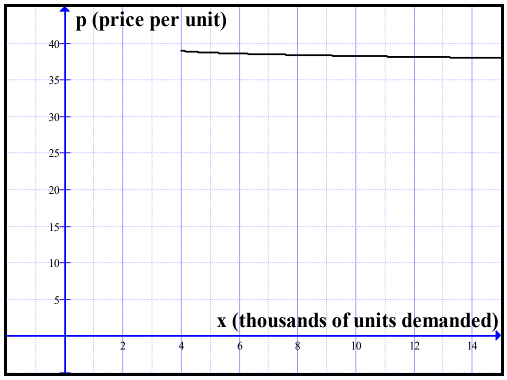
88. a. The domain is the set of x such that $0.01x - 0.4 \geq 0$. Solving this inequality yields

$$0.01x \geq 0.4$$

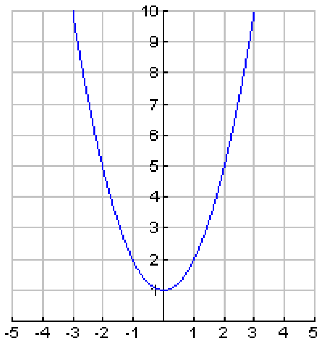
$$x \geq 4 \text{ or } [4, \infty)$$

This means that the demand model is defined when at least 4,000 units per day are demanded.

b.



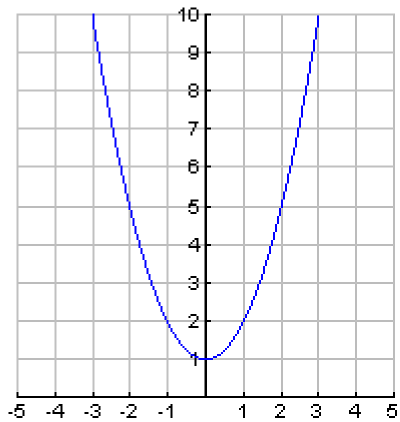
89. The equation is not linear – you need more than two points to plot the graph.



90.
Note that $-(-x)^2 \neq x^2$. Rather, $-(-x)^2 \neq -x^2$. As such, the graph IS symmetric with respect to the y-axis.

91.
To test for symmetry about the y-axis, one should replace x by $-x$, NOT y by $-y$. Doing so here yields the equation $-x = |y|$, which is not equivalent to the original equation $x = |y|$.

92.
To test for symmetry about the x-axis, replace y by $-y$, NOT x by $-x$. The conclusion should be that the graph is symmetric about the y-axis. The correct graph is given to the right:



93. $\boxed{\text{False}}$ The correct conclusion would be that the point $(a,-b)$ must also be on the graph. For instance, $y^2 = x$ is symmetric about the x-axis and $(1,1)$ is on the graph, but $(-1,1)$ is not.

94. $\boxed{\text{True}}$
By definition of symmetry about the y-axis.

95. $\boxed{\text{True}}$

96. $\boxed{\text{False}}$. This is true only for linear equations.

97. <u>x-axis symmetry</u> (Replace y by $-y$):

$$-y = \frac{ax^2+b}{cx^3}$$

$$y = -\left(\frac{ax^2+b}{cx^3}\right)$$

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

$$y = \frac{a(-x)^2+b}{c(-x)^3} = \frac{ax^2+b}{-cx^3}$$

$$y = -\left(\frac{ax^2+b}{cx^3}\right)$$

No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

$$-y = \frac{a(-x)^2+b}{c(-x)^3} = \frac{ax^2+b}{-cx^3} = -\left(\frac{ax^2+b}{cx^3}\right) \text{ so that } y = \frac{ax^2+b}{cx^3}$$

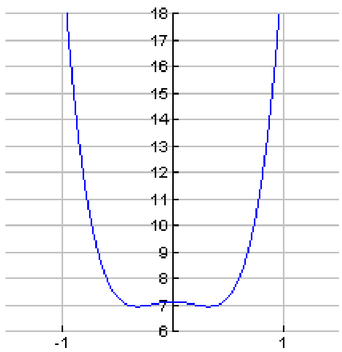
Yes, since equivalent to the original.

98. Consider $y=(x-a)^2-b^2$.

<u>x-intercepts</u>: $0=(x-a)^2-b^2 \Rightarrow 0=(x-a-b)(x-a+b) \Rightarrow x=a+b,\ a-b$.
So, $(a+b,0)$, $(a-b,0)$.

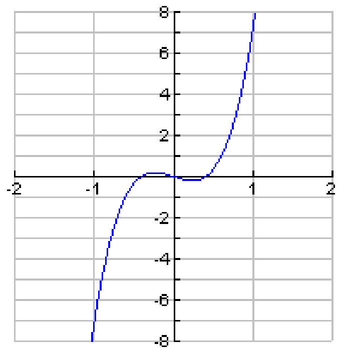
<u>y-intercept</u>: $y=(0-a)^2-b^2=a^2-b^2$. So, $(0,a^2-b^2)$.

99.



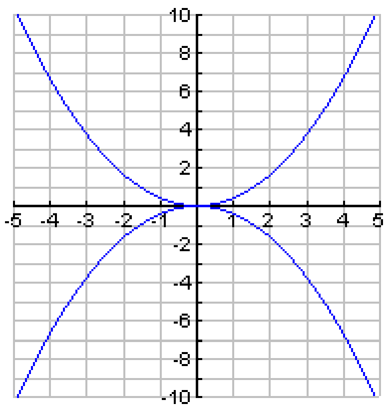
Symmetric with respect to the y-axis.

100.



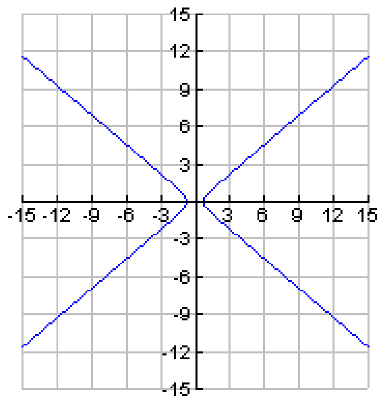
Symmetric with respect to the origin.

101.

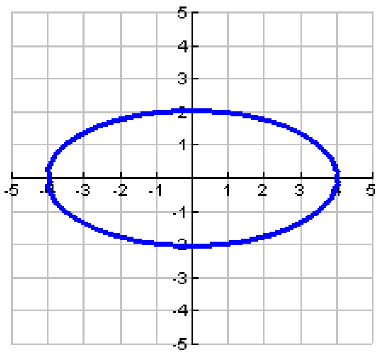
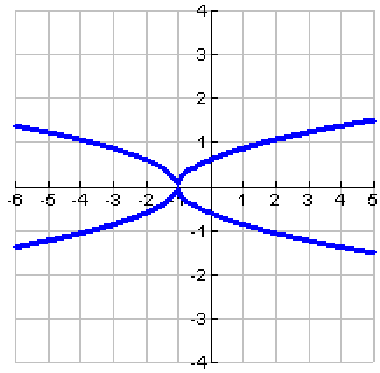


Symmetric with respect to the x-axis, y-axis, and the origin.

102.



Symmetric with respect to the x-axis, y-axis, and the origin.

103.	104.
 Symmetric with respect to the x-axis, y-axis, and the origin.	 Symmetric with respect to the x-axis

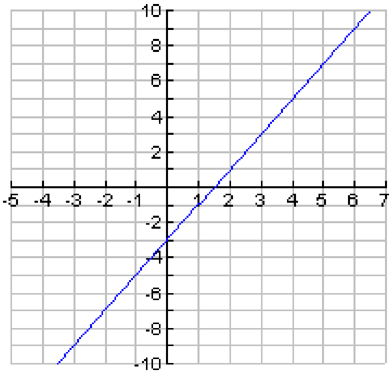
Section 2.3 Solutions ---

1. $m=\frac{3-6}{1-2}=\boxed{3}$	**2.** $m=\frac{1-9}{2-4}=\boxed{4}$	**3.** $m=\frac{5-(-3)}{-2-2}=\boxed{-2}$
4. $m=\frac{-4-6}{-1-4}=\boxed{2}$	**5.** $m=\frac{9-(-10)}{-7-3}=\boxed{-\frac{19}{10}}$	**6.** $m=\frac{-3-6}{11-(-2)}=\boxed{-\frac{9}{13}}$

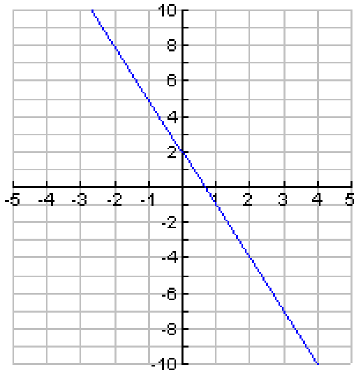
7. $m=\frac{-1.7-5.2}{0.2-3.1}=\frac{6.9}{2.9}\cong\boxed{2.379}$	**8.** $m=\frac{1.7-(-2.3)}{-2.4-(-5.6)}=\frac{4.0}{3.2}=\boxed{1.25}$
9. $m=\frac{-\frac{1}{4}-\left(-\frac{3}{4}\right)}{\frac{2}{3}-\frac{5}{6}}=-\frac{\frac{1}{2}}{\frac{1}{6}}=\boxed{-3}$	**10.** $m=\frac{\frac{3}{5}-\frac{7}{5}}{\frac{1}{2}-\left(-\frac{3}{4}\right)}=-\frac{\frac{4}{5}}{\frac{5}{4}}=\boxed{-\frac{16}{25}}$

11. x-intercept: $(0.5,0)$ y-intercept: $(0,-1)$ slope: $m=\frac{-3-3}{-1-2}=2$ rising	**12.** x-intercept: $(-2,0)$ y-intercept: $(0,3)$ slope: $m=\frac{-3-3}{-4-0}=\frac{3}{2}$ rising	**13.** x-intercept: $(1,0)$ y-intercept: $(0,1)$ slope: $m=\frac{3-(-1)}{-2-2}=-1$ falling
14. x-intercept: $(0,0)$ y-intercept: $(0,0)$ slope: $m=\frac{3-(-2)}{-3-2}=-1$ falling	**15.** x-intercept: None y-intercept: $(0,1)$ slope: $m=0$ horizontal	**16.** x-intercept: $(-4,0)$ y-intercept: None slope: Undefined vertical

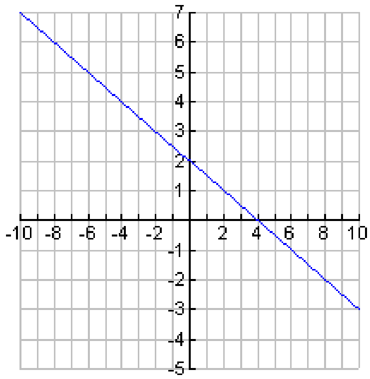
17.
<u>*x*-intercept</u>:
$$\begin{aligned} 0 &= 2x-3 \\ \tfrac{3}{2} &= x \end{aligned} \quad \text{So, } \left(\tfrac{3}{2},0\right).$$
<u>*y*-intercept</u>: $y=2(0)-3=-3$. So, $(0,-3)$.



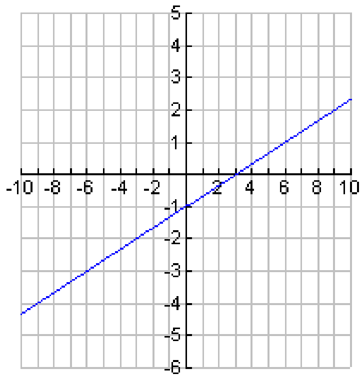
18.
<u>*x*-intercept</u>:
$$\begin{aligned} 0 &= -3x+2 \\ \tfrac{2}{3} &= x \end{aligned} \quad \text{So, } \left(\tfrac{2}{3},0\right).$$
<u>*y*-intercept</u>: $y=-3(0)+2=2$. So, $(0,2)$.



19.
<u>*x*-intercept</u>:
$$\begin{aligned} 0 &= -\tfrac{1}{2}x+2 \\ 4 &= x \end{aligned} \quad \text{So, } (4,0).$$
<u>*y*-intercept</u>: $y=-\frac{1}{2}(0)+2=2$. So, $(0,2)$.



20.
<u>*x*-intercept</u>:
$$\begin{aligned} 0 &= \tfrac{1}{3}x-1 \\ 3 &= x \end{aligned} \quad \text{So, } (3,0).$$
<u>*y*-intercept</u>: $y=\frac{1}{3}(0)-1=-1$. So, $(0,-1)$.



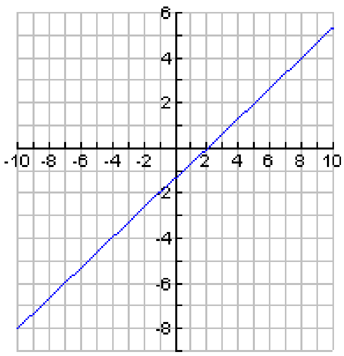
21.

<u>x-intercept</u>:

$$\begin{aligned} 4 &= 2x - 3(0) \\ 2 &= x \end{aligned} \quad \text{So, } (2,0).$$

<u>y-intercept</u>:

$$\begin{aligned} 4 &= 2(0) - 3y \\ -\tfrac{4}{3} &= y \end{aligned} \text{. So, } \left(0, -\tfrac{4}{3}\right).$$



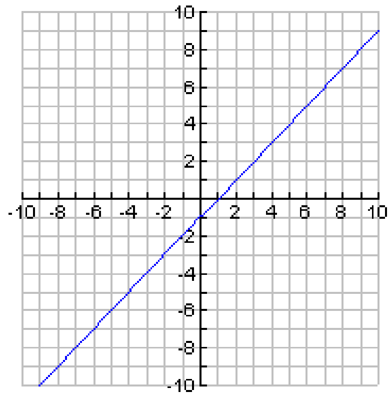
22.

<u>x-intercept</u>:

$$\begin{aligned} -1 &= -x + 0 \\ 1 &= x \end{aligned} \quad \text{So, } (1,0).$$

<u>y-intercept</u>:

$$\begin{aligned} -1 &= 0 + y \\ -1 &= y \end{aligned} \text{. So, } (0, -1).$$



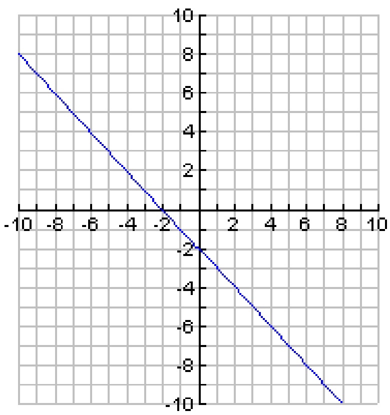
23.

<u>x-intercept</u>:

$$\begin{aligned} -1 &= \tfrac{1}{2}x + \tfrac{1}{2}(0) \\ -2 &= x \end{aligned} \quad \text{So, } (-2,0).$$

<u>y-intercept</u>:

$$\begin{aligned} -1 &= \tfrac{1}{2}(0) + \tfrac{1}{2}y \\ -2 &= y \end{aligned} \text{. So, } (0, -2).$$



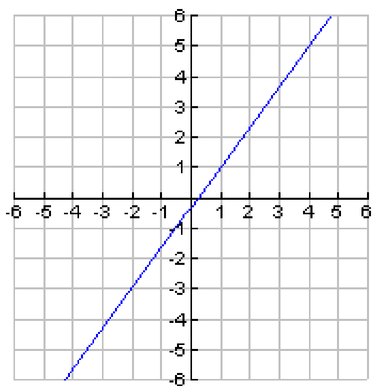
24.

<u>x-intercept</u>:

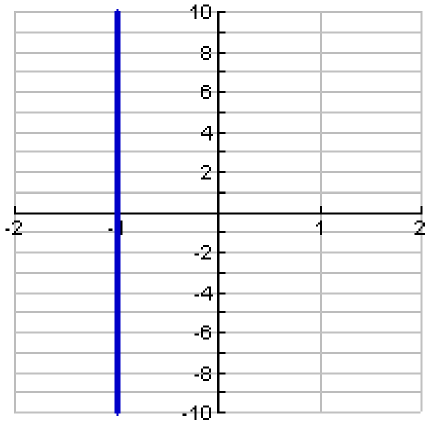
$$\begin{aligned} \tfrac{1}{12} &= \tfrac{1}{3}x - \tfrac{1}{4}(0) \\ \tfrac{1}{4} &= x \end{aligned} \quad \text{So, } \left(\tfrac{1}{4},0\right).$$

<u>y-intercept</u>:

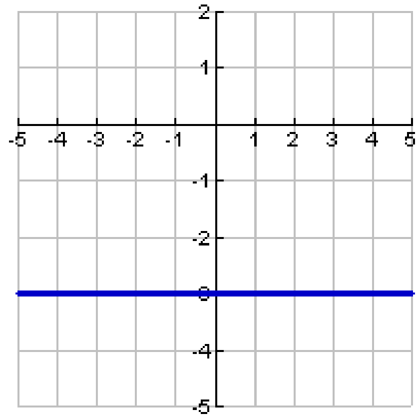
$$\begin{aligned} \tfrac{1}{12} &= \tfrac{1}{3}(0) - \tfrac{1}{4}y \\ -\tfrac{1}{3} &= y \end{aligned} \text{. So, } \left(0, -\tfrac{1}{3}\right).$$



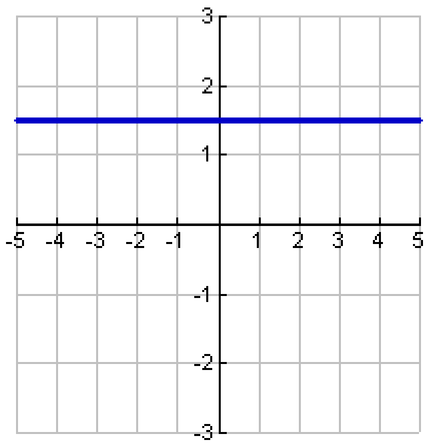
25.
x-intercept: $(-1,0)$
y-intercept: None



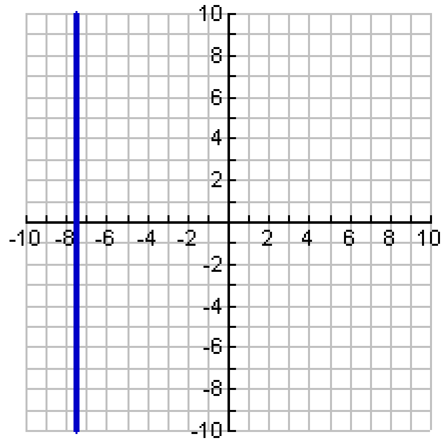
26.
x-intercept: None
y-intercept: $(0,-3)$



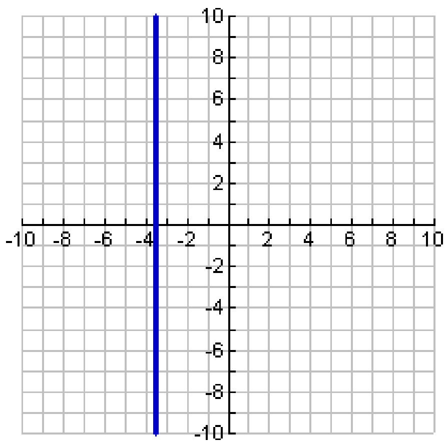
27.
x-intercept: None
y-intercept: $(0,1.5)$



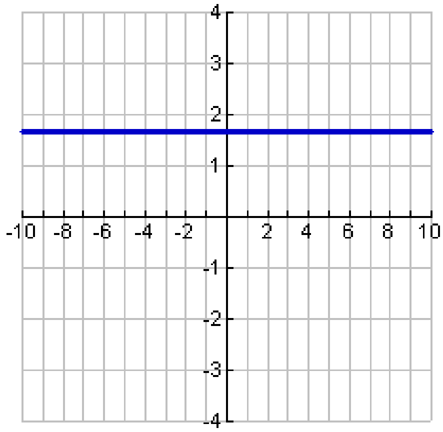
28.
x-intercept: $(-7.5,0)$
y-intercept: None



29.
x-intercept: $\left(-\frac{7}{2},0\right)$
y-intercept: None



30.
x-intercept: None
y-intercept: $\left(0,\frac{5}{3}\right)$



31.
$y=\frac{2}{5}x-2 \quad m=\frac{2}{5} \quad y\text{-intercept: }(0,-2)$

32.
$y=\frac{3}{4}x-3 \quad m=\frac{3}{4} \quad y\text{-intercept: }(0,-3)$

33.
$y=-\frac{1}{3}x+2 \quad m=-\frac{1}{3} \quad y\text{-intercept: }(0,2)$

34.
$y=-\frac{1}{2}x+4 \quad m=-\frac{1}{2} \quad y\text{-intercept: }(0,4)$

35.
$y=4x-3 \quad m=4 \quad y\text{-intercept: }(0,-3)$

36.
$y=x-5 \quad m=1 \quad y\text{-intercept: }(0,-5)$

37.
$y=-2x+4 \quad m=-2 \quad y\text{-intercept: }(0,4)$

38.
$y=\frac{1}{4}x-\frac{1}{2} \quad m=\frac{1}{4} \quad y\text{-intercept: }\left(0,-\frac{1}{2}\right)$

39.
$y=\frac{2}{3}x-2 \quad m=\frac{2}{3} \quad y\text{-intercept: }(0,-2)$

40.
$y=-4x+3 \quad m=-4 \quad y\text{-intercept: }(0,3)$

41.
$y=-\frac{3}{4}x+6 \quad m=-\frac{3}{4} \quad y\text{-intercept: }(0,6)$

42.
$y=-\frac{5}{8}x+5 \quad m=-\frac{5}{8} \quad y\text{-intercept: }(0,5)$

43. $y=2x+3$

44. $y=-2x+1$

45. $y=-\frac{1}{3}x+0=-\frac{1}{3}x$	**46.** $y=\frac{1}{2}x-3$
47. $y=2$	**48.** $y=-1.5$
49. $x=\frac{3}{2}$	**50.** $x=-3.5$
51. Find b: $\begin{aligned}-3&=5(-1)+b\\2&=b\end{aligned}$ So, the equation is $\boxed{y=5x+2}$.	**52.** Find b: $\begin{aligned}-1&=2(1)+b\\-3&=b\end{aligned}$ So, the equation is $\boxed{y=2x-3}$.
53. Find b: $\begin{aligned}2&=-3(-2)+b\\-4&=b\end{aligned}$ So, the equation is $\boxed{y=-3x-4}$.	**54.** Find b: $\begin{aligned}-4&=-1(3)+b\\-1&=b\end{aligned}$ So, the equation is $\boxed{y=-x-1}$.
55. Find b: $\begin{aligned}-1&=\frac{3}{4}(1)+b\\-\frac{7}{4}&=b\end{aligned}$ So, the equation is $\boxed{y=\frac{3}{4}x-\frac{7}{4}}$.	**56.** Find b: $\begin{aligned}3&=-\frac{1}{7}(-5)+b\\\frac{16}{7}&=b\end{aligned}$ So, the equation is $\boxed{y=-\frac{1}{7}x+\frac{16}{7}}$.
57. Since $m=0$, the line is horizontal. So, the equation is $\boxed{y=4}$.	**58.** Since $m=0$, the line is horizontal. So, the equation is $\boxed{y=-3}$.
59. Since m is undefined, the line is vertical. So, the equation is $\boxed{x=-1}$.	**60.** Since m is undefined, the line is vertical. So, the equation is $\boxed{x=4}$.
61. slope: $m=\frac{-1-2}{-2-3}=\frac{3}{5}$ y-intercept: Use the point $(-2,-1)$ to find b: $-1=\frac{3}{5}(-2)+b$, $\frac{1}{5}=b$ So, the equation is $\boxed{y=\frac{3}{5}x+\frac{1}{5}}$.	**62.** slope: $m=\frac{-3-1}{-4-5}=\frac{4}{9}$ y-intercept: Use the point $(-4,-3)$ to find b: $-3=\frac{4}{9}(-4)+b$, $-\frac{11}{9}=b$ So, the equation is $\boxed{y=\frac{4}{9}x-\frac{11}{9}}$.

63.
slope:
$$m=\frac{-1-(-6)}{-3-(-2)}=-5$$
y-intercept:
Use the point $(-3,-1)$ to find b:
$$-1=-5(-3)+b$$
$$-16=b$$
So, the equation is $\boxed{y=-5x-16}$.

64.
slope:
$$m=\frac{-8-(-2)}{-5-7}=\frac{1}{2}$$
y-intercept:
Use the point $(-5,-8)$ to find b:
$$-8=\tfrac{1}{2}(-5)+b$$
$$-\tfrac{11}{2}=b$$
So, the equation is $\boxed{y=\tfrac{1}{2}x-\tfrac{11}{2}}$.

65.
slope:
$$m=\frac{-37-(-42)}{20-(-10)}=\frac{1}{6}$$
y-intercept:
Use the point $(20,-37)$ to find b:
$$-37=\tfrac{1}{6}(20)+b$$
$$-\tfrac{121}{3}=b$$
So, the equation is $\boxed{y=\tfrac{1}{6}x-\tfrac{121}{3}}$.

66.
slope:
$$m=\frac{12-(-12)}{-8-(-20)}=2$$
y-intercept:
Use the point $(-8,12)$ to find b:
$$12=2(-8)+b$$
$$28=b$$
So, the equation is $\boxed{y=2x+28}$.

67. slope: $m=\dfrac{4-(-5)}{-1-2}=-3$

y-intercept:
Use the point $(-1,4)$ to find b:
$$4=-3(-1)+b$$
$$1=b$$
So, the equation is $\boxed{y=-3x+1}$.

68. slope: $m=\dfrac{3-(-3)}{-2-2}=-\dfrac{3}{2}$

y-intercept:
Use the point $(-2,3)$ to find b:
$$3=-\tfrac{3}{2}(-2)+b$$
$$0=b$$
So, the equation is $\boxed{y=-\tfrac{3}{2}x}$.

69.

slope: $m=\frac{\frac{3}{4}-\frac{9}{4}}{\frac{1}{2}-\frac{3}{2}}=\frac{3}{2}$

y-intercept:

Use the point $\left(\frac{1}{2},\frac{3}{4}\right)$ to find b:

$\frac{3}{4}=\frac{3}{2}\left(\frac{1}{2}\right)+b$

$0=b$

So, the equation is $\boxed{y=\frac{3}{2}x}$.

70.

slope: $m=\frac{-\frac{1}{2}-\frac{1}{2}}{-\frac{2}{3}-\frac{7}{3}}=\frac{1}{3}$

y-intercept:

Use the point $\left(-\frac{2}{3},-\frac{1}{2}\right)$ to find b:

$-\frac{1}{2}=\frac{1}{3}\left(-\frac{2}{3}\right)+b$

$-\frac{5}{18}=b$

So, the equation is $\boxed{y=\frac{1}{3}x-\frac{5}{18}}$.

71. Since m is undefined, the line is vertical. So, the equation is $\boxed{x=3}$.

72. Since m is undefined, the line is vertical. So, the equation is $\boxed{x=-5}$.

73. Since $m=\frac{7-7}{3-9}=0,$ the line is horizontal. So, the equation is $\boxed{y=7}$.

74. Since $m=\frac{-1-(-1)}{-2-3}=0$, the line is horizontal. So, the equation is $\boxed{y=-1}$.

75. The slope is $m=\frac{6-0}{0-(-5)}=\frac{6}{5}$.

Since $(0,6)$ is the y-intercept, $b=6$.

So, the equation is $\boxed{y=\frac{6}{5}x+6}$.

76. Since m is undefined, the line is vertical. So, the equation is $\boxed{x=0}$.

77. Since m is undefined, the line is vertical. So, the equation is $\boxed{x=-6}$.

78. Since m is undefined, the line is vertical. So, the equation is $\boxed{x=-9}$.

79. The slope is undefined.
So, the equation of the line passing through the points $\left(\frac{2}{5},-\frac{3}{4}\right)$ and $\left(\frac{2}{5},\frac{1}{2}\right)$ is

$\boxed{x=\frac{2}{5}}$.

80. Since m is undefined, the line is vertical. So, the equation is $\boxed{x=\frac{1}{3}}$.

81. We identify the slope and y-intercept, and then express the equation in slope-intercept form as $\boxed{y=x-1}$.

82. We identify the slope and y-intercept, and then express the equation in slope-intercept form as $\boxed{y=x+1}$.

83. We identify the slope and y-intercept, and then express the equation in slope-intercept form as $\boxed{y=-2x+3}$.	**84.** We identify the slope and y-intercept, and then express the equation in slope-intercept form as $\boxed{y=-4x+2}$.
85. We identify the slope and y-intercept, and then express the equation in slope-intercept form as $\boxed{y=-\frac{1}{2}x+1}$.	**86.** We identify the slope and y-intercept, and then express the equation in slope-intercept form as $\boxed{y=-\frac{2}{5}x+2}$.
87. <u>slope</u>: Since parallel to $y=2x-1$, $m=2$. <u>y-intercept</u>: Use the point $(-3,1)$ to find b: $1=2(-3)+b$ $7=b$ So, the equation is $\boxed{y=2x+7}$.	**88.** <u>slope</u>: Since parallel to $y=-x+2$, $m=-1$. <u>y-intercept</u>: Use the point $(1,3)$ to find b: $3=-1(1)+b$ $4=b$ So, the equation is $\boxed{y=-x+4}$.
89. <u>slope</u>: Since perpendicular to $2x+3y=12$ (whose slope is $-\frac{2}{3}$), $m=\frac{3}{2}$. <u>y-intercept</u>: Since $(0,0)$ is assumed to be on the line and is the y-intercept, $b=0$. So, the equation is $\boxed{y=\frac{3}{2}x}$.	**90.** <u>slope</u>: Since perpendicular to $x-y=7$ (whose slope is 1), $m=-1$. <u>y-intercept</u>: Since $(0,6)$ is assumed to be on the line and is the y-intercept, $b=6$. So, the equation is $\boxed{y=-x+6}$.
91. Since parallel to x-axis, the line is horizontal. So, its equation is of the form $y=b$. Since $(3,5)$ is assumed to be on the line, the equation must be $\boxed{y=5}$.	**92.** Since parallel to y-axis, the line is vertical. So, its equation is of the form $x=a$. Since $(3,5)$ is assumed to be on the line, the equation must be $\boxed{x=3}$.

93. Since perpendicular to y-axis, the line is horizontal. So, its equation is of the form $y=b$. Since $(-1,2)$ is assumed to be on the line, the equation must be $\boxed{y=2}$.	**94.** Since perpendicular to x-axis, the line is vertical. So, its equation is of the form $x=a$. Since $(-1,2)$ is assumed to be on the line, the equation must be $\boxed{x=-1}$.
95. <u>slope</u>: Since parallel to $\frac{1}{2}x-\frac{1}{3}y=5$ (whose slope is $\frac{3}{2}$), $m=\frac{3}{2}$. <u>y-intercept</u>: Use the point $(-2,-7)$ to find b: $-7=\frac{3}{2}(-2)+b$ $-4=b$ So, the equation is $\boxed{y=\frac{3}{2}x-4}$.	**96.** <u>slope</u>: Since perpendicular to $-\frac{2}{3}x+\frac{3}{2}y=-2$ (whose slope is $\frac{4}{9}$), $m=-\frac{9}{4}$. <u>y-intercept</u>: Use the point $(1,4)$ to find b: $4=-\frac{9}{4}(1)+b$ $\frac{25}{4}=b$ So, the equation is $\boxed{y=-\frac{9}{4}x+\frac{25}{4}}$.
97. Note that $8x+10y=-45$ is equivalent to $y=-\frac{4}{5}x-\frac{9}{2}$. The slope is $-\frac{4}{5}$. So, the slope of a line perpendicular to it is $\frac{5}{4}$. Using this as the slope, together with the point $\left(-\frac{2}{3},\frac{2}{3}\right)$, we have the equation: $y-\frac{2}{3}=\frac{5}{4}\left(x+\frac{2}{3}\right)$ $y-\frac{2}{3}=\frac{5}{4}x+\frac{5}{6}$ $y=\frac{5}{4}x+\frac{3}{2}$	**98.** Note that $6x+14y=7$ is equivalent to $y=-\frac{3}{7}x+\frac{1}{2}$. The slope is $-\frac{3}{7}$. So, the slope of a line perpendicular to it is $\frac{7}{3}$. Using this as the slope, together with the point $\left(\frac{6}{5},3\right)$, we have the equation: $y-3=\frac{7}{3}\left(x-\frac{6}{5}\right)$ $y-3=\frac{7}{3}x-\frac{14}{5}$ $y=\frac{7}{3}x+\frac{1}{5}$

99. Note that $-15x+35y=7$ is equivalent to $y=\frac{3}{7}x+\frac{1}{5}$. The slope is $\frac{3}{7}$. So, the slope of a line parallel to it is $\frac{3}{7}$. Using this as the slope, together with the point $\left(\frac{7}{2},4\right)$, we have the equation: $y-4=\frac{3}{7}\left(x-\frac{7}{2}\right)$ $y-4=\frac{3}{7}x-\frac{3}{2}$ $y=\frac{3}{7}x+\frac{5}{2}$	**100.** Note that $10x+45y=-9$ is equivalent to $y=-\frac{2}{9}x-\frac{1}{5}$. The slope is $-\frac{2}{9}$. So, the slope of a line parallel to it is $-\frac{2}{9}$. Using this as the slope, together with the point $\left(-\frac{1}{4},-\frac{13}{9}\right)$, we have the equation: $y+\frac{13}{9}=-\frac{2}{9}\left(x+\frac{1}{4}\right)$ $y+\frac{13}{9}=-\frac{2}{9}x-\frac{1}{18}$ $y=-\frac{2}{9}x-\frac{3}{2}$
101. Let h = number of hours a job lasts. The cost (in dollars) is given by $C(h)=1200+25h$. So, for $h=32$, $C=2000$. This means that a $\boxed{\text{32-hour job will cost \$2,000}}$.	**102.** Let x = number of miles. The cost (in dollars) is given by $\boxed{C=50+0.39x}$.

103. Let L = monthly loan payment and x = # times filled up gas tank.
Then, $500=L+25x$. So, if $x=5$, then $500=L+125$, so that $L=375$.
The monthly payment is $\boxed{\$375}$.

104. Let B = monthly loan payment
M = cost of filling gas tank once
x = # times filled up gas tank

Then, the corresponding total monthly cost is given by $C=B+Mx$.
We are given that $(3,520)$ and $(5,600)$ satisfy the equation.
<u>We compute M and B as follows</u>:

<u>slope</u>: $M=\dfrac{520-600}{3-5}=40$ <u>y-intercept</u>: Use $(3,520)$ to find B:

$$520=B+40(3)$$
$$400=B$$

Thus, the monthly loan payment is \$400 and it costs \$40 every time you fill up with gasoline.

105. Let x = number of units sold.

Operating Cost: C(x) = 1,300 + 3.50x
Revenue: R(x) = 7.25x

Find the value of x such that C(x) = R(x).

$$1{,}300 + 3.50x = 7.25x$$
$$1{,}300 = 3.75x$$
$$x = \frac{1{,}300}{3.75} \approx 347 \text{ units}$$

106. Let x = number of units sold.

Operating Cost: C(x) = 12,000 + 13.50x
Revenue: R(x) = 27.25x

Find the value of x such that C(x) = R(x).

$$12{,}000 + 13.50x = 27.25x$$
$$12{,}000 = 13.75x$$
$$x = \frac{12{,}000}{13.75} \approx 873 \text{ units}$$

107. Assume that F and C are related by $F = mC + b$.
We are given that $(25,77)$ and $(20,68)$ (where the points are listed in the form (C,F)) satisfy the equation. We compute m and b as follows:

slope: $m = \frac{77-68}{25-20} = \frac{9}{5}$ y-intercept: Use $(25,77)$ to find b:

$$77 = \tfrac{9}{5}(25) + b$$
$$32 = b$$

So, the equation relating F and C is given by $\boxed{F = \tfrac{9}{5}C + 32}$.

The temperature for which $F = C$ can be found by substituting $F = C$ into the equation:

$$C = \tfrac{9}{5}C + 32$$
$$-\tfrac{4}{5}C = 32$$
$$-40 = C$$

Thus, $\boxed{-40 \text{ degrees Celsius} = -40 \text{ degrees Fahrenheit}}$.

108. Assume $C = mx + b$, where C is temperature (in degrees Celsius) and x is elevation (in feet). We are given that $(0,15)$ and $(500,14)$ satisfy the equation. So, We compute m and b as follows:

slope: $m = \frac{15-14}{0-500} = -\frac{1}{500}$

y-intercept: Since $(0,15)$ is assumed to be on the line and is the y-intercept, $b = 15$.

So, the equation is $\boxed{C = -\frac{1}{500}x + 15}$.

The expected temperature at 2500 ft. is $\boxed{10 \text{ degrees Celsius}}$.

109. Since $(1900, 67)$ and $(2000, 69)$ are assumed to be on the line, the slope of the line is $m = \frac{69-67}{2000-1900} = \frac{2}{100} = \frac{1}{50}$. So, the rate of change (in inches per year) is $\boxed{\frac{1}{50}}$.
110. Since $(1900, 64)$ and $(2000, 67)$ are assumed to be on the line, the slope of the line is $m = \frac{67-64}{2000-1900} = 0.03$. So, the rate of change (in inches per year) is $\boxed{0.03}$.
111. <u>Note</u>: 6 pounds 4 ounces = 100 ounces 6 pounds 10 ounces = 106 ounces Since $(1900,100)$ and $(2000,106)$ are assumed to be on the line, the slope of the line is $m = \frac{106-100}{2000-1900} = 0.06$. So, the rate of change (in ounces per year) is $\boxed{0.06}$. To determine the expected weight in the year 2040, we need the equation of the line. So far, we know the form of the equation is $y = 0.06x + b$. Use $(1900,100)$ to find b: $$\begin{aligned} 100 &= 0.06(1900) + b \\ -14 &= b \end{aligned}$$ So, the equation is $y = 0.06x - 14$. Therefore, in 2040, $y = 0.06(2040) - 14 = 108.4$ oz. Since 108.4 oz. = 6.775 pounds, and 0.775 pounds = 12.4 oz., we expect a baby to weigh $\boxed{\text{6 pounds 12.4 oz}}$ in 2040.
112. Since $(1906, 4.5)$ and $(1957, 4)$ are assumed to be on the line, the slope of the line is $m = \frac{4.5-4}{1906-1957} \cong -0.01$. So, the rate of change is $\boxed{-0.01}$.
113. The y-intercept represents the flat monthly fee of \$500 since $x = 0$ implies no sales made.
114. y-intercept: Represents the cost of the standard model with no customizations chosen. It is $(0, 35{,}000)$.

115. The rate of change is

$$\frac{33.8-35.1}{5-0}=-0.26\,\text{in./yr.}$$

Using the point $(0,35.1)$, and assuming that $x=0$ corresponds to 2014, the equation that governs this trend is given by

$$y-35.1=-0.26(x-0)\Rightarrow y=-0.26x+35.1.$$

Hence, in 2021, you can expect the average rainfall to be $-0.26(7)+35.1=33.28\,\text{in.}$

116. The rate of change is

$$\frac{32-35}{2-0}=-1.5°\text{F/yr.}$$

Using the point $(0,35)$, and assuming that $x=0$ corresponds to Jan. 2017, the equation that governs this trend is given by

$$y-35=-1.5(x-0)\Rightarrow y=-1.5x+35.$$

Hence, in 2022, you can expect the average temperature to be $-1.5(5)+35=27.5°\text{F}..$

117. The rate of change is

$$\frac{24-30}{2-0}=-3\,\text{billion bags/yr.}$$

Using the point $(0,30)$, and assuming that $x=0$ corresponds to 2016, the equation that governs this trend is given by

$$y-30=-3(x-0)\Rightarrow y=-3x+30.$$

Hence, in 2021, you can expect $-3(5)+30=15$ billion plastic bags to be used in California.

118. The rate of change is

$$\frac{6040-5686}{2-0}=177 \text{ dollars per year}$$

Using the point $(0,5686)$, and remembering that $x=0$ corresponds to 2016, the equation that governs this trend is given by

$$y-5686=177(x-0) \Rightarrow y=177x+5686.$$

Hence, in 2022, you can expect the average credit card debt to be $177(6)+5686=\$6748$.

119.

a. (1, 16(1) + 15.93) = (1, 31.93), (2, 16(2) + 19.18) = (2, 51.18), (5, 111.83)

b. $m=\frac{31.93-0}{1-0}=31.93$ This means that when you buy a single bottle, the cost per bottle of Hoison sauce is \$31.93.

c. $m=\frac{51.18-0}{2-0}=25.59$ This means that when you buy 2 bottles of Hoison sauce, the cost per bottle of Hoison sauce is \$25.59.

d. $m=\frac{111.83-0}{5-0}=22.37$ This means that when you buy 5 bottles of Hoison sauce, the cost per bottle of Hoison sauce is \$22.37.

120.

a. (1, 18.27), (2, 2(4) + 14.77) = (2, 22.77), (5, 35.93)

b. $m=\frac{18.27-0}{1-0}=18.27$ This means that when you buy a single bottle, the cost per bottle is \$18.27.

c. $m=\frac{22.77-0}{2-0}=11.39$ This means that when you buy 2 bottles the cost per bottle of is \$11.39.

d. $m=\frac{35.93-0}{5-0}=7.19$ This means that when you buy 5 bottles the cost per bottle of is \$7.19.

121. The computations used to calculate the x- and y-intercepts should be reversed. So, the x-intercept is (3, 0) and the y-intercept is $(0,-2)$.	
122. The denominator of the slope should be $4-(-2)$, resulting in $m=-\frac{1}{3}$.	
123. The denominator and numerator in the slope computation should be switched, resulting in the slope being undefined.	
124. These two are listed incorrectly: **a.** horizontal **b.** vertical	
125. True. Since the equation $mx+b=0$ has at most one solution.	**126.** False. Any vertical line $x=a$ $(a\neq 0)$ does not have a y-intercept.
127. False. The lines are perpendicular.	**128.** True.
129. Any vertical line is perpendicular to a line with slope 0.	**130.** Any vertical line is parallel to a line with no slope.

131. Since $B\neq 0$, $Ax+By=C$ can be written as $y=-\frac{A}{B}x+\frac{C}{B}$. Since the desired line is parallel to this line, its slope $m=-\frac{A}{B}$. Use the point $(-B,A+1)$ on the line to find the y-intercept:

$$\begin{aligned} A+1&=-\tfrac{A}{B}(-B)+b \\ A+1&=A+b \\ b&=1 \end{aligned}$$

So, the equation of the line in this case is $y=-\frac{A}{B}x+1$.

132. We know that the point $(B,A-1)$ is on the line. Since it is parallel to $Ax+By=C$, and the slope of this line is $-\frac{A}{B}$ (assuming $B\neq 0$), the equation of the desired line is

$$\begin{aligned} y-(A-1)&=-\tfrac{A}{B}(x-B) \\ y&=(A-1)-\tfrac{A}{B}x+A \\ &\boxed{y=-\tfrac{A}{B}x+(2A-1)} \end{aligned}$$

133. We know that the point $(-A, B-1)$ is on the line. Since it is perpendicular to $Ax+By=C$, and the slope of this line is $-\frac{A}{B}$ (assuming $B \neq 0$), the slope of the desired line is $\frac{B}{A}$ (assuming $A \neq 0$). So, the equation of the desired line is

$$y-(B-1)=\tfrac{B}{A}(x+A)$$
$$y=(B-1)+\tfrac{B}{A}x+B$$
$$\boxed{y=\tfrac{B}{A}x+(2B-1)}$$

134. Case 1: $A \neq 0$ and $B \neq 0$

In such case, $Ax+By=C$ can be written as $y=-\frac{A}{B}x+\frac{C}{B}$. Since the desired line is perpendicular to this line, its slope $m=\frac{B}{A}$. Use the point $(A, B+1)$ on the line to find the y-intercept:

$$B+1=\tfrac{B}{A}(A)+b$$
$$b=1$$

So, the equation of the line in this case is $y=\frac{B}{A}x+1$.

Case 2: $A=0$ and $B \neq 0$

In such case, the line $Ax+By=C$ can be written as $y=\frac{C}{B}$, which is horizontal. Since the desired line is perpendicular to this one, it must be vertical. So, since $(A, B+1)$ is on the line, its equation is $x=A$, which is $x=0$.

Case 3: $A \neq 0$ and $B=0$

In such case, the line $Ax+By=C$ can be written as $x=\frac{C}{A}$, which is vertical. Since the desired line is perpendicular to this one, it must be horizontal. So, since $(A, B+1)$ is on the line, its equation is $y=B+1$, which is $y=1$.

135. Let $y_1=mx+b_1$ and $y_2=mx+b_2$, assuming that $b_1 \neq b_2$. At a point of intersection of these two lines, $y_1=y_2$. This is equivalent to $mx+b_1=mx+b_2$, which implies $b_1=b_2$, which contradicts our assumption. Hence, there are no points of intersection.

136. Solving $m_1x+b_1=m_2x+b_2$ yields

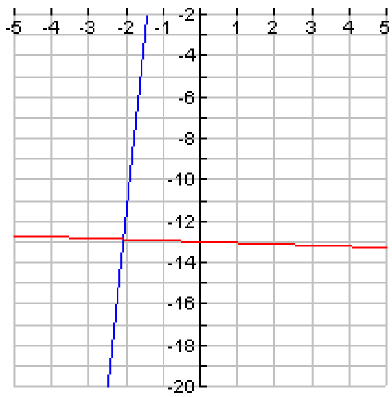
$$(m_1-m_2)x=b_2-b_1 \quad \Rightarrow \quad \boxed{x=\frac{b_2-b_1}{m_1-m_2}}.$$

This is the x-coordinate of the intersection point.

137. Slope of $y_1 = 17x + 22$ is 17.

Slope of $y_2 = -\frac{1}{17}x - 13$ is $-\frac{1}{17}$.

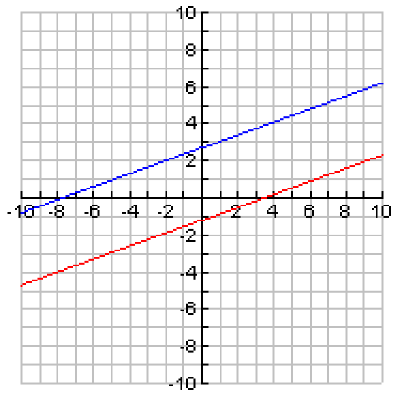
Since $17\left(-\frac{1}{17}\right) = -1$, $\boxed{\text{perpendicular}}$.



138. Slope of $y_1 = 0.35x + 2.7$ is 0.35.

Slope of $y_2 = 0.35x - 1.2$ is 0.35.

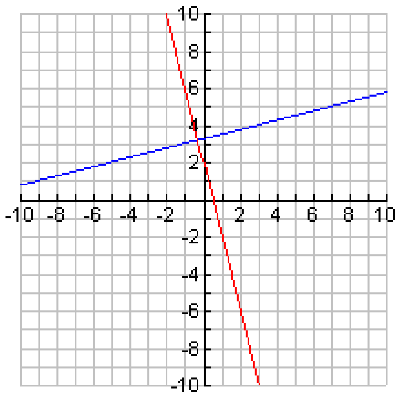
Since they have the same slope, $\boxed{\text{parallel}}$.



139. Slope of $y_1 = 0.25x + 3.3$ is 0.25.

Slope of $y_2 = -4x + 2$ is -4.

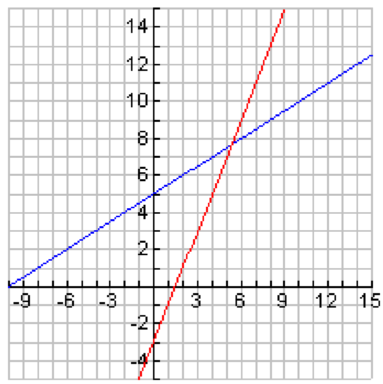
Since $0.25(-4) = -1$, they are $\boxed{\text{perpendicular}}$.



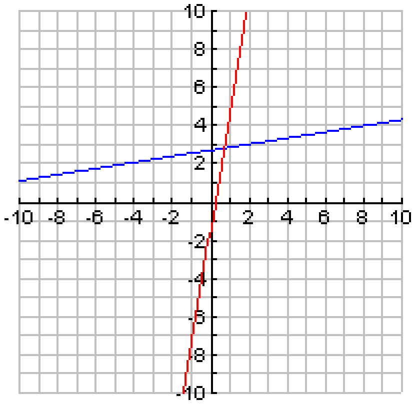
140. Slope of $y_1 = \frac{1}{2}x + 5$ is $\frac{1}{2}$.

Slope of $y_2 = 2x - 3$ is 2.

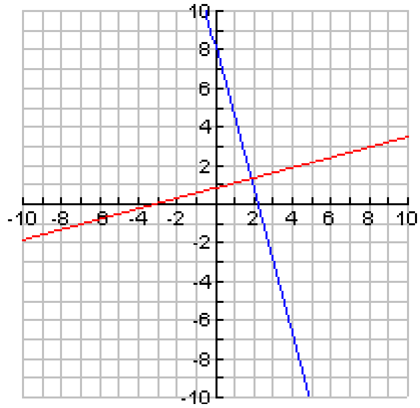
Since $\frac{1}{2}(2) \neq -1$ and $\frac{1}{2} \neq 2$, they are $\boxed{\text{neither}}$ parallel nor perpendicular.



141. Slope of $y_1 = 0.16x + 2.7$ is 0.16.
Slope of $y_2 = 6.25x - 1.4$ is 6.25.
Since $(0.16)(6.25) \neq -1$ and $0.16 \neq 6.25$, they are $\boxed{\text{neither}}$ parallel nor perpendicular.



142. Slope of $y_1 = -3.75x + 8.2$ is -3.75.
Slope of $y_2 = \frac{4}{15}x + \frac{5}{6}$ is $\frac{4}{15}$.
Since $(-3.75)(\frac{4}{15}) = -1$ they are $\boxed{\text{perpendicular}}$.



Section 2.4 Solutions ---

1. $(x-1)^2+(y-2)^2=9$	**2.** $(x-3)^2+(y-4)^2=25$
3. $(x-(-3))^2+(y-(-4))^2=10^2$ $(x+3)^2+(y+4)^2=100$	**4.** $(x-(-1))^2+(y-(-2))^2=4^2$ $(x+1)^2+(y+2)^2=16$
5. $(x-5)^2+(y-7)^2=81$	**6.** $(x-2)^2+(y-8)^2=36$
7. $(x-(-11))^2+(y-12)^2=13^2$ $(x+11)^2+(y-12)^2=169$	**8.** $(x-6)^2+(y-(-7))^2=8^2$ $(x-6)^2+(y+7)^2=64$
9. $(x-0)^2+(y-0)^2=2^2$ $x^2+y^2=4$	**10.** $(x-0)^2+(y-0)^2=9$ $x^2+y^2=9$
11. $(x-0)^2+(y-2)^2=3^2$ $x^2+(y-2)^2=9$	**12.** $(x-3)^2+(y-0)^2=2^2$ $(x-3)^2+y^2=4$
13. $(x-0)^2+(y-0)^2=\left(\sqrt{2}\right)^2$ $x^2+y^2=2$	**14.** $(x-(-1))^2+(y-2)^2=\left(\sqrt{7}\right)^2$ $(x+1)^2+(y-2)^2=7$
15. $(x-5)^2+(y-(-3))^2=\left(2\sqrt{3}\right)^2$ $(x-5)^2+(y+3)^2=12$	**16.** $(x-(-4))^2+(y-(-1))^2=\left(3\sqrt{5}\right)^2$ $(x+4)^2+(y+1)^2=45$

17. $\left(x-\frac{2}{3}\right)^2+\left(y-\left(-\frac{3}{5}\right)\right)^2=\left(\frac{1}{4}\right)^2$ $\left(x-\frac{2}{3}\right)^2+\left(y+\frac{3}{5}\right)^2=\frac{1}{16}$	**18.** $\left(x-\left(-\frac{1}{3}\right)\right)^2+\left(y-\left(-\frac{2}{7}\right)\right)^2=\left(\frac{2}{5}\right)^2$ $\left(x+\frac{1}{3}\right)^2+\left(y+\frac{2}{7}\right)^2=\frac{4}{25}$
19. $(x-1.3)^2+(y-2.7)^2=(3.2)^2$ $(x-1.3)^2+(y-2.7)^2=10.24$	**20.** $(x-(-3.1))^2+(y-4.2)^2=(5.5)^2$ $(x+3.1)^2+(y-4.2)^2=30.25$
21. The center is $(1,3)$ and the radius is $\sqrt{25}=5$.	**22.** The equation can be written as $(x-(-1))^2+(y-(-3))^2=\left(\sqrt{11}\right)^2$. So, center is $(-1,-3)$ and radius is $\sqrt{11}$.
23. The equation can be written as $(x-2)^2+(y-(-5))^2=(7)^2$. So, center is $(2,-5)$ and radius is 7.	**24.** The equation can be written as $(x-(-3))^2+(y-7)^2=9^2$. So, center is $(-3,7)$ and radius is 9.
25. The center is $(4,9)$ and the radius is $\sqrt{20}=2\sqrt{5}$.	**26.** The equation can be written as $(x-(-1))^2+(y-(-2))^2=\left(\sqrt{8}\right)^2$. So, center is $(-1,-2)$ and radius is $\sqrt{8}=$ $2\sqrt{2}$.
27. The center is $\left(\frac{2}{5},\frac{1}{7}\right)$ and the radius is $\sqrt{\frac{4}{9}}=\frac{2}{3}$.	**28.** The center is $\left(\frac{1}{2},\frac{1}{3}\right)$ and the radius is $\sqrt{\frac{9}{25}}=\frac{3}{5}$.
29. The equation can be written as $(x-1.5)^2+(y-(-2.7))^2=\left(\sqrt{1.69}\right)^2$. So, center is $(1.5,-2.7)$ and radius is $\sqrt{1.69}=1.3$.	**30.** The equation can be written as $(x-(-3.1))^2+(y-7.4)^2=\left(\sqrt{56.25}\right)^2$. So, center is $(-3.1,7.4)$ and radius is $\sqrt{56.25}=7.5$.

31. The equation can be written as $(x-0)^2+(y-0)^2=\left(\sqrt{50}\right)^2$. So, center is $(0,0)$ and radius is $\sqrt{50}=5\sqrt{2}$.	**32.** The equation can be written as $(x-0)^2+(y-0)^2=\left(\sqrt{8}\right)^2$. So, center is $(0,0)$ and radius is $\sqrt{8}=2\sqrt{2}$.
33. Completing the square gives us: $x^2+y^2+4x+6y-3=0$ $x^2+4x+y^2+6y=3$ $(x^2+4x+4)+(y^2+6y+9)=3+4+9$ $(x+2)^2+(y+3)^2=16$ $(x-(-2))^2+(y-(-3))^2=16$ So, center is $(-2,-3)$ and radius is $\sqrt{16}=4$.	**34.** Completing the square gives us: $x^2+y^2+2x+10y+17=0$ $x^2+2x+y^2+10y=-17$ $(x^2+2x+1)+(y^2+10y+25)=-17+1+25$ $(x+1)^2+(y+5)^2=9$ $(x-(-1))^2+(y-(-5))^2=9$ So, center is $(-1,-5)$ and radius is $\sqrt{9}=3$.
35. Completing the square gives us: $x^2+y^2+6x+8y-75=0$ $x^2+6x+y^2+8y=75$ $(x^2+6x+9)+(y^2+8y+16)=75+9+16$ $(x+3)^2+(y+4)^2=100$ $(x-(-3))^2+(y-(-4))^2=100$ So, center is $(-3,-4)$ and radius is $\sqrt{100}=10$.	**36.** Completing the square gives us: $x^2+y^2+2x+4y-9=0$ $x^2+2x+y^2+4y=9$ $(x^2+2x+1)+(y^2+4y+4)=9+1+4$ $(x+1)^2+(y+2)^2=14$ $(x-(-1))^2+(y-(-2))^2=14$ So, center is $(-1,-2)$ and radius is $\sqrt{14}$.

37. Completing the square gives us:

$$x^2+y^2-10x-14y-7=0$$
$$x^2-10x\quad+y^2-14y=7$$
$$(x^2-10x+25)+(y^2-14y+49)=7+25+49$$
$$(x-5)^2+(y-7)^2=81$$

So, center is $(5,7)$ and radius is 9.

38. Completing the square gives us:

$$\begin{aligned} x^2+y^2-4x-16y+32&=0\\ x^2-4x\quad+y^2-16y&=-32\\ \left(x^2-4x+4\right)+\left(y^2-16y+64\right)&=-32+4+64\\ (x-2)^2+(y-8)^2&=36 \end{aligned}$$

So, center is $(2,8)$ and radius is 6.

39. Completing the square gives us:

$$\begin{aligned} x^2+y^2-2y-15&=0\\ x^2+\left(y^2-2y+1\right)-15-1&=0\\ x^2+(y-1)^2&=16 \end{aligned}$$

So, the center is $(0,1)$ and radius is 4.

40. Completing the square gives us:

$$\begin{aligned} x^2+y^2+2x-8&=0\\ \left(x^2+2x+1\right)+y^2-8-1&=0\\ (x+1)^2+y^2&=9 \end{aligned}$$

So, the center is $(-1,0)$ and radius is 3.

41. Completing the square gives us:

$$\begin{aligned} x^2+y^2-2x-6y+1&=0\\ x^2-2x\quad+y^2-6y&=-1\\ \left(x^2-2x+1\right)+\left(y^2-6y+9\right)&=-1+1+9\\ (x-1)^2+(y-3)^2&=9 \end{aligned}$$

So, center is $(1,3)$ and radius is 3.

42. Completing the square gives us:

$$\begin{aligned} x^2+y^2-8x-6y+21&=0\\ x^2-8x\quad+y^2-6y&=-21\\ \left(x^2-8x+16\right)+\left(y^2-6y+9\right)&=-21+16+9\\ (x-4)^2+(y-3)^2&=4 \end{aligned}$$

So, center is $(4,3)$ and radius is 2.

43. Completing the square gives us:

$$\begin{aligned} x^2+y^2-10x+6y+22&=0\\ x^2-10x\quad+y^2+6y&=-22\\ \left(x^2-10x+25\right)+\left(y^2+6y+9\right)&=-22+25+9\\ (x-5)^2+(y+3)^2&=12\\ (x-5)^2+(y-(-3))^2&=12 \end{aligned}$$

So, center is $(5,-3)$ and radius is $\sqrt{12}=2\sqrt{3}$.

44. Completing the square gives us:

$$x^2+y^2+8x+2y-28=0$$
$$x^2+8x\quad+y^2+2y=28$$
$$\left(x^2+8x+16\right)+\left(y^2+2y+1\right)=28+16+1$$
$$(x+4)^2+(y+1)^2=45$$
$$(x-(-4))^2+(y-(-1))^2=45$$

So, center is $(-4,-1)$ and radius is $\sqrt{45}=3\sqrt{5}$.

45. Completing the square gives us:

$$x^2+y^2-6x-4y+1=0$$
$$x^2-6x\quad+y^2-4y=-1$$
$$\left(x^2-6x+9\right)+\left(y^2-4y+4\right)=-1+9+4$$
$$(x-3)^2+(y-2)^2=12$$

So, center is $(3,2)$ and radius is $\sqrt{12}=2\sqrt{3}$.

46. Completing the square gives us:

$$x^2+y^2-2x-10y+2=0$$
$$x^2-2x\quad+y^2-10y=-2$$
$$\left(x^2-2x+1\right)+\left(y^2-10y+25\right)=-2+1+25$$
$$(x-1)^2+(y-5)^2=24$$

So, center is $(1,5)$ and radius is $\sqrt{24}=2\sqrt{6}$.

47. Completing the square gives us:

$$x^2+y^2-x+y+\tfrac{1}{4}=0$$
$$x^2-x\quad+y^2+y=-\tfrac{1}{4}$$
$$\left(x^2-x+\tfrac{1}{4}\right)+\left(y^2+y+\tfrac{1}{4}\right)=-\tfrac{1}{4}+\tfrac{1}{4}+\tfrac{1}{4}$$
$$\left(x-\tfrac{1}{2}\right)^2+\left(y+\tfrac{1}{2}\right)^2=\tfrac{1}{4}$$
$$\left(x-\tfrac{1}{2}\right)^2+\left(y-(-\tfrac{1}{2})\right)^2=\tfrac{1}{4}$$

So, center is $\left(\tfrac{1}{2},-\tfrac{1}{2}\right)$ and radius is $\sqrt{\tfrac{1}{4}}=\tfrac{1}{2}$.

48. Completing the square gives us:

$$x^2+y^2-\tfrac{1}{2}x-\tfrac{3}{2}y+\tfrac{3}{8}=0$$
$$x^2-\tfrac{1}{2}x\quad+y^2-\tfrac{3}{2}y=-\tfrac{3}{8}$$
$$\left(x^2-\tfrac{1}{2}x+\tfrac{1}{16}\right)+\left(y^2-\tfrac{3}{2}y+\tfrac{9}{16}\right)=-\tfrac{3}{8}+\tfrac{1}{16}+\tfrac{9}{16}$$
$$\left(x-\tfrac{1}{4}\right)^2+\left(y-\tfrac{3}{4}\right)^2=\tfrac{1}{4}$$

So, center is $\left(\tfrac{1}{4},\tfrac{3}{4}\right)$ and radius is $\sqrt{\tfrac{1}{4}}=\tfrac{1}{2}$.

49. Completing the square gives us:

$$x^2 + y^2 - 2.6x - 5.4y - 1.26 = 0$$
$$x^2 - 2.6x \quad + y^2 - 5.4y = 1.26$$
$$\left(x^2 - 2.6x + 1.69\right) + \left(y^2 - 5.4y + 7.29\right) = 1.26 + 1.69 + 7.29$$
$$(x-1.3)^2 + (y-2.7)^2 = 10.24$$

So, center is $(1.3, 2.7)$ and radius is $\sqrt{10.24} = 3.2$.

50. Completing the square gives us:

$$x^2 + y^2 - 6.2x - 8.4y - 3 = 0$$
$$x^2 - 6.2x \quad + y^2 - 8.4y = 3$$
$$\left(x^2 - 6.2x + 9.61\right) + \left(y^2 - 8.4y + 17.64\right) = 3 + 9.61 + 17.64$$
$$(x-3.1)^2 + (y-4.2)^2 = 30.25$$

So, center is $(3.1, 4.2)$ and radius is $\sqrt{30.25} = 5.5$.

51. The center is $(-1,-2)$.

The radius is the distance from $(-1,-2)$ to $(1,0)$, which is given by

$$\sqrt{(-1-1)^2 + (-2-0)^2} = \sqrt{8}.$$

So, the equation is

$$(x-(-1))^2 + (y-(-2))^2 = \left(\sqrt{8}\right)^2$$
$$(x+1)^2 + (y+2)^2 = 8.$$

52. The center is $(4,9)$.

The radius is the distance from $(4,9)$ to $(2,5)$, which is given by

$$\sqrt{(4-2)^2 + (9-5)^2} = \sqrt{20}.$$

So, the equation is

$$(x-4)^2 + (y-9)^2 = 20.$$

53. The center is $(-2,3)$.

The radius is the distance from $(-2,3)$ to $(3,7)$, which is given by

$$\sqrt{(-2-3)^2 + (3-7)^2} = \sqrt{41}.$$

So, the equation is

$$(x-(-2))^2 + (y-3)^2 = 41$$
$$(x+2)^2 + (y-3)^2 = 41.$$

54. The center is $(1,1)$.

The radius is the distance from $(1,1)$ to $(-8,-5)$, which is given by

$$\sqrt{(1-(-8))^2 + (1-(-5))^2} = \sqrt{117}.$$

So, the equation is

$$(x-1)^2 + (y-1)^2 = 117.$$

55. The center is $(-2,-5)$.
The radius is the distance from $(-2,-5)$ to $(1,-9)$, which is given by

$$\sqrt{(-2-1)^2+(-5-(-9))^2}=5.$$

So, the equation is

$$(x-(-2))^2+(y-(-5))^2=25$$
$$(x+2)^2+(y+5)^2=25.$$

56. The center is $(-3,-4)$.
The radius is the distance from $(-3,-4)$ to $(-1,-8)$, which is given by

$$\sqrt{(-3-(-1))^2+(-4-(-8))^2}=\sqrt{20}=2\sqrt{5}.$$

So, the equation is

$$(x-(-3))^2+(y-(-4))^2=20$$
$$(x+3)^2+(y+4)^2=20.$$

57. Assume that the phone tower is located at $(0,0)$. Then, the coordinates of your home are $(33,95)$. The distance from the phone tower is then $\sqrt{95^2+33^2}\cong 100.568$ miles, which exceeds the reception area. So, you cannot use the cell phone at home.

58. Assume that the phone tower is located at $(0,0)$. Then, the coordinates of your home are $(-87,-45)$. The distance from the phone tower is then $\sqrt{87^2+45^2}\cong 97.949$ miles, which is within the reception area. So, you can use the cell phone at home.

59. Assume that the stake is located at $(0,0)$. In order to stay within the boundary of the yard, the leash must be no longer than 50 ft. The outer perimeter for the dog would then be described by $(x-0)^2+(y-0)^2=50^2$, that is $x^2+y^2=2500$.

60. Now, the dog is restricted to one-fourth of the yard. Using the given diagram, the stake would be located at $(25,25)$. Also, the length of the leash would be reduced to 25 ft. The outer perimeter for the dog would then be described by $(x-25)^2+(y-25)^2=\underbrace{25^2}_{625}$.

61. The center of the inner circle is $(0,0)$. Since the diameter is 3000 ft., the radius is 1500 ft. So, the equation of the inner circle is $(x-0)^2+(y-0)^2=1500^2$, that is $x^2+y^2=2,250,000$.

62. The center of the outer circle is $(0,0)$. Since the diameter is 6000 ft., the radius is 3000 ft. So, the equation of the outer circle is $(x-0)^2+(y-0)^2=3000^2$, that is $x^2+y^2=9\times10^6$.

63. Location of tower = center of reception area = (0,0). We also know the radius is 200 miles. Hence, the equation of the circle is $\boxed{x^2+y^2=40,000}$.

64. Assuming the fire station is located at the origin, we know that since the radius is 2 miles, the equation of the circle where fire has spread is $\boxed{x^2+y^2=4}$.

65. The center of the Ferris wheel is 35 feet above the ground so it is located at (0, 35). Using $r=25$, we get the equation $x^2+(y-35)^2=625$.

66. Inner circle:

$(x-250)^2+(y-500)^2=400^2$

Middle circle:

$(x-250)^2+(y-500)^2=800^2$

Outer circle:

$(x-250)^2+(y-500)^2=1200^2$

67. a.

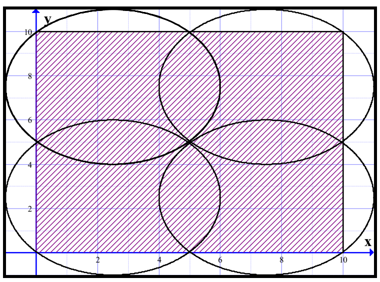
Tower 1: $(x-2.5)^2+(y-2.5)^2=3.5^2$

Tower 2: $(x-2.5)^2+(y-7.5)^2=3.5^2$

Tower 3: $(x-7.5)^2+(y-2.5)^2=3.5^2$

Tower 4: $(x-7.5)^2+(y-7.5)^2=3.5^2$

b. This placement of cell phone towers will provide cell phone coverage for the entire 10 mile by 10 mile square.



68. a.

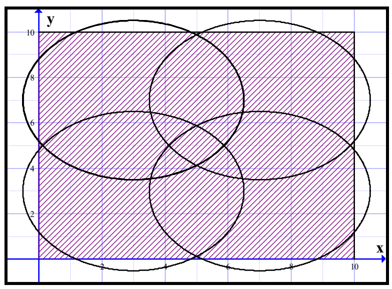
Tower 1: $(x-3)^2+(y-3)^2=3.5^2$

Tower 2: $(x-3)^2+(y-7)^2=3.5^2$

Tower 3: $(x-7)^2+(y-3)^2=3.5^2$

Tower 4: $(x-7)^2+(y-7)^2=3.5^2$

b. This placement of cell phone towers will not provide cell phone coverage for the entire 10 mile by 10 mile square.



69. The center should be $(4,-3)$.	**70.** The radius should be $\sqrt{2}$.
71. The standard form of the equation of a circle requires that the right-side be non-negative. Since the radius would have to be $\sqrt{-16}$, which is not a real number, the result cannot be a circle.	**72.** The right-side, upon completing the square, should be $3+9+4=16$. So, the radius would be 4 rather than $2\sqrt{3}$.
73. True. Since the graph is comprised of infinitely many points.	**74.** True. Since the left-side is always non-negative.
75. True. Since the left-side is always non-negative.	**76.** True. The solution is $(1,-3)$.

77. Completing the square gives us:

$$x^2+y^2+10x-6y+34=0$$
$$x^2+10x\quad+y^2-6y=-34$$
$$\left(x^2+10x+25\right)+\left(y^2-6y+9\right)=-34+25+9$$
$$(x+5)^2+(y-3)^2=0$$

Thus, the graph consists of the single point $(-5,3)$.

78. Completing the square gives us:

$$x^2+y^2-4x+6y+49=0$$
$$x^2-4x\quad+y^2+6y=-49$$
$$\left(x^2-4x+4\right)+\left(y^2+6y+9\right)=-49+4+9$$
$$(x-2)^2+(y+3)^2=-36$$

Since no ordered pair of real numbers (x,y) can satisfy this equation, there is no graph.

79. The diameter is equal to the distance between $(5,2)$ and $(1,-6)$, which is given by $\sqrt{(5-1)^2+(2-(-6))^2}=\sqrt{80}=4\sqrt{5}$. So, the radius is $\frac{1}{2}\left(4\sqrt{5}\right)=2\sqrt{5}$.
The center is the midpoint of the segment joining the points $(5,2)$ and $(1,-6)$, which is given by $\left(\frac{5+1}{2},\frac{2+(-6)}{2}\right)=(3,-2)$. Therefore, the equation is then given by:

$$(x-3)^2+(y-(-2))^2=\left(2\sqrt{5}\right)^2$$
$$(x-3)^2+(y+2)^2=20$$

80. The diameter is equal to the distance between $(3,0)$ and $(-1,-4)$, which is given by $\sqrt{(3-(-1))^2+(0-(-4))^2}=\sqrt{32}=4\sqrt{2}$. So, the radius is $\frac{1}{2}\left(4\sqrt{2}\right)=2\sqrt{2}$.
The center is the midpoint of the segment joining the points $(3,0)$ and $(-1,-4)$, which is given by $\left(\frac{3+(-1)}{2},\frac{0+(-4)}{2}\right)=(1,-2)$. Therefore, the equation is then given by:

$$(x-1)^2+(y+2)^2=\underbrace{\left(2\sqrt{2}\right)^2}_{8}$$

81. Completing the square gives us:

$$x^2+y^2+ax+by+c=0$$
$$x^2+ax\quad+y^2+by=-c$$
$$\left(x^2+ax+\tfrac{a^2}{4}\right)+\left(y^2+by+\tfrac{b^2}{4}\right)=-c+\tfrac{a^2}{4}+\tfrac{b^2}{4}$$
$$\left(x+\tfrac{a}{2}\right)^2+\left(y+\tfrac{b}{2}\right)^2=-c+\tfrac{a^2}{4}+\tfrac{b^2}{4}$$

If $-c+\frac{a^2}{4}+\frac{b^2}{4}=0$, which is equivalent to $4c=a^2+b^2$, then the graph will consist of the single point $\left(-\frac{a}{2},-\frac{b}{2}\right)$.

82. Completing the square gives us:

$$x^2+y^2+ax+by+c=0$$
$$x^2+ax\quad+y^2+by=-c$$
$$\left(x^2+ax+\tfrac{a^2}{4}\right)+\left(y^2+by+\tfrac{b^2}{4}\right)=-c+\tfrac{a^2}{4}+\tfrac{b^2}{4}$$
$$\left(x+\tfrac{a}{2}\right)^2+\left(y+\tfrac{b}{2}\right)^2=-c+\tfrac{a^2}{4}+\tfrac{b^2}{4}$$

If $-c+\tfrac{a^2}{4}+\tfrac{b^2}{4}<0,$ which is equivalent to $4c>a^2+b^2,$ then there is no graph.

83. Completing the square gives us:

$$x^2+y^2-2ax=100-a^2$$
$$\left(x^2-2ax+a^2\right)+y^2-a^2=100-a^2$$
$$(x-a)^2+y^2=100$$

So, the center is (a, 0) and radius is 10.

84. Completing the square gives us:

$$x^2+y^2+2by=49-b^2$$
$$x^2+\left(y^2+2by+b^2\right)-b^2=49-b^2$$
$$x^2+(y+b)^2=49$$

So, the center is (0, $-b$) and radius is 7.

85. The equation is given by

$$(x-2)^2+(y+5)^2=-20,$$

so there is no graph.

86. The equation is given by

$$(x-1)^2+(y+3)^2=0,$$

so the graph consists of the single point $(1,-3)$.

87. Completing the square gives us:

$$x^2+y^2+10x-6y+34=0$$
$$x^2+10x\quad+y^2-6y=-34$$
$$\left(x^2+10x+25\right)+\left(y^2-6y+9\right)=-34+25+9$$
$$(x+5)^2+(y-3)^2=0$$

Thus, the graph consists of the single point $(-5,3)$.

88. Completing the square gives us:

$$x^2+y^2-4x+6y+49=0$$
$$x^2-4x \quad +y^2+6y=-49$$
$$\left(x^2-4x+4\right)+\left(y^2+6y+9\right)=-49+4+9$$
$$(x-2)^2+(y+3)^2=-36$$

Since no ordered pair of real numbers (x,y) can satisfy this equation, there is no graph.

89. a. Completing the square yields

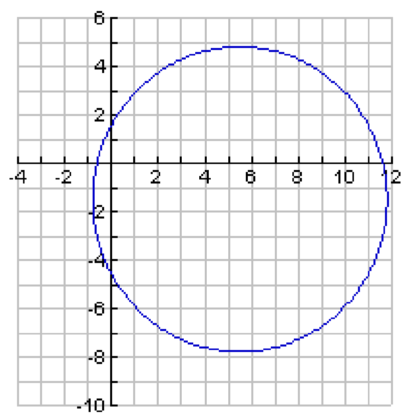
$$\left(x^2-11x \quad \right)+\left(y^2+3y \quad \right)=7.19$$
$$\left(x^2-11x+30.25\right)+\left(y^2+3y+2.25\right)=7.19+30.25+2.25=39.69$$
$$(x-5.5)^2+(y+1.5)^2=39.69 \quad \textbf{(1)}$$

Center (5.5, −1.5), Radius 6.3

b. Solving **(1)** for y yields:

$$(y+1.5)^2=39.69-(x-5.5)^2$$
$$y+1.5=\pm\sqrt{39.69-(x-5.5)^2}$$
$$y=-1.5\pm\sqrt{39.69-(x-5.5)^2}$$

c.



d. The graphs in (a) and (c) are the same.

90. a. Completing the square yields

$$\left(x^2+1.2x\quad\right)+\left(y^2-3.2y\quad\right)=-2.11$$

$$\left(x^2+1.2x+0.36\right)+\left(y^2-3.2y+2.56\right)=-2.11+0.36+2.56=0.81$$

$$(x+0.6)^2+(y-1.6)^2=0.81\quad \textbf{(1)}$$

Center (−0.6, 1.6), Radius 0.9

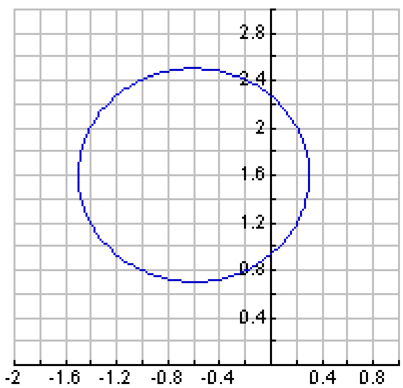
b. Solving **(1)** for y yields:

$$(y-1.6)^2=0.81-(x+0.6)^2$$

$$y-1.6=\pm\sqrt{0.81-(x+0.6)^2}$$

$$y=1.6\pm\sqrt{0.81-(x+0.6)^2}$$

c.



d. The graphs in (a) and (c) are the same.

Section 2.5 Solutions ---

1. Negative linear association because the data closely cluster around what is reasonably described as a line with negative slope.

2. There is no identifiable direction of association, and the data are certainly not linear and there is not even a recognizable nonlinear curve that describes a pattern to which the data conform.

3. Although the data seem to be comprised of two *linear* segments, the overall data set cannot be described as having a positive or negative direction of association. Moreover, the pattern of the data is not linear, per se; rather, it is nonlinear and conforms to an identifiable curve (an upside down V called the *absolute value* function).

4. Positive nonlinear association because the data are rising from left to right and cluster relatively closely around what is reasonably described as a nonlinear curve.

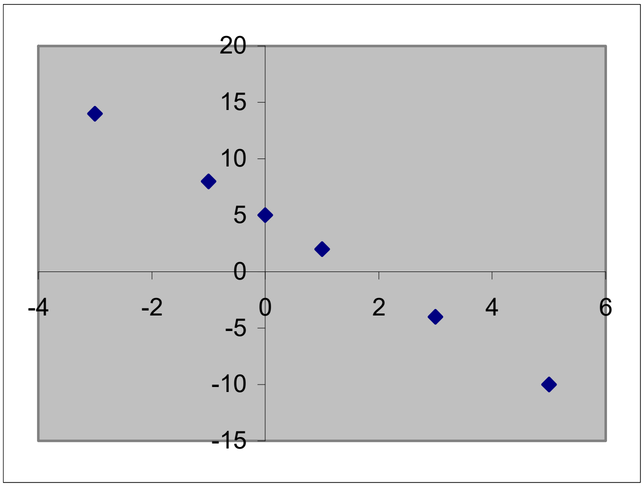
5. **B** because the association is positive, thereby eliminating choices A and C. And, since the data are closely clustered around a linear curve, the bigger of the two correlation coefficients, 0.80, is more appropriate.

6. **A** because the association is negative, thereby eliminating choices B and D. And, since the data are closely clustered around a linear curve, the correlation coefficient closer to –1 is more appropriate.

7. **C** because the association is negative, thereby eliminating choices B and D. And, the data are more loosely clustered around a linear curve than are those pictured in #6. So, the correlation coefficient is the negative choice closer to 0.

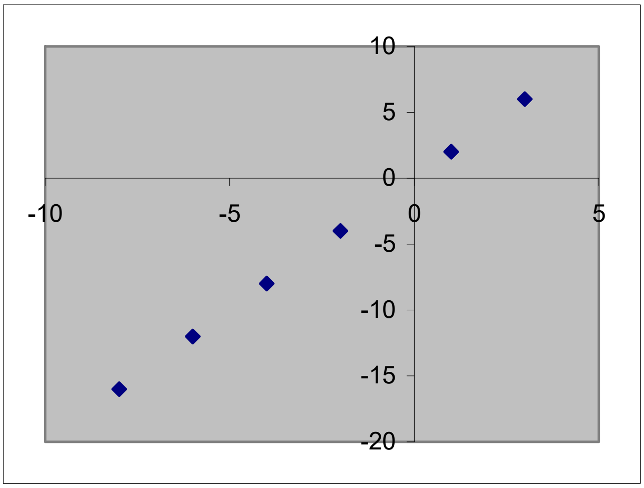
8. **D** because there is no real identifiable association, so that the correlation coefficient closest to 0 is the most appropriate.

9. a.



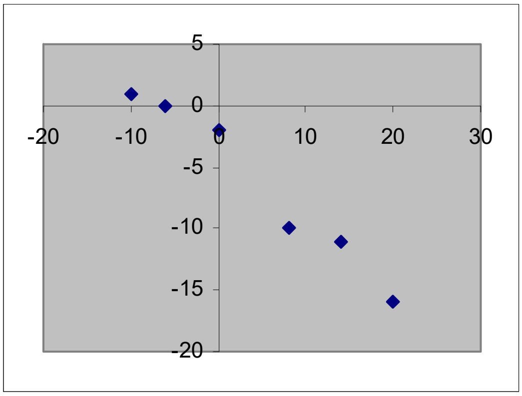
b. The data seem to be nearly perfectly aligned to a line with negative slope. So, it is reasonable to guess that the correlation coefficient is very close to -1.
c. The equation of the best fit line is $y = -3x + 5$ with a correlation coefficient of $r = -1$.
d. There is a perfect negative linear association between x and y.

10. a.



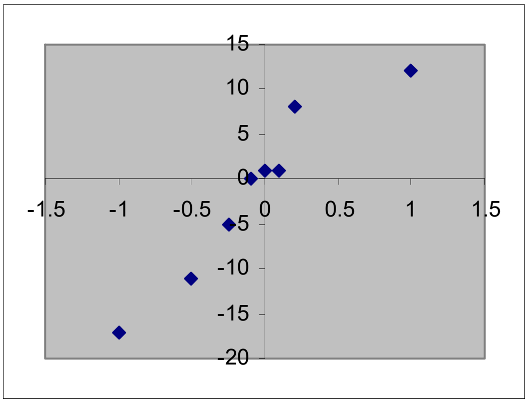
b. The data seem to be nearly perfectly aligned to a line with positive slope. So, it is reasonable to guess that the correlation coefficient is very close to 1.
c. The equation of the best fit line is $y = 2x$ with a correlation coefficient of $r = 1$.
d. There is a perfect positive linear relationship between x and y.

11. a.



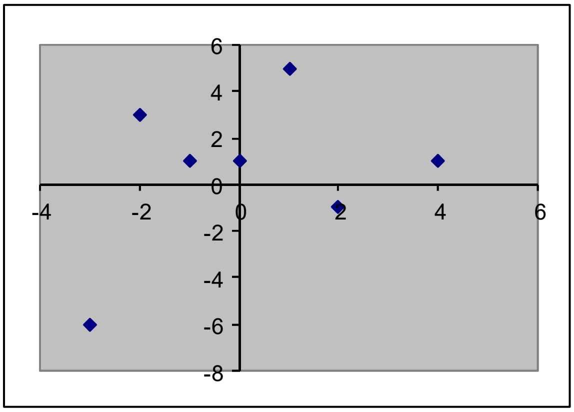
b. The data tend to fall from left to right, so that the correlation coefficient should be negative. Also, the data do not seem to stray too far from a linear curve, so the r value should be reasonably close to –1, but not equal to it. A reasonable guess would be around –0.90.
c. The equation of the best fit line is approximately $y = -0.5844x - 3.801$ with a correlation coefficient of about $r = 0.9833$.
d. There is a strong (but not perfect) negative linear relationship between x and y.

12. a.



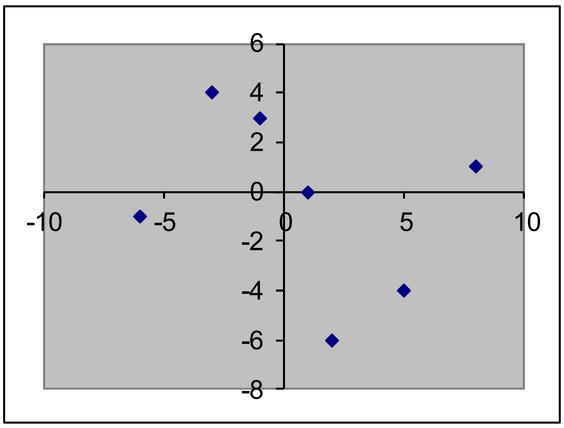
b. The data tend to rise from left to right, so that the correlation coefficient should be positive. Also, the data do not seem to stray too far from a linear curve, so the r value should be reasonably close to 1, but not equal to it. A reasonable guess would be around 0.90.
c. The equation of the best fit line is approximately $y = 15.717x - 0.2945$ with a correlation coefficient of about $r = 0.9569$.
d. There is a strong (but not perfect) positive linear relationship between x and y.

13. a.



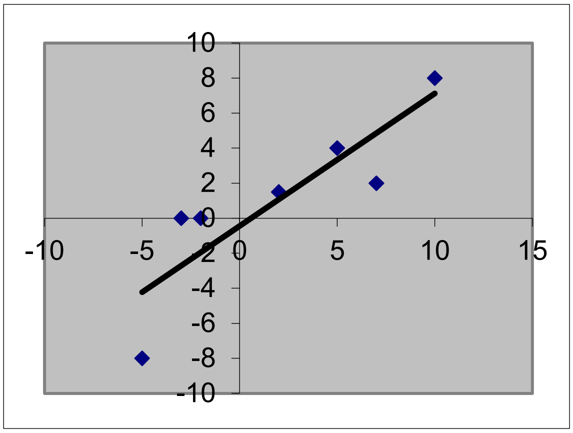
b. The data seem to rise from left to right, but it is difficult to be certain about this relationship since the data stray considerably away from an identifiable line. As such, it is reasonable to guess that r is a rather small value close to 0, say around 0.30.
c. The equation of the best fit line is approximately $y = 0.5x + 0.5$ with a correlation coefficient of about 0.349.
d. There is a very loose (bordering on unidentifiable) positive linear relationship between x and y.

14. a.



b. It is very difficult to discern if there is a rising or falling trend in the data as you move from left to right, and it does not appear to be reasonably described by a line. As such, it is reasonable to guess that r is a rather small value close to 0, say around 0.25 or less.
c. The equation of the best fit line is approximately $y = -0.2256x - 0.2352$ with a correlation coefficient of about 0.297.
d. The relationship between x and y is not really discernible.

15. a.



The equation of the best fit line is about $y = 0.7553x - 0.4392$ with a correlation coefficient of about $r = 0.868$.

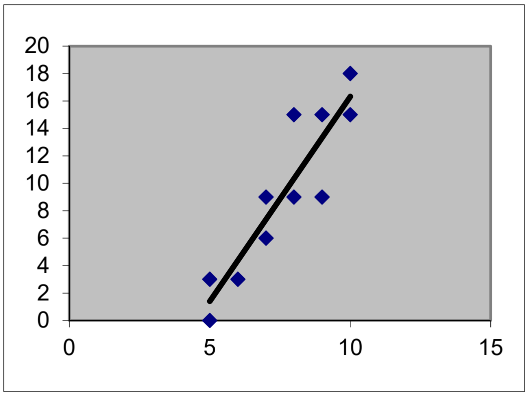
b. The values $x = 0$ and $x = -6$ are within the range of the data set, so that using the best fit line for predictive purposes is reasonable. This is not the case for the values $x = 12$ and $x = -15$. The predicted value of y when $x = 0$ is approximately -0.4392, and the predicted value of y when $x = -6$ is -4.971.

c. Solve the equation $2 = 0.7553x - 0.4392$ for x to obtain:

$$2.4392 = 0.7553x \text{ so that } x = 3.229.$$

So, using the best fit line, you would expect to get a y-value of 2 when x is approximately 3.229.

16. a.



The equation of the best fit line is about $y = 2.9832x - 13.508$ with a correlation coefficient of about $r = 0.909$.

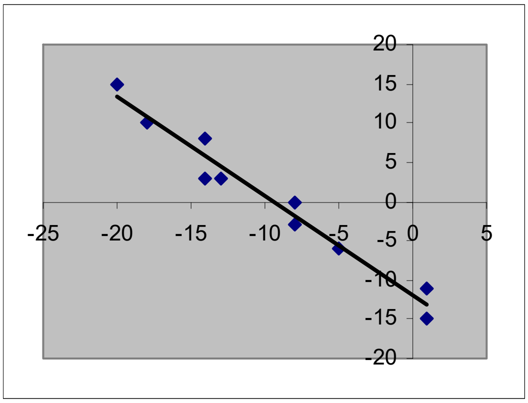
b. None of the given x-values are within reasonable enough range of the data set to ensure that the best fit line should be used for predictive purposes for them.

c. Solve the equation $2 = 2.9832x - 13.508$ for x to obtain:

$$15.508 = 2.9832x \text{ so that } x = 5.198.$$

So, using the best fit line, you would expect to get a y-value of 2 when x is approximately 5.198.

17. a.



The equation of the best fit line is about $y = -1.2631x - 11.979$ with a correlation coefficient of about $r = -0.980$.

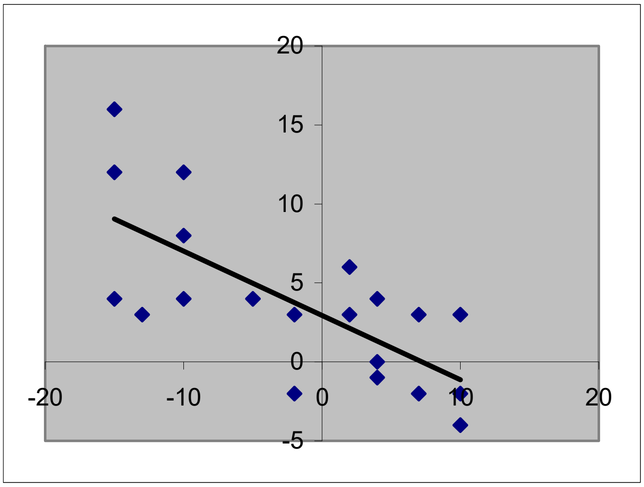
b. The values $x = -15, -6$, and 0 are within the range of the data set, so that using the best fit line for predictive purposes is reasonable. This is not the case for the value $x = 12$. The predicted value of y when $x = -15$ is approximately 6.9675, the predicted value of y when $x = -6$ is about -4.4004, and the predicted value of y when $x = 0$ is -11.979.

c. Solve the equation $2 = -1.2631x - 11.979$ for x to obtain:

$$13.979 = -1.2631x \text{ so that } x = -11.067.$$

So, using the best fit line, you would expect to get a y-value of 2 when x is approximately -11.067.

18. a.



The equation of the best fit line is about $y = -0.4077x + 2.9457$ with a correlation coefficient of about $r = -0.715$.

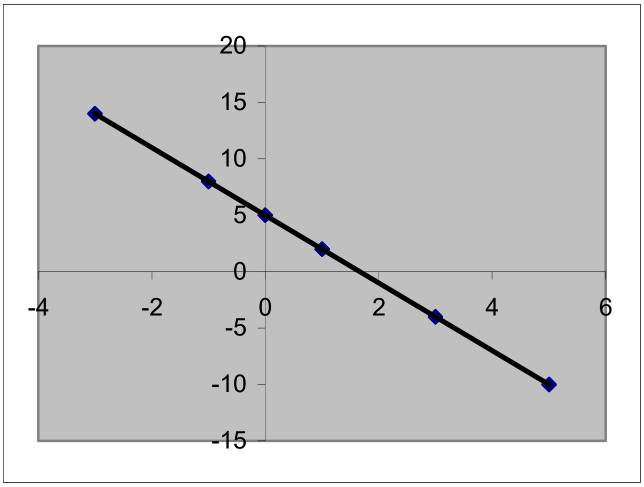
b. All of the given x-values are within reasonable range of the data set to be able to obtain a reasonable predicted y-value for each of them. The predicted value of y when $x = -15$ is about 9.0612, the predicted value of y when $x = -6$ is about 5.3919, the predicted value of y when $x = 0$ is 2.9457, and the predicted value of y when $x = 12$ is about -1.9467.

c. Solve the equation $2 = -0.4077x + 2.9457$ for x to obtain:

$$-0.9457 = -0.4077x \text{ so that } x = 2.3196.$$

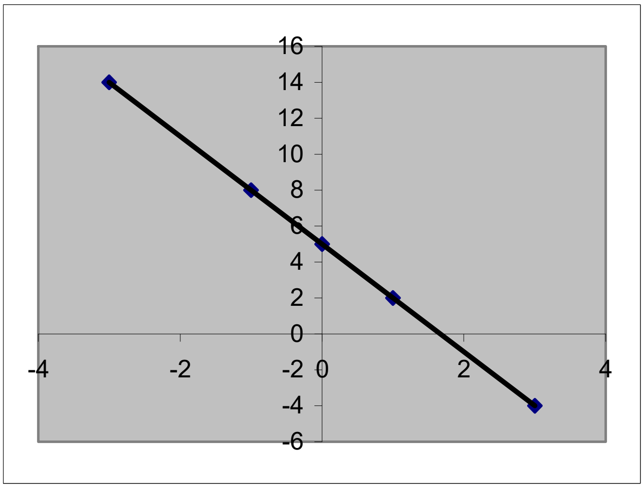
So, using the best fit line, you would expect to get a y-value of 2 when x is approximately 2.3196.

19. a. The scatterplot for the entire data set is:



The equation of the best fit line is $y = -3x + 5$ with a correlation coefficient of $r = -1$.

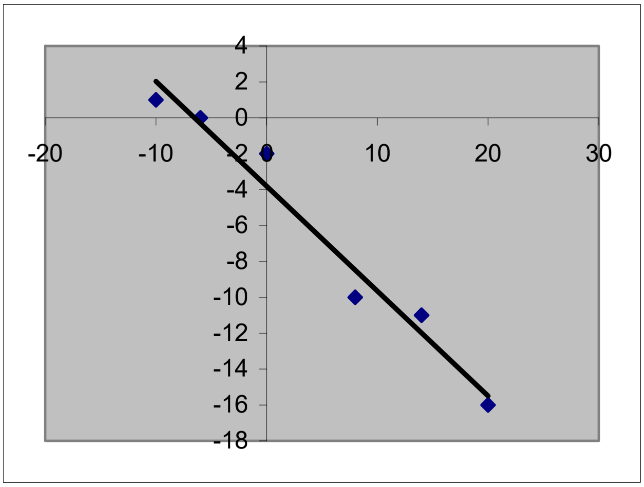
b. The scatterplot for the data set obtained by removing the starred data point $(5, -10)$ is:



The equation of the best fit line of this modified data set is $y = -3x + 5$ with a correlation coefficient of $r = -1$.

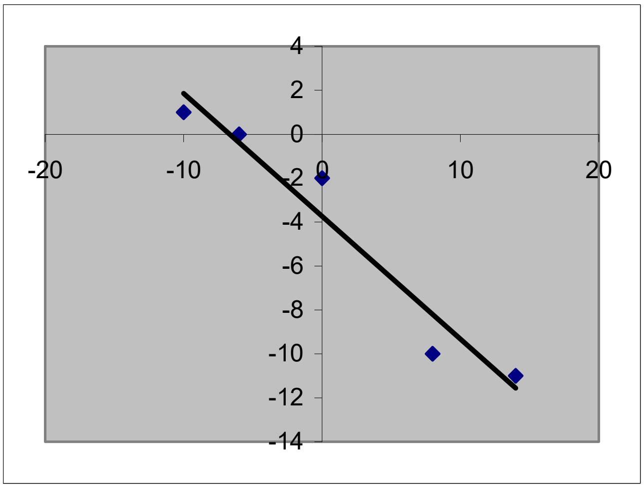
c. Removing the data point did not result in the slightest change in either the equation of the best fit line or the correlation coefficient. This is reasonable since the relationship between x and y in the original data set is perfectly linear, so that all of the points lie ON the same line. As such, removing one of them has no effect on the line itself.

20. **a.** The scatterplot for the entire data set is:



The equation of the best fit line is $y = -0.5844x - 3.801$ with a correlation coefficient of about $r = -0.983$.

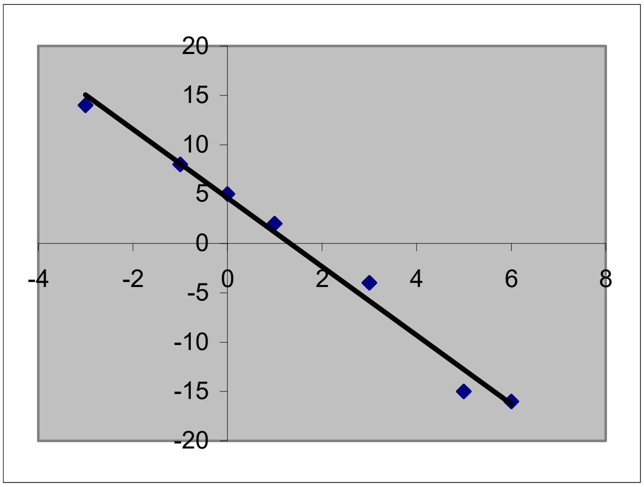
b. The scatterplot for the data set obtained by removing the starred data point $(20, -16)$ is:



The equation of the best fit line of this modified data set is $y = -0.5597x - 3.7284$ with a correlation coefficient of $r = -0.971$.

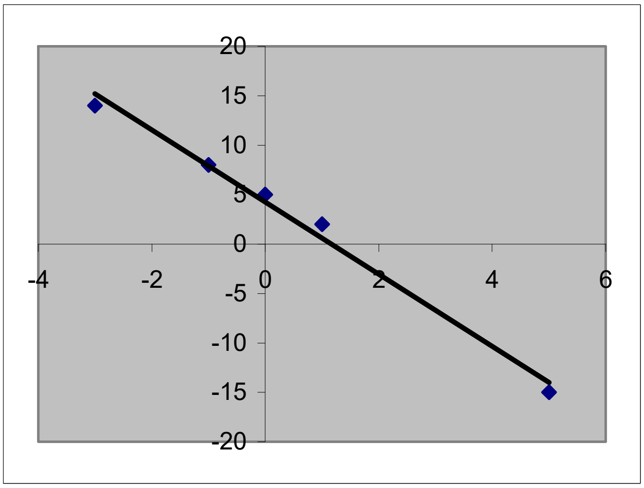
c. Removing the data point did change both the best fit line and the correlation coefficient, but only very slightly.

21. a. The scatterplot for the entire data set is:



The equation of the best fit line is $y = -3.4776x + 4.6076$ with a correlation coefficient of about $r = -0.993$.

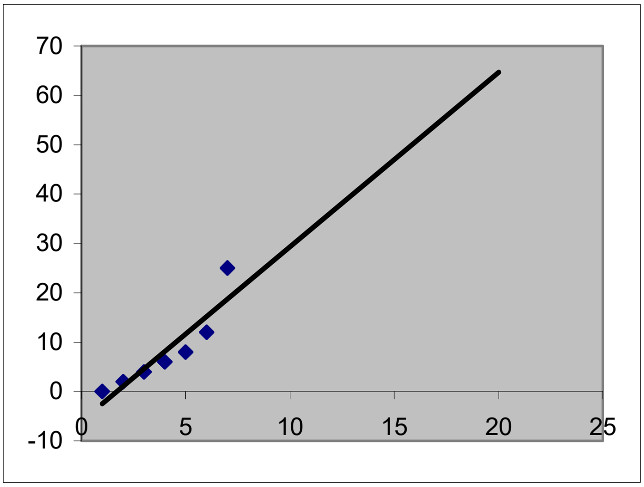
b. The scatterplot for the data set obtained by removing the starred data points $(3, -4)$ and $(6, -16)$ is:



The equation of the best fit line of this modified data set is $y = -3.6534x + 4.2614$ with a correlation coefficient of $r = -0.995$.

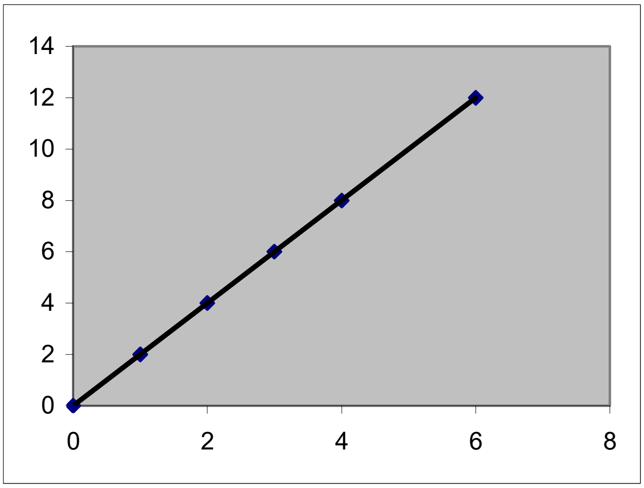
c. Removing the data point did change both the best fit line and the correlation coefficient, but only very slightly.

22. a. The scatterplot for the entire data set is:



The equation of the best fit line is $y = 3.0362x - 1.833$ with a correlation coefficient of about $r = 0.925$.

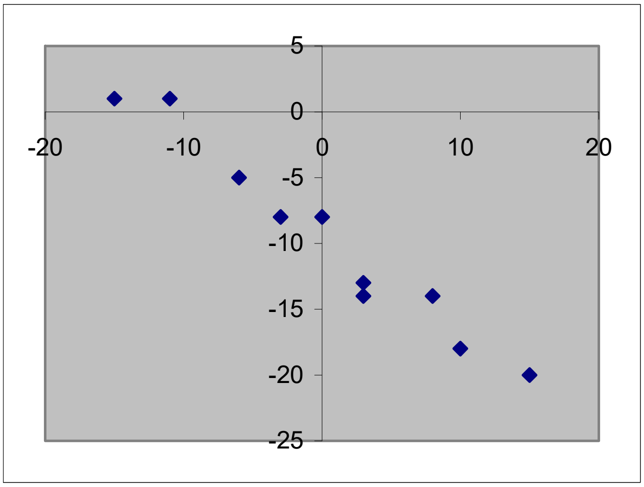
b. The scatterplot for the data set obtained by removing the starred data point (7, 25) is:



The equation of the best fit line of this modified data set is $y = 2x$ with a correlation coefficient of $r = 1$.

c. Removing the data point resulted in significant changes in both the best fit line and the correlation coefficient.

23. a.

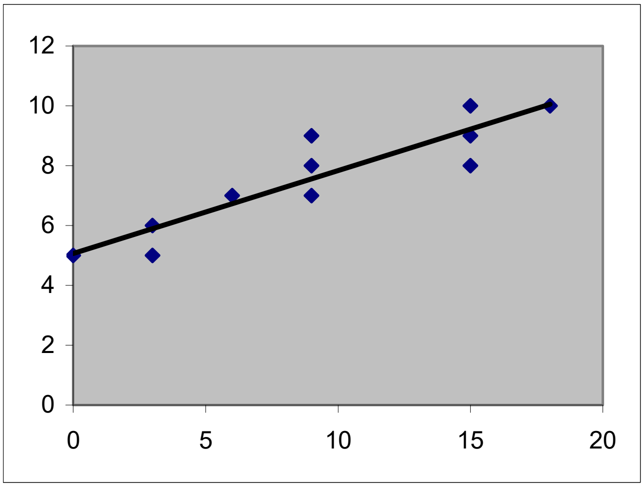


b. The correlation coefficient is approximately $r = -0.980$. This is identical to the r-value from Problem 17. This makes sense because simply interchanging the x- and y-values does not change how the points cluster together in the xy-plane.

c. The equation of the best fit line for the paired data (y, x) is $x = -0.7607y - 9.4957$.

d. It is not reasonable to use the best fit line in (c) to find the predicted value of x when $y = 23$ because this value falls outside the range of the given data. However, it is okay to use the best fit line to find the predicted values of x when $y = 2$ or $y = -16$. Indeed, the predicted value of x when $y = 2$ is about -11.0171, and the predicted value of x when $y = -16$ is about 2.6755.

24. a.

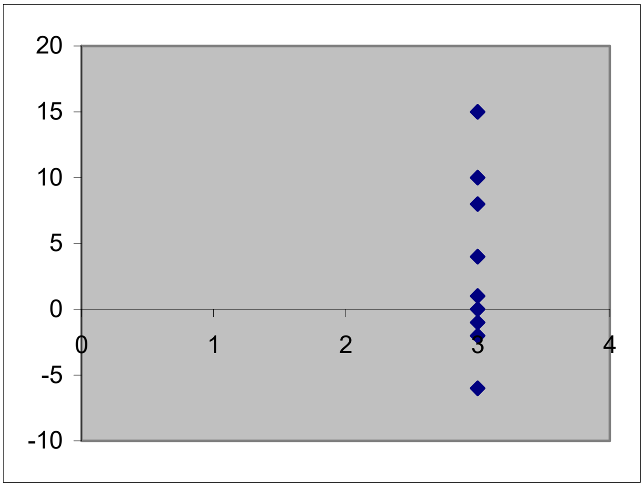


b. The correlation coefficient is approximately 0.909. This is identical to the *r*-value from Problem 16. This makes sense because simply interchanging the *x*- and *y*-values does not change how the points cluster together in the *xy*-plane.

c. The equation of the best fit line for the paired data (y, x) is $x = 0.2773y + 5.0654$.

d. The only *y*-value for which it is reasonable to use the best fit line in (c) for predictive purposes is $y = 2$ because the other two values lie outside the range of values present in the data set. The predicted value of x when $y = 2$ is about $x = 5.62$.

25. First, note that the scatterplot is given by



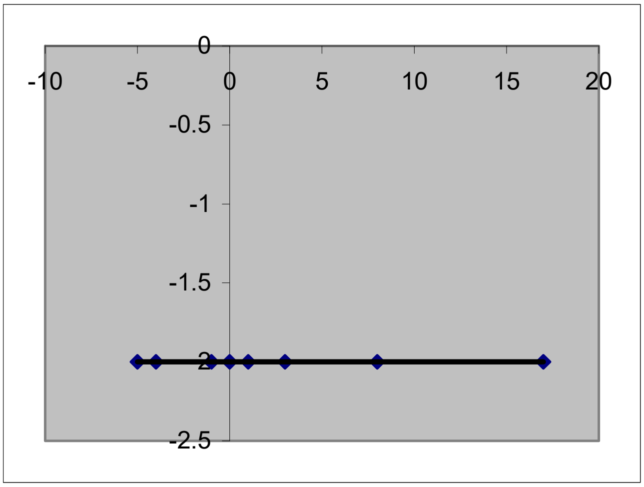
The paired data all lie identically on the vertical line $x = 3$. As such, you might think that the square of the correlation coefficient would be 1 and the best fit line is, in fact, $x = 3$. However, since there is absolutely no *variation* in the x-values for this data set, it turns out that in the formula for the correlation coefficient

$$r = \frac{n\sum xy - \left(\sum x\right)\left(\sum y\right)}{\sqrt{n\sum x^2 - \left(\sum x\right)^2} \cdot \sqrt{n\sum y^2 - \left(\sum y\right)^2}}$$

the quantity $\sqrt{n\sum x^2 - \left(\sum x\right)^2}$ turns out to be zero. (Check this on Excel for this data set!) As such, there is no meaningful r-value for this data set.

Also, the best fit line is definitely the vertical line $x = 3$, but the technology cannot provide it because its slope is undefined.

26. First, note that the scatterplot is given by



The paired data all lie identically on the horizontal line $y = -2$. As such, you might think that the square of the correlation coefficient would be 1 and the best fit line is, in fact, $y = -2$. However, since there is absolutely no *variation* in the y-values for this data set, it turns out that in the formula for the correlation coefficient

$$r = \frac{n\sum xy - \left(\sum x\right)\left(\sum y\right)}{\sqrt{n\sum x^2 - \left(\sum x\right)^2} \cdot \sqrt{n\sum y^2 - \left(\sum y\right)^2}}$$

the quantity $\sqrt{n\sum y^2 - \left(\sum y\right)^2}$ turns out to be zero. (Check this on Excel for this data set!) As such, there is no meaningful r-value for this data set.

However, this time, the technology is able to produce the equation of the best fit line (unlike in Problem 25) because the slope is defined – it is simply 0.

27. The y-intercept 1.257 is mistakenly interpreted as the slope. The correct interpretation is that for every unit increase in x, the y-value increases by about 5.175.

28. Since the slope of the best fit line will be negative, the correlation coefficient r should be negative as well. As such, r should equal -0.9913, not 0.9913.

29. a. Here is a table listing all of the correlation coefficients between each of the events and the total points:

Event	r
100 m	−0.567
Long Jump	0.842
Shot Put	0.227
High Jump	0.587
400 m	−0.715
110 m Hurdle	−0.448
Discus	0.173
Pole Vault	0.446
Javelin	0.542

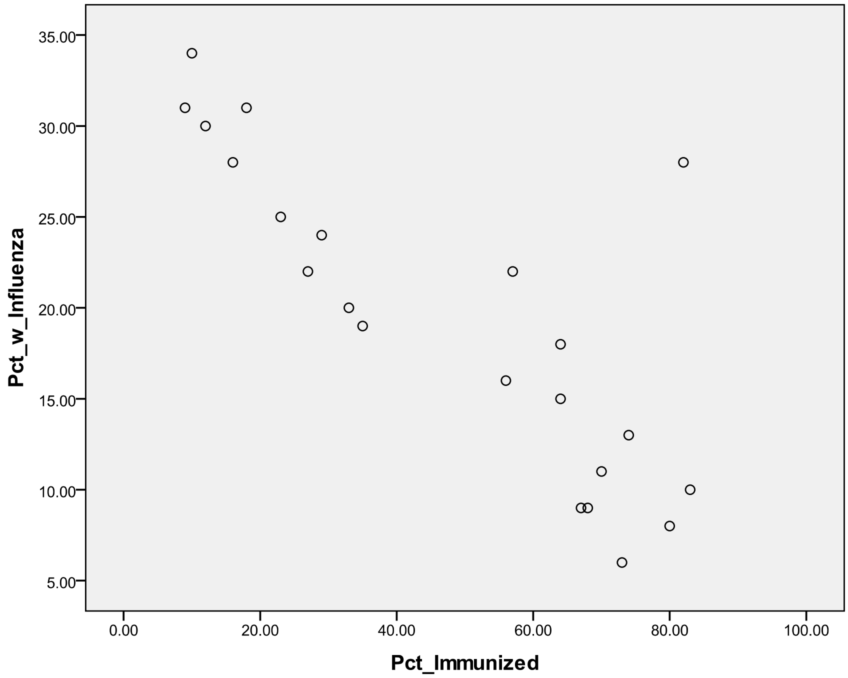
b. Long jump has the strongest correlation coefficient, $r = 0.842$.
c. The equation of the best fit line between the two events in (b) is $y = 939.98x + 1261.2$.
d. Evaluate the equation in (c) at $x = 40$ to get the total points are about 38,860.

30. Here is a table listing all of the correlation coefficients between each of the events and the total points:

Event	r
100 m	−0.567
Long Jump	0.842
Shot Put	0.227
High Jump	0.587
400 m	−0.715
110 m Hurdle	−0.448
Discus	0.173
Pole Vault	0.446
Javelin	0.542

a. The 400 m event has the second strongest relationship to the total points, $r = -0.715$.
b. The equation of the best fit line between the two events in (a) is $y = -232.03x + 19473.1$.
c. Since $r = -0.715$ indicates a reasonably strong relationship between 400 m and total points, we can make a reasonably accurate prediction. However, it will not be completely accurate.
d. Evaluate the equation in (c) at $x = 40$ to get the total points are about 10,192.

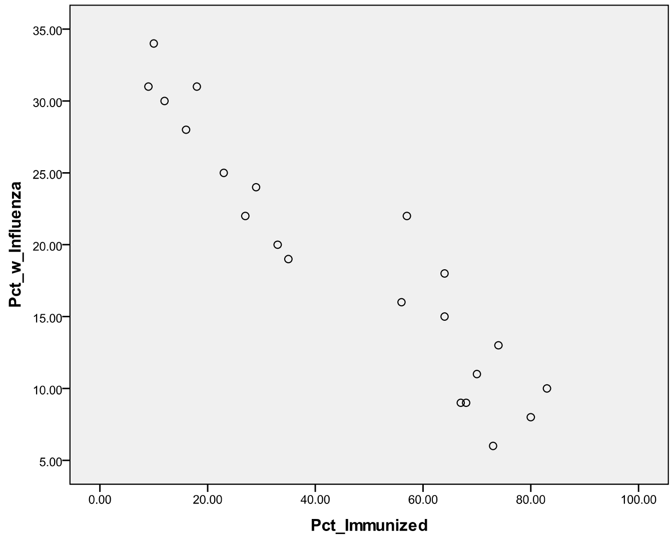
31. a. A scatterplot illustrating the relationship between ***% residents immunized*** and ***% residents with influenza*** is shown below.



b. The correlation coefficient between ***% residents immunized*** and ***% residents with influenza*** is $r = -0.812$.
c. Based on the correlation coefficient ($r = -0.812$), we would believe that there is a strong relationship between % residents immunized and % residents with influenza.
d. The equation of the best fit line that describes the relationship between ***% residents immunized*** and ***% residents with influenza*** is $y = -0.27x + 32.20$.
e. Since $r = -0.812$ indicates a strong relationship between % residents immunized and % residents with influenza, we can make a reasonably accurate prediction. However it will not be completely accurate.

32. a. The nursing home number of the outlier is 21.

b. The scatterplot illustrating the relationship between ***% residents immunized*** and ***% residents with influenza*** WITH THE OUTLIER REMOVED is shown below.

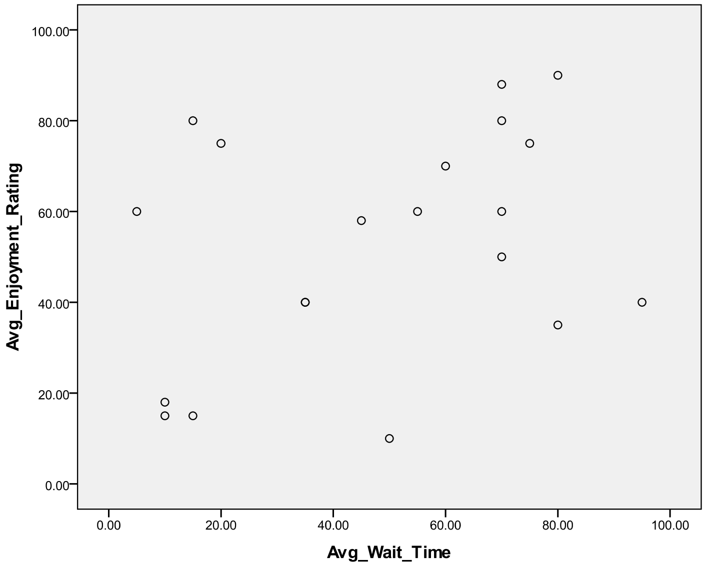


c. The revised correlation coefficient between ***% residents immunized*** and ***% residents with influenza*** is $r = -0.938$.

d. By removing the outlier, the correlation coefficient goes from -0.812 to -0.938 and as such, the strength of the relationship between *% residents immunized* and *% residents with influenza* is increased.

e. The revised equation of the best fit line that describes the relationship between ***% residents immunized*** and ***% residents with influenza*** is $y = -0.31x + 33.54$.

33. a. A scatterplot illustrating the relationship between ***average wait times*** and ***average rating of enjoyment*** is shown below.



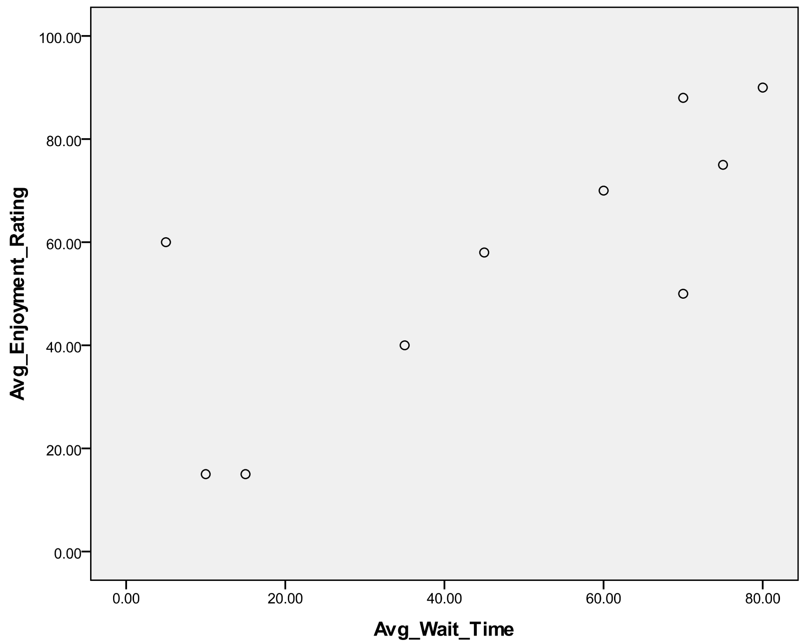
b. The correlation coefficient between ***average wait times*** and ***average rating of enjoyment*** is $r = 0.348$.

c. The correlation coefficient ($r = 0.348$) indicates a somewhat weak relationship between average wait times and average rating of enjoyment.

d. The equation of the best fit line that describes the relationship between ***average wait times*** and ***average rating of enjoyment*** is $y = 0.31x + 37.83$.

e. No, given the somewhat weak correlation coefficient between average wait times and average rating of enjoyment, one could not use the best fit line to produce accurate predictions.

34. a. A scatterplot illustrating the relationship between ***average wait times*** and ***average rating of enjoyment*** for ***Park 1*** is shown below.



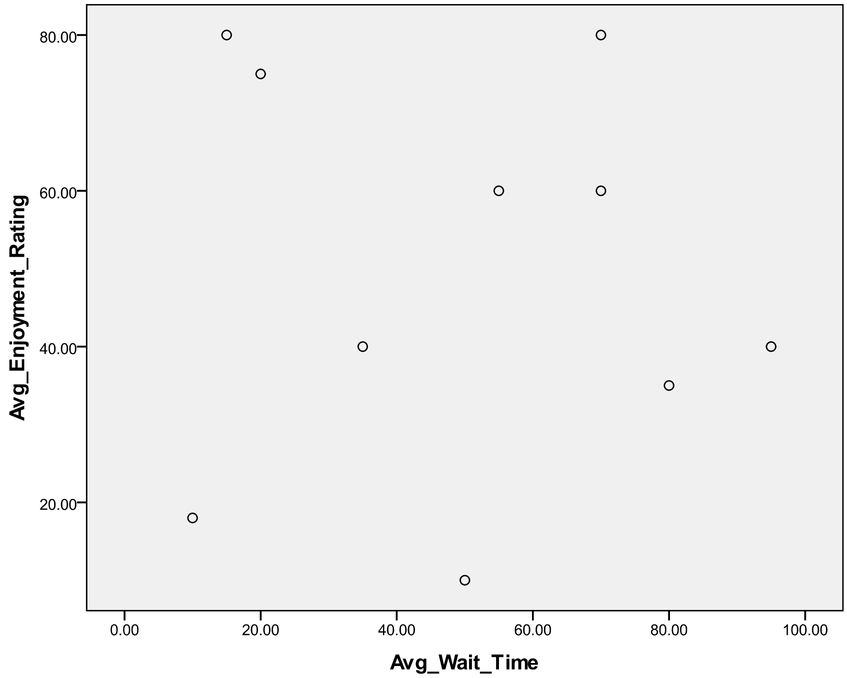
b. The correlation coefficient between ***average wait times*** and ***average rating of enjoyment*** is $r = 0.767$.

c. The correlation coefficient ($r = 0.767$) indicates a strong relationship between average wait times and average rating of enjoyment for Park 1.

d. The equation of the best fit line that describes the relationship between ***average wait times*** and ***average rating of enjoyment*** is $y = 0.71x + 22.91$.

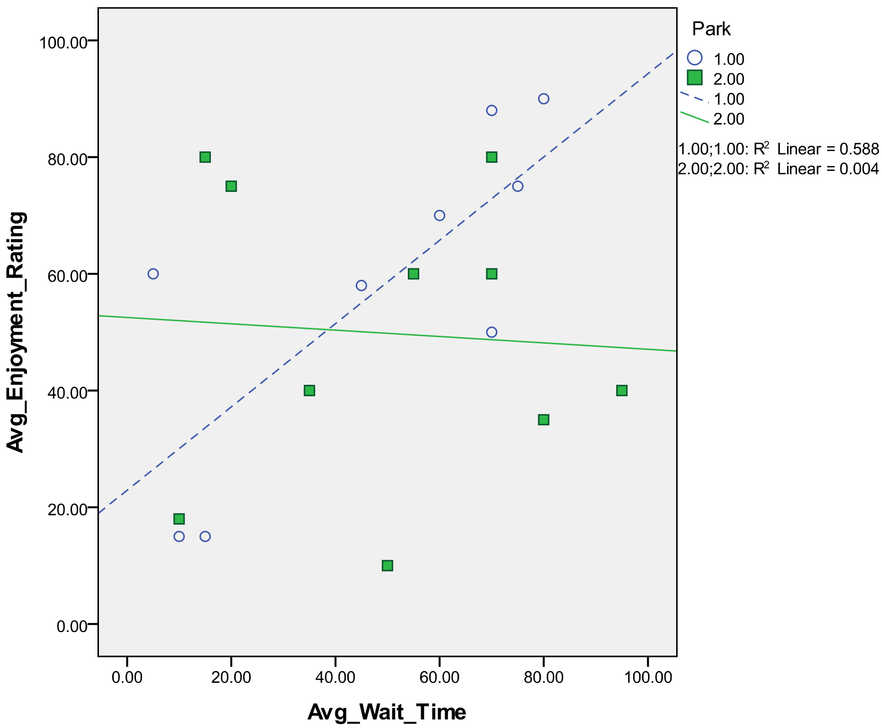
e. Yes, given the strong correlation coefficient between average wait times and average rating of enjoyment for Park 1, one could use the best fit line to produce accurate predictions.

35. a. A scatterplot illustrating the relationship between ***average wait times*** and ***average rating of enjoyment*** for ***Park 2*** is shown below.



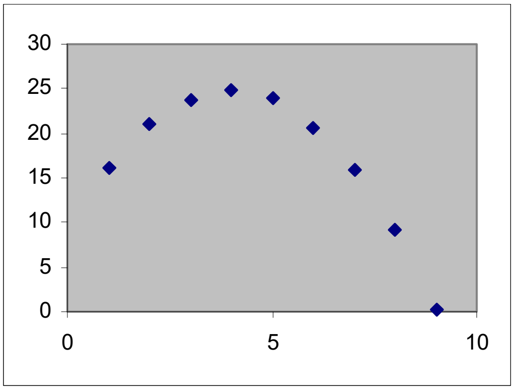
b. The correlation coefficient between ***average wait times*** and ***average rating of enjoyment*** is $r = -0.064$.
c. The correlation coefficient ($r = -0.064$) indicates a weak relationship between average wait times and average rating of enjoyment for Park 2.
d. The equation of the best fit line that describes the relationship between ***average wait times*** and ***average rating of enjoyment*** is $y = -0.05x + 52.53$.
e. No, given the weak correlation coefficient between average wait times and average rating of enjoyment for Park 2, one could not use the best fit line to produce accurate predictions.

36. Consider the combined scatterplot with best fit lines for Park 1 and Park 2 below.



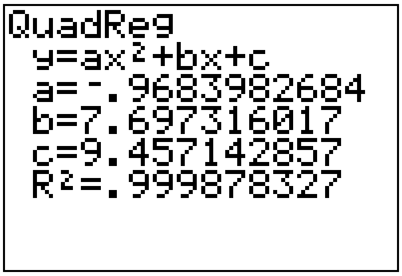
As can be seen from the scatterplot and from reviewing the correlation coefficients, the relationship between average wait times and average rating of enjoyment for Park 1 in Florida ($r = 0.767$) is quite different from this relationship for Park 2 in California ($r = -0.064$). Specifically relationship between average wait times and average rating of enjoyment for Park 1 appears to be much stronger than the same relationship for Park 2.

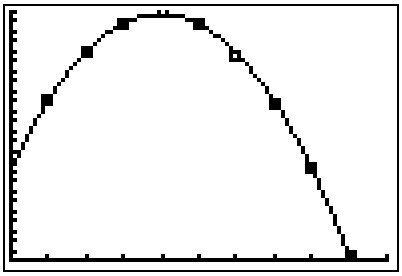
37. a. The scatterplot for this data set is given by



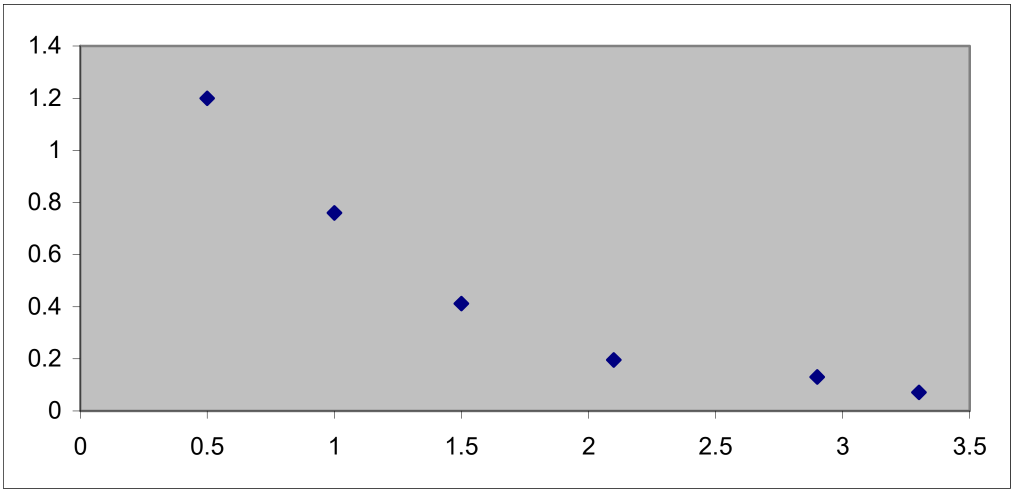
b. The equation of the best fit *line* is $y = -1.9867x + 27.211$ with a correlation coefficient of $r = -0.671$. This line does not seem to accurately describe the data because some of the points rise as you move left to right, while others fall as you move left to right; a line cannot capture both types of behavior simultaneously. Also, r being negative has no meaning here.

c. The best fit is provided by QuadReg. The associated equation of the best fit *quadratic* curve, the correlation coefficient, and associated scatterplot are:



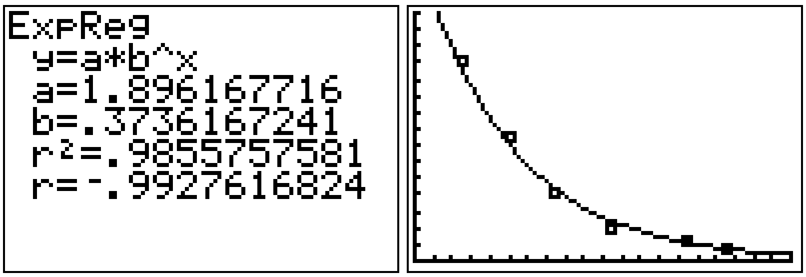


38. **a.** The scatterplot for this data set is given by

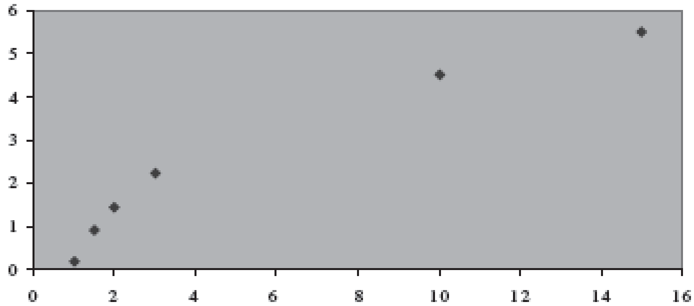


b. The equation of the best fit *line* is $y = -0.3733x + 1.1647$ with a correlation coefficient of $r = -0.923$. This line seems to provide a reasonably good fit for this data, although not perfect.

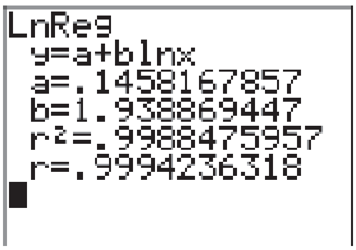
c. The best fit is provided by ExpReg. The associated equation of the best fit *exponential* curve, the correlation coefficient, and associated scatterplot are:

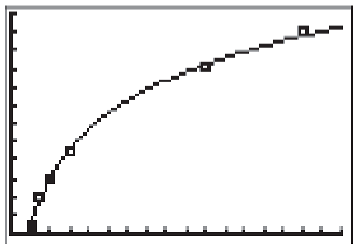


39. a. The scatterplot for this data set is given by

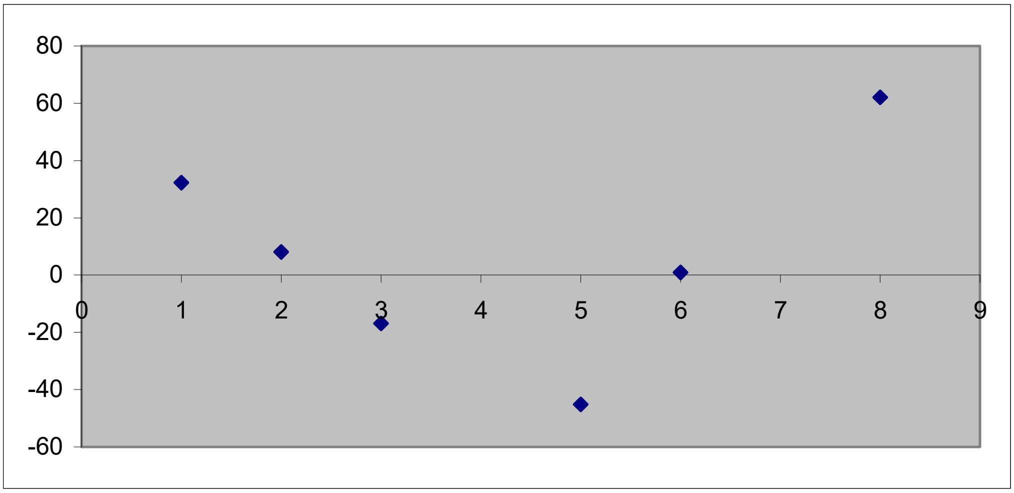


b. The equation of the best fit *line* is $y = 0.3537x + 0.5593$ with a correlation coefficient of $r = 0.971$. This line seems to provide a very good fit for this data, although not perfect.
c. The best fit is provided by LnReg. The associated equation of the best fit *logarithmic* curve, the correlation coefficient, and associated scatterplot are:

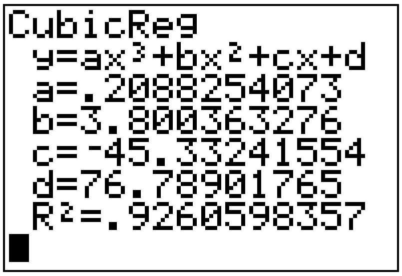


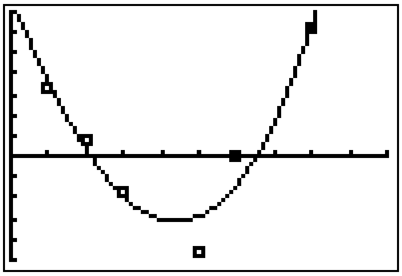


40. a. The scatterplot for this data set is given by

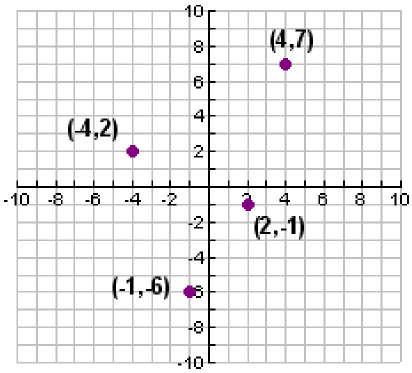


b. The equation of the best fit *line* is $y = 2.9237x - 5.2956$ with a correlation coefficient of $r = 0.206$. This line seems to provide a terrible fit for the data.
c. The best fit is provided by CubicReg. The associated equation of the best fit *cubic polynomial* curve, the correlation coefficient, and associated scatterplot are:





1 – 4.



$(-4,2)$ is in Quadrant II.
$(4,7)$ is in Quadrant I.
$(-1,-6)$ is in Quadrant III.
$(2,-1)$ is in Quadrant IV.

5.
$\sqrt{(-2-4)^2+(0-3)^2} = \sqrt{45} = \boxed{3\sqrt{5}}$

6.
$\sqrt{(1-4)^2+(4-4)^2} = \boxed{3}$

7.
$\sqrt{(-4-2)^2+(-6-7)^2} = \boxed{\sqrt{205}}$

8.
$\sqrt{\left(\frac{1}{4}-\frac{1}{3}\right)^2+\left(\frac{1}{12}-\left(-\frac{7}{3}\right)\right)^2} =$
$\sqrt{\left(-\frac{1}{12}\right)^2+\left(\frac{29}{12}\right)^2} = \frac{\sqrt{842}}{12} \cong \boxed{2.418}$

9.
$\left(\frac{2+3}{2}, \frac{4+8}{2}\right) = \boxed{\left(\frac{5}{2},6\right)}$

10.
$\left(\frac{-2+5}{2}, \frac{6+7}{2}\right) = \boxed{\left(\frac{3}{2},\frac{13}{2}\right)}$

11.
$\left(\frac{2.3+5.4}{2}, \frac{3.4+7.2}{2}\right) = \boxed{(3.85,5.3)}$

12.
$\left(\frac{-a+a}{2}, \frac{2+4}{2}\right) = \boxed{(0,3)}$

13. The distance equals
$\sqrt{(-5-10)^2+(-20-30)^2} = \sqrt{2725}$
$\cong \boxed{52.20}$

14. The midpoint is
$\left(\frac{-5+10}{2}, \frac{-20+30}{2}\right) = \boxed{\left(\frac{5}{2},5\right)}$.

<table>
<tr>
<td>

15.
<u>x-intercepts</u>:
$x^2+4(0)^2=4 \ \Rightarrow\ x=\pm 2$
So, $(\pm 2,0)$.
<u>y-intercepts</u>: $0^2+4y^2=4 \ \Rightarrow\ y=\pm 1$
So, $(0,\pm 1)$.

</td>
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16.
<u>x-intercepts</u>:
$$x^2-x+2=0 \ \Rightarrow\ x=\frac{1\pm\sqrt{1-4(2)}}{2}=\frac{1\pm i\sqrt{7}}{2}$$
Since these solutions are not real, there are no x-intercepts.
<u>y-intercept</u>: $y=0^2-0+2 \Rightarrow\ y=2$
So, $(0,2)$.

</td>
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17.
<u>x-intercepts</u>: $\sqrt{x^2-9}=0 \ \Rightarrow\ x=\pm 3$
So, $(\pm 3,0)$.
<u>y-intercepts</u>: $3i=\sqrt{0^2-9}=y$. Since this is not real, there is no y-intercept.

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18.
<u>x-intercepts</u>:
$$\frac{x^2-x-12}{x-12}=\frac{(x-4)(x+3)}{x-12}=0$$
$$\Rightarrow\ x=-3,4$$
So, $(-3,0),(4,0)$.
<u>y-intercepts</u>: $y=\dfrac{0^2-0-12}{0-12}=1$.
So, $(0,1)$.

</td>
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19. <u>x-axis symmetry</u> (Replace y by $-y$):
$$x^2+(-y)^3=4$$
$$x^2-y^3=4$$
No, since not equivalent to the original.

</td>
<td>

<u>y-axis symmetry</u> (Replace x by $-x$):
$$(-x)^2+y^3=4$$
$$x^2+y^3=4$$
Yes, since equivalent to the original.

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<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):
$$(-x)^2+(-y)^3=4$$
$$x^2-y^3=4$$
No, since not equivalent to the original.

</td>
</tr>
</table>

20. <u>x-axis symmetry</u> (Replace y by $-y$):

$$-y = x^2 - 2$$
$$y = -x^2 + 2$$

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

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

Yes, since equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

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

No, since not equivalent to the original.

21. <u>x-axis symmetry</u> (Replace y by $-y$):

$$x(-y) = 4$$
$$-xy = 4$$

No, since not equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

$$(-x)y = 4$$
$$-xy = 4$$

No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

$$(-x)(-y) = 4$$
$$xy = 4$$

Yes, since equivalent to the original.

22. <u>x-axis symmetry</u> (Replace y by $-y$):

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

Yes, since equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

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

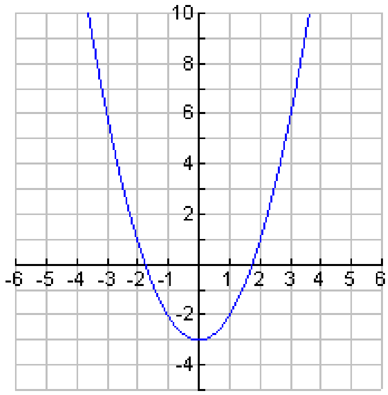
No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

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

No, since not equivalent to the original.

23.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8
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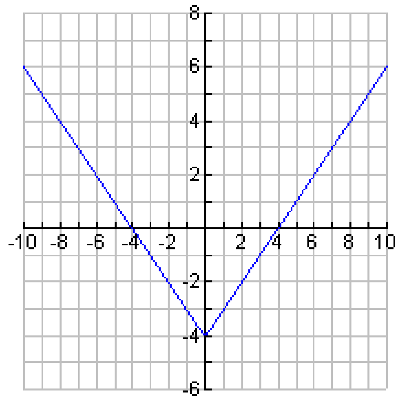
-6 -5 -4 -3 -2 -1 1 2 3 4 5 6

24.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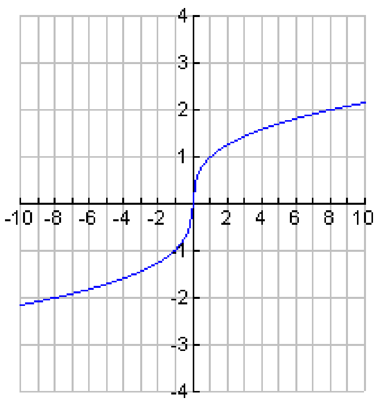
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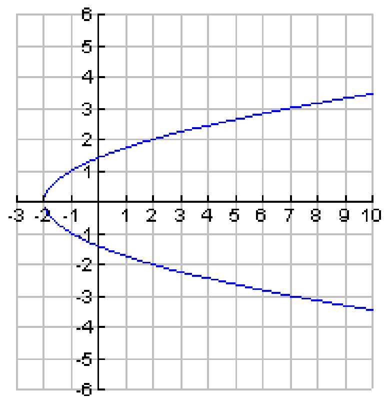
26.


6
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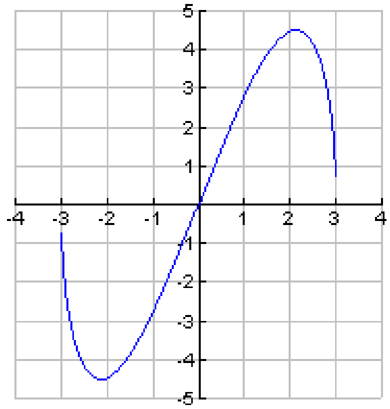
-3 -2 -1 1 2 3 4 5 6 7 8 9 10

27.



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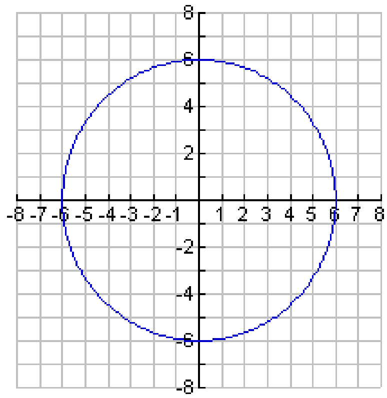

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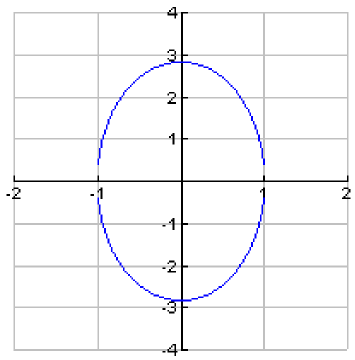
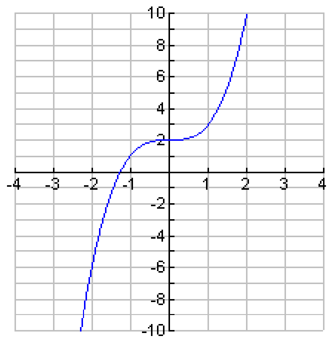


30.



31.
$y=-3x+6 \quad m=-3 \quad y$-intercept: $(0,6)$

32.
$y=-\frac{3}{4}x+\frac{9}{4} \quad m=-\frac{3}{4} \quad y$-intercept: $(0,\frac{9}{4})$

33.
$y=-\frac{3}{2}x-\frac{1}{2} \quad m=-\frac{3}{2} \quad y$-intercept: $(0,-\frac{1}{2})$

34.
$y=-\frac{8}{3}x-\frac{1}{2} \quad m=-\frac{8}{3} \quad y$-intercept: $(0,-\frac{1}{2})$

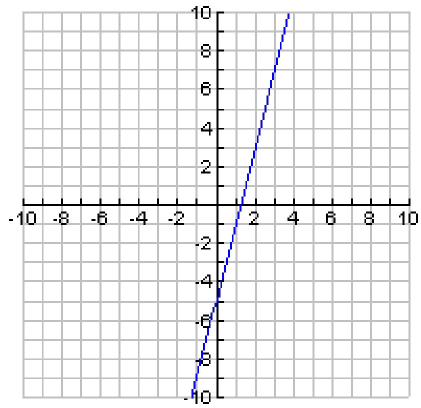
35.

<u>x-intercept</u>:

$$\begin{aligned} 0 &= 4x-5 \\ \tfrac{5}{4} &= x \end{aligned} \quad \text{So, } \left(\tfrac{5}{4},0\right).$$

<u>y-intercept</u>: $y=4(0)-5=-5$. So, $(0,-5)$.

<u>slope</u>: $m=4$



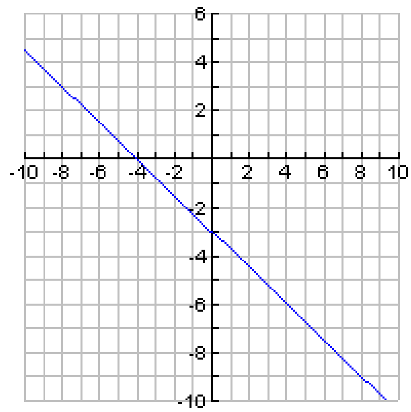
36.

<u>x-intercept</u>:

$$\begin{aligned} 0 &= -\tfrac{3}{4}x-3 \\ -4 &= x \end{aligned} \quad \text{So, } (-4,0).$$

<u>y-intercept</u>: $y=-\frac{3}{4}(0)-3=-3$. So, $(0,-3)$.

<u>slope</u>: $m=-\frac{3}{4}$



37.

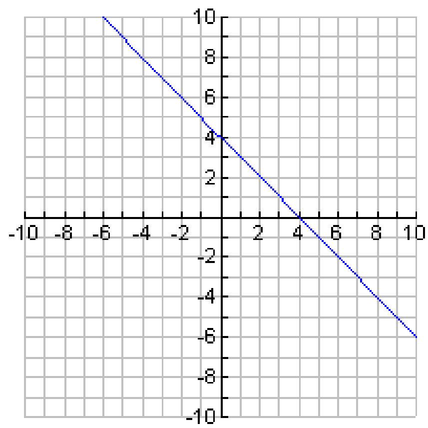
<u>x-intercept</u>:

$x+0=4$ So, $(4,0)$.

<u>y-intercept</u>: $0+y=4$. So, $(0,4)$.

<u>slope</u>:

$$\begin{aligned} x+y &= 4 \\ y &= -x+4 \end{aligned} \quad \text{So, } m=-1.$$



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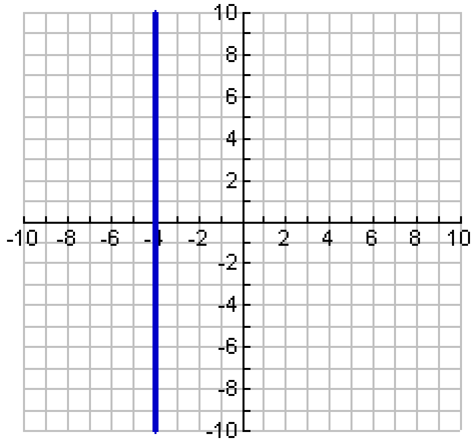
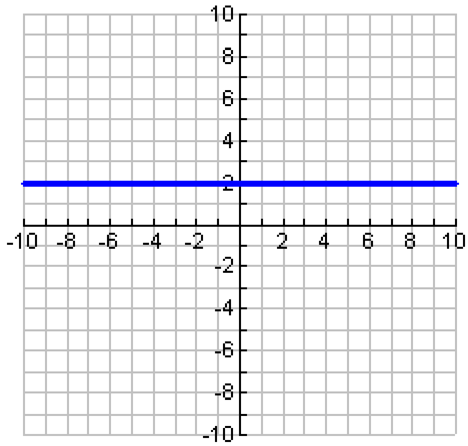


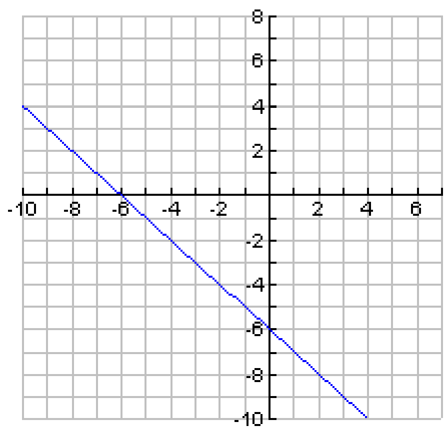
x-intercept: $(-4,0)$
y-intercept: None
slope: Undefined

39.



x-intercept: None
y-intercept: $(0,2)$
slope: $m=0$

40.



x-intercept:

$$-\tfrac{1}{2}x-\tfrac{1}{2}(0)=3 \qquad \text{So, } (-6,0).$$
$$x=-6$$

y-intercept:

$$-\tfrac{1}{2}(0)-\tfrac{1}{2}y=3 \qquad \text{So, } (0,-6).$$
$$y=-6$$

slope:

$$-\tfrac{1}{2}x-\tfrac{1}{2}y=3$$
$$-\tfrac{1}{2}y=\tfrac{1}{2}x+3 \qquad \text{So, } m=-1.$$
$$y=-x-6$$

41. $y = 4x - 3$

42. $y = 4$

43. $x = -3$

44. $y = -\frac{2}{3}x + \frac{3}{4}$

45. Find b:
$$4 = -2(-3) + b$$
$$-2 = b$$
So, the equation is $\boxed{y = -2x - 2}$.

46. Find b:
$$16 = \tfrac{3}{4}(2) + b$$
$$\tfrac{29}{2} = b$$
So, the equation is $\boxed{y = \frac{3}{4}x + \frac{29}{2}}$.

47. Since $m = 0$, the line is horizontal. So, the equation is $\boxed{y = 6}$.

48. Since m is undefined, the line is vertical. So, the equation is $\boxed{x = 2}$.

49.

slope: $m = \dfrac{-2-3}{-4-2} = \dfrac{5}{6}$

y-intercept:
Use the point $(-4, -2)$ to find b:
$$-2 = \tfrac{5}{6}(-4) + b$$
$$\tfrac{4}{3} = b$$
So, the equation is $\boxed{y = \frac{5}{6}x + \frac{4}{3}}$.

50.

slope: $m = \dfrac{4-5}{-1-(-2)} = -1$

y-intercept:
Use the point $(-1, 4)$ to find b:
$$4 = (-1)(-1) + b$$
$$3 = b$$
So, the equation is $\boxed{y = -x + 3}$.

51.

slope: $m = \dfrac{\frac{1}{2} - \frac{5}{2}}{-\frac{3}{4} - \left(-\frac{7}{4}\right)} = -2$

y-intercept:
Use the point $\left(-\frac{3}{4}, \frac{1}{2}\right)$ to find b:
$$\tfrac{1}{2} = -2\left(-\tfrac{3}{4}\right) + b$$
$$-1 = b$$
So, the equation is $\boxed{y = -2x - 1}$.

52.

slope: $m = \dfrac{-2-2}{3-(-9)} = -\dfrac{1}{3}$

y-intercept:
Use the point $(3, -2)$ to find b:
$$-2 = \left(-\tfrac{1}{3}\right)(3) + b$$
$$-1 = b$$
So, the equation is $\boxed{y = -\frac{1}{3}x - 1}$.

53.
slope:
Since parallel to $2x-3y=6$ (whose slope is $\frac{2}{3}$), $m=\frac{2}{3}$.
y-intercept:
Use the point $(-2,-1)$ to find b:

$$-1=\tfrac{2}{3}(-2)+b$$
$$\tfrac{1}{3}=b$$

So, the equation is $\boxed{y=\frac{2}{3}x+\frac{1}{3}}$.

54.
slope:
Since perpendicular to $5x-3y=0$ (whose slope is $\frac{5}{3}$), $m=-\frac{3}{5}$.
y-intercept:
Use the point $(5,6)$ to find b:

$$6=-\tfrac{3}{5}(5)+b$$
$$9=b$$

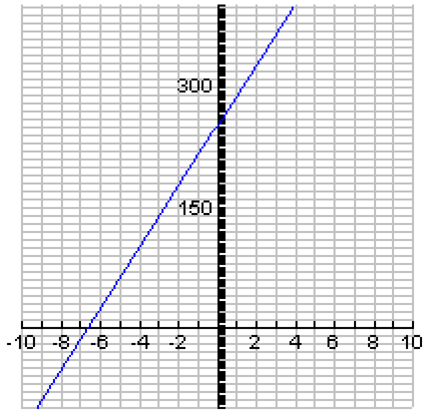
So, the equation is $\boxed{y=-\frac{3}{5}x+9}$.

55.
slope:
Since perpendicular to $\frac{2}{3}x-\frac{1}{2}y=12$ (whose slope is $\frac{4}{3}$), $m=-\frac{3}{4}$.
y-intercept:
Use the point $\left(-\frac{3}{4},\frac{5}{2}\right)$ to find b:

$$\tfrac{5}{2}=-\tfrac{3}{4}\left(-\tfrac{3}{4}\right)+b$$
$$\tfrac{31}{16}=b$$

So, the equation is $\boxed{y=-\frac{3}{4}x+\frac{31}{16}}$.

56. Case 1: $B\neq 0$
Since the desired line is parallel to $Ax+By=C$ (whose slope is $-\frac{A}{B}$), its slope is $-\frac{A}{B}$. So, its equation is of the form $y=-\frac{A}{B}x+D$. Use the fact that the point $(a+2,b-1)$ is on the line to see that $b-1=-\frac{A}{B}(a+2)+D$, which is equivalent to $D=b-1+\frac{A}{B}(a+2)$. Thus, the equation is $\boxed{y=-\frac{A}{B}x+\left(b-1+\frac{A}{B}(a+2)\right)}$.
Case 2: $B=0$
The desired line is parallel to $Ax=C$, which is vertical. Since the line whose equation we seek passes through $(a+2,b-1)$, its equation must be $\boxed{x=a+2}$.

57. Since $(1020,1324)$ and $(950,1240)$ are assumed to be on the line, the slope of the line is $m=\dfrac{1324-1240}{1020-950}=1.2$. Use the point $(1020,1324)$ to find y-intercept b: $$1324=1.2(1020)+b$$ $$100=b$$ Thus, the equation is $\boxed{y=1.2x+100}$, where x is the pretest score and y is the posttest score.	
58. Let $C=250+38t$. If $t=1.5$, then $C=307$. So, it costs \$307 for a job taking 1.5 hours. 	
59. $(x-(-2))^2+(y-3)^2=6^2$ $(x+2)^2+(y-3)^2=36$	**60.** $(x-(-6))^2+(y-(-8))^2=\left(3\sqrt{6}\right)^2$ $(x+6)^2+(y+8)^2=54$
61. $\left(x-\frac{3}{4}\right)^2+\left(y-\frac{5}{2}\right)^2=\frac{4}{25}$	**62.** $(x-1.2)^2+(y-(-2.4))^2=(3.6)^2$ $(x-1.2)^2+(y+2.4)^2=12.96$
63. The center is $(-2,-3)$ and the radius is $\sqrt{81}=9$.	**64.** The center is $(4,-2)$ and the radius is $\sqrt{32}=4\sqrt{2}$.

65.
The center is $\left(-\frac{3}{4},\frac{1}{2}\right)$ and the radius is $\sqrt{\frac{16}{36}}=\frac{4}{6}=\frac{2}{3}$.

66. Completing the square gives us:

$$x^2+y^2+4x-2y=0$$
$$x^2+4x\quad+y^2-2y=0$$
$$\left(x^2+4x+4\right)+\left(y^2-2y+1\right)=4+1$$
$$(x+2)^2+(y-1)^2=5$$
$$(x-(-2))^2+(y-1)^2=\left(\sqrt{5}\right)^2$$

So, center is $(-2,1)$ and radius is $\sqrt{5}$.

67. Completing the square gives us:

$$x^2+y^2-4x+2y+11=0$$
$$x^2-4x\quad+y^2+2y=-11$$
$$\left(x^2-4x+4\right)+\left(y^2+2y+1\right)=-11+4+1$$
$$(x-2)^2+(y+1)^2=-6$$

Since the left-side is always non-negative, there is no graph. Hence, this is not a circle and so there is no center or radius in this case.

68. Completing the square gives us:

$$3x^2+3y^2-6x-7=0$$
$$3x^2-6x\quad+3y^2=7$$
$$x^2-2x\quad+y^2=\tfrac{7}{3}$$
$$\left(x^2-2x+1\right)+\left(y^2+0\right)=\tfrac{7}{3}+1$$
$$(x-1)^2+(y-0)^2=\tfrac{10}{3}$$

So, center is $(1,0)$ and radius is $\sqrt{\frac{10}{3}}$.

69. Completing the square gives us:

$$9x^2+9y^2-6x+12y-76=0$$
$$x^2-\tfrac{2}{3}x\quad+y^2+\tfrac{4}{3}y=\tfrac{76}{9}$$
$$\left(x^2-\tfrac{2}{3}x+\tfrac{1}{9}\right)+\left(y^2+\tfrac{4}{3}y+\tfrac{4}{9}\right)=\tfrac{76}{9}+\tfrac{1}{9}+\tfrac{4}{9}$$
$$\left(x-\tfrac{1}{3}\right)^2+\left(y+\tfrac{2}{3}\right)^2=9$$
$$\left(x-\tfrac{1}{3}\right)^2+\left(y-(-\tfrac{2}{3})\right)^2=9$$

So, center is $\left(\frac{1}{3},-\frac{2}{3}\right)$ and radius is 3.

70. Completing the square gives us:

$$x^2+y^2+3.2x-6.6y-2.4=0$$
$$x^2+3.2x \quad +y^2-6.6y=2.4$$
$$\left(x^2+3.2x+2.56\right)+\left(y^2-6.6y+10.89\right)=2.4+2.56+10.89$$
$$(x+1.6)^2+(y-3.3)^2=15.85$$

So, center is $(-1.6, 3.3)$ and radius is $\sqrt{15.85}\cong 3.98$.

71. The center is $(2,7)$. The radius is the distance from $(2,7)$ to $(3,6)$, which is given by $\sqrt{(2-3)^2+(7-6)^2}=\sqrt{2}$. So, the equation is $\boxed{(x-2)^2+(y-7)^2=2}$.

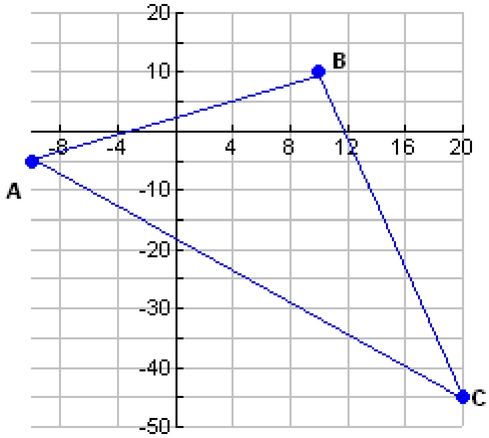
72. The center is the midpoint of the segment joining the points $(-2,-1)$ and $(5,5)$, which is given by $\left(\dfrac{-2+5}{2}, \dfrac{-1+5}{2}\right)=\left(\frac{3}{2},2\right)$. The radius is equal to the distance between the center and an endpoint of a diameter, say $(-2,-1)$. This is given by

$$\sqrt{\left(\tfrac{3}{2}-(-2)\right)^2+\left(2-(-1)\right)^2}=\sqrt{\left(\tfrac{7}{2}\right)^2+3^2}=\tfrac{1}{2}\sqrt{85}.$$

Therefore, the equation is

$$\boxed{\left(x-\tfrac{3}{2}\right)^2+(y-2)^2=\tfrac{85}{4}=21.25}$$

73. The triangle is depicted as follows:



Observe that

$$m_{AB} = \frac{10-(-5)}{10-(-10)} = \frac{3}{4}$$
$$m_{BC} = \frac{10-(-45)}{10-20} = -\frac{11}{2}$$
$$m_{AC} = \frac{-5-(-45)}{-10-20} = -\frac{4}{3}$$

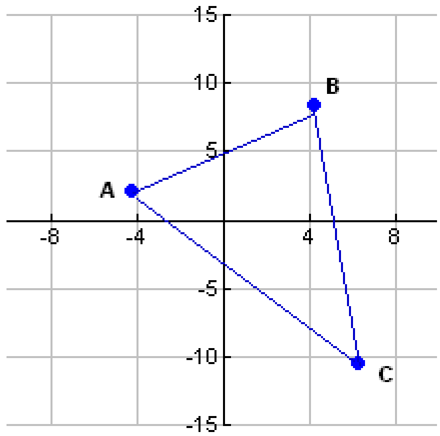
Since $m_{AB} \cdot m_{AC} = -1$, we know that AB is perpendicular to AC. Thus, the triangle is $\boxed{\text{right}}$.

Next, observe that

$$d(A,B) = \sqrt{(10-(-10))^2 + (10-(-5))^2} = 25$$
$$d(A,C) = \sqrt{(20-(-10))^2 + (-45-(-5))^2} = 50$$
$$d(B,C) = \sqrt{(10-(-45))^2 + (10-20)^2} \approx 55.9$$

So, it is not isosceles.

74. The triangle is depicted as follows:



Observe that

$$m_{AB} = \frac{8.4-2.1}{4.2-(-4.2)} = 0.75$$

$$m_{AC} = \frac{2.1-(-10.5)}{-4.2-6.3} = -1.2$$

$$m_{BC} = \frac{8.4-(-10.5)}{4.2-6.3} = -9$$

No two sides are perpendicular, so the triangle is not right.

Next, observe that

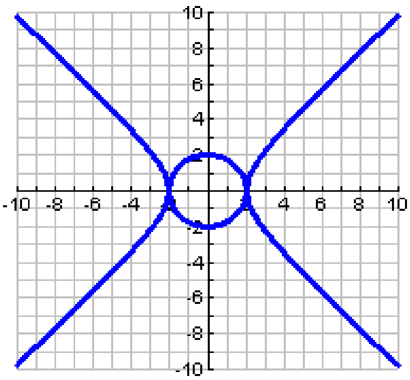
$$d(A,B) = \sqrt{(8.4-2.1)^2 + (4.2-(-4.2))^2} \approx 10.5$$

$$d(B,C) = \sqrt{(8.4-(-10.5))^2 + (4.2-6.3)^2} \approx 19.02$$

$$d(A,C) = \sqrt{(2.1-(-10.5))^2 + (-4.2-6.3)^2} \approx 16.4$$

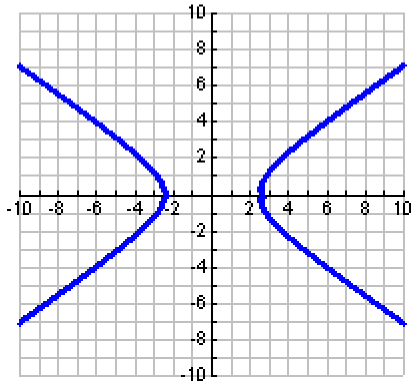
So, it is not isosceles. Hence, the triangle is $\boxed{\text{neither}}$.

75.



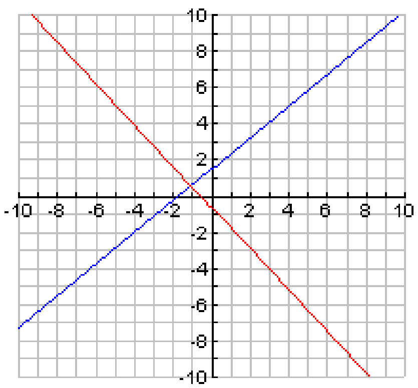
Symmetric with respect to x-axis, y-axis, and origin

76.

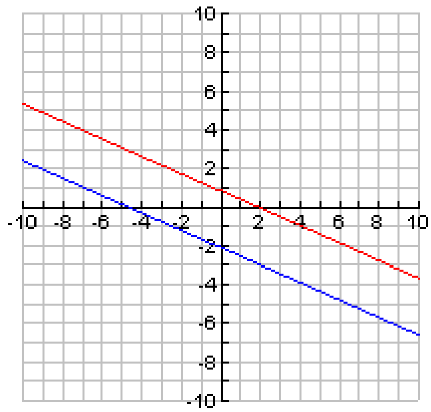


Symmetric with respect to x-axis, y-axis, and origin

77. Slope of $y_1 = 0.875x + 1.5$ is 0.875.
Slope of $y_2 = -\frac{8}{7}x - \frac{9}{14}$ is $-\frac{8}{7}$.
Since $(0.875)(-\frac{8}{7}) = -1$, the lines are $\boxed{\text{perpendicular}}$.



78. Slope of $y_1 = -0.45x - 2.1$ is -0.45.
Slope of $y_2 = \frac{5}{6} - \frac{9}{20}x$ is $-\frac{9}{20}$.
Since $-0.45 = -\frac{9}{20}$, the lines are $\boxed{\text{parallel}}$.



79. Completing the square yields

$$\left(9x^2-6x\qquad\right)+\left(9y^2+12y\qquad\right)=76$$

$$9\left(x^2-\tfrac{2}{3}x\qquad\right)+9\left(y^2+\tfrac{4}{3}y\qquad\right)=76$$

$$9\left(x^2-\tfrac{2}{3}x+\tfrac{1}{9}\right)+\left(y^2+\tfrac{4}{3}y+\tfrac{4}{9}\right)=76+1+4=81$$

$$\left(x-\tfrac{1}{3}\right)^2+\left(y+\tfrac{2}{3}\right)^2=9 \qquad \textbf{(1)}$$

Solving **(1)** for y yields:

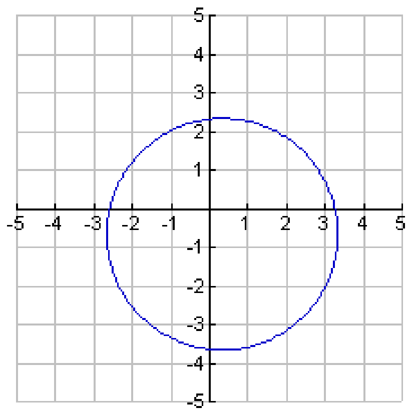
$$\left(x-\tfrac{1}{3}\right)^2+\left(y+\tfrac{2}{3}\right)^2=9$$

$$\left(y+\tfrac{2}{3}\right)^2=9-\left(x-\tfrac{1}{3}\right)^2$$

$$y+\tfrac{2}{3}=\pm\sqrt{9-\left(x-\tfrac{1}{3}\right)^2}$$

$$y=-\tfrac{2}{3}\pm\sqrt{9-\left(x-\tfrac{1}{3}\right)^2}$$

The graph agrees with the graph in Exercise 69.



80. Completing the square yields

$$\left(x^2+3.2x\qquad\right)+\left(y^2-6.6y\qquad\right)=2.4$$

$$\left(x^2+3.2x+2.56\right)+\left(y^2-6.6y+10.89\right)=2.4+2.56+10.89=15.85$$

$$(x+1.6)^2+(y-3.3)^2=15.85 \qquad \textbf{(1)}$$

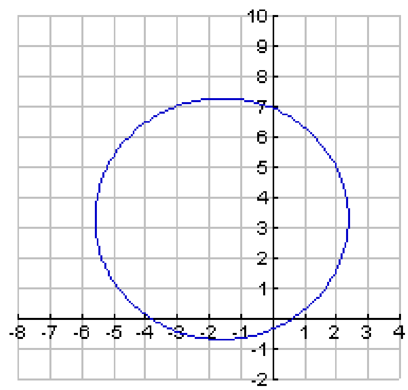
Solving **(1)** for y yields:

$$(y-3.3)^2=15.85-(x+1.6)^2$$

$$y-3.3=\pm\sqrt{15.85-(x+1.6)^2}$$

$$y=3.3\pm\sqrt{15.85-(x+1.6)^2}$$

The graph agrees with the graph in Exercise 70.



Chapter 2 Practice Test Solutions --

1.

$$d=\sqrt{(-7-2)^2+(-3-(-2))^2}=\boxed{\sqrt{82}}$$

2.

$$M=\left(\frac{-3+5}{2},\frac{5+(-1)}{2}\right)=\boxed{(1,2)}$$

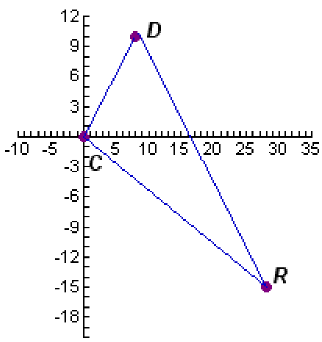
3.

$$d=\sqrt{(-2-3)^2+(4-6)^2}=\boxed{\sqrt{29}}$$

$$M=\left(\frac{-2+3}{2},\frac{4+6}{2}\right)=\boxed{\left(\tfrac{1}{2},5\right)}$$

4.

Suppose the coordinates of Chapel Hill are (0,0). Then, Durham is located at (8,10) and Raleigh is located at $(28,-15)$, as shown:



$$d(C,R)=\sqrt{28^2+(-15)^2}\cong 31.76$$

$$d(C,D)=\sqrt{8^2+10^2}\cong 12.81$$

$$d(D,R)=\sqrt{(28-8)^2+(-15-10)^2}\cong 32.02$$

So, the perimeter of the research triangle is approximately $\boxed{77 \text{ miles}}$.

5.

Solve for y:

$$5=\sqrt{(3-6)^2+(y-5)^2}$$

$$25=9+(y-5)^2$$

$$25=9+y^2-10y+25$$

$$0=y^2-10y+9$$

$$0=(y-9)(y-1)$$

$$\boxed{1,\,9=y}$$

6.

$(-3,-4)$

7. <u>x-axis symmetry</u> (Replace y by $-y$):

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

$$x-y^2=5$$

Yes, since equivalent to the original.

<u>y-axis symmetry</u> (Replace x by $-x$):

$$-x-y^2=5$$

No, since not equivalent to the original.

<u>symmetry about origin</u> (Replace y by $-y$ and x by $-x$):

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

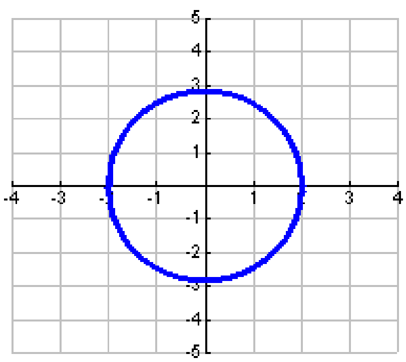
$$-x-y^2=5$$

No, since not equivalent to the original.

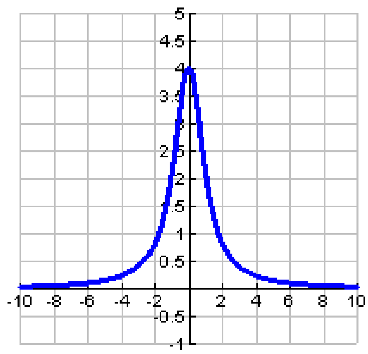
8. <u>x-intercepts</u>: $4x^2-9(0)^2=36 \Rightarrow x^2=9 \Rightarrow x=\pm 3$ So, $(\pm 3,0)$.

<u>y-intercepts</u>: $4(0)^2-9y^2=36$, which has no real solution. So, no y-intercepts.

9.



10.



11.

<u>x-intercept</u>: $x-3(0)=6 \Rightarrow x=6$.

So, $(6,0)$.

<u>y-intercept</u>: $0-3y=6 \Rightarrow y=-2$.

So, $(0,-2)$.

12.

$$4x-6y=12 \Rightarrow -6y=-4x+12$$

$$\Rightarrow \boxed{y=\tfrac{2}{3}x-2}$$

13.

$$\tfrac{2}{3}x-\tfrac{1}{4}y=2 \Rightarrow -\tfrac{1}{4}y=2-\tfrac{2}{3}x$$

$$\Rightarrow \boxed{y=\tfrac{8}{3}x-8}$$

14. $y=4x+3$

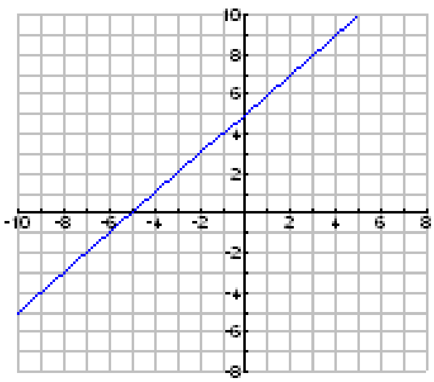
15.

slope: $m = \dfrac{9-2}{4-(-3)} = 1$

y-intercept: Use the point $(-3,2)$ to find b:

$$2 = 1(-3) + b$$
$$5 = b$$

So, the equation is $\boxed{y = x + 5}$.



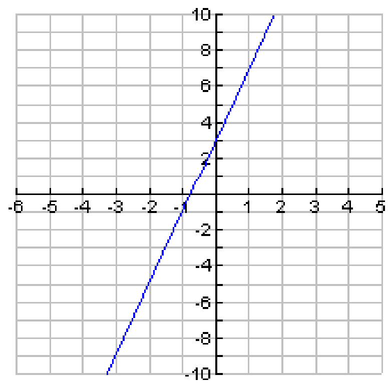
16.

slope: Since parallel to $y = 4x + 3$ (whose slope is 4), $m = 4$.

y-intercept: Use the point $(1,7)$ to find b:

$$7 = 4(1) + b$$
$$3 = b$$

So, the equation is $\boxed{y = 4x + 3}$.



17.

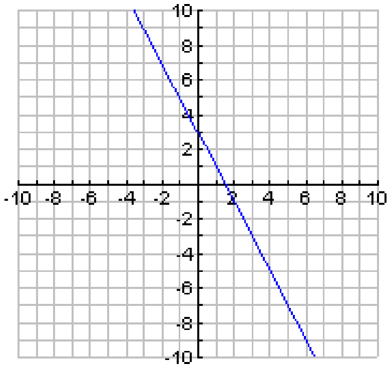
slope: Since perpendicular to $2x-4y=5$ (whose slope is $\frac{1}{2}$), $m=-2$.

y-intercept:

Use the point $(1,1)$ to find b:

$$1=-2(1)+b$$
$$3=b$$

So, the equation is $\boxed{y=-2x+3}$.



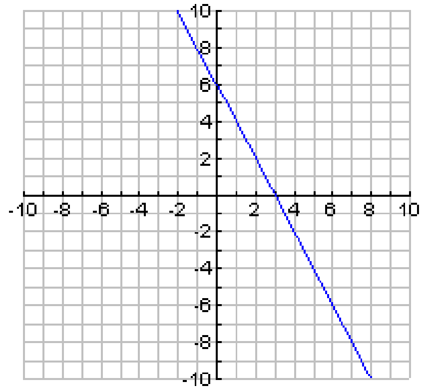
18.

slope: $m=\dfrac{6-0}{0-3}=-2$

y-intercept:

Since $(0,6)$ is on the line and is the y-intercept, $b=6$.

So, the equation is $\boxed{y=-2x+6}$.



19.

slope: $m=\dfrac{4-(-2)}{1-(-2)}=2$

y-intercept: Use the point $(1,4)$ to find b:

$$4=2(1)+b$$
$$2=b$$

So, the equation is $\boxed{y=2x+2}$.

20.

slope: $m=\dfrac{3-(-1)}{-2-2}=-1$

y-intercept: Use the point $(-2,3)$ to find b:

$$3=(-1)(-2)+b$$
$$1=b$$

So, the equation is $\boxed{y=-x+1}$.

21.

$$(x-6)^2+(y-(-7))^2=8^2$$
$$(x-6)^2+(y+7)^2=64$$

22. Completing the square gives us:

$$x^2+y^2-10x+6y+22=0$$
$$x^2-10x\quad+y^2+6y=-22$$
$$\left(x^2-10x+25\right)+\left(y^2+6y+9\right)=-22+25+9$$
$$(x-5)^2+(y+3)^2=12$$
$$(x-5)^2+(y-(-3))^2=\left(\sqrt{12}\right)^2$$

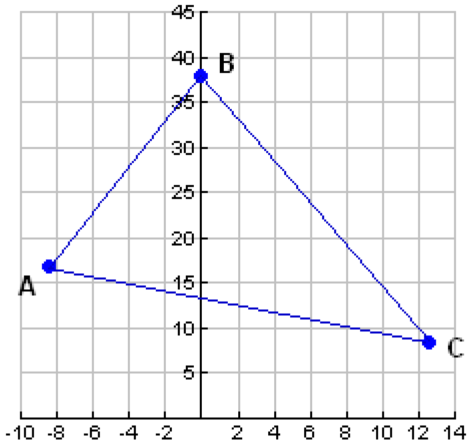
So, center is $(5,-3)$ and radius is $\sqrt{12}=2\sqrt{3}$.

23. The center is $(4,9)$. The radius is the distance from $(4,9)$ to $(2,5)$, which is given by $\sqrt{(4-2)^2+(9-5)^2}=\sqrt{20}$. So, the equation is $\boxed{(x-4)^2+(y-9)^2=20}$.

24. The center is $(0,0)$ and the radius is 93 million miles. Then, assuming that x and y are measured in "millions of miles", the equation is

$$(x-0)^2+(y-0)^2=93^2$$
$$\boxed{x^2+y^2=8649}.$$

25. The triangle is depicted as follows:



Observe that

$$m_{AB} = \frac{37.8-16.8}{0-(-8.4)} = 2.5$$

$$m_{BC} = \frac{37.8-8.4}{0-12.6} = -2.\overline{3}$$

$$m_{AC} = \frac{16.8-8.4}{-8.4-12.6} = -0.4$$

Since $m_{AB} \cdot m_{AC} = -1$, AB is perpendicular to AC. So, the triangle is $\boxed{\text{right}}$.

Next, observe that

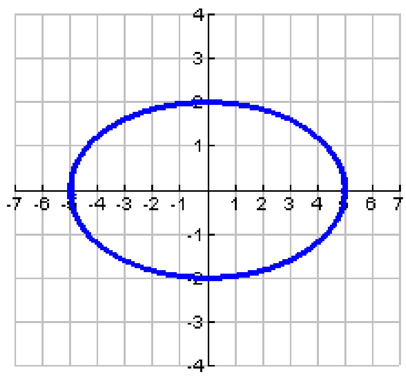
$$d(A,B) = \sqrt{(37.8-16.8)^2 + (0+8.4)^2} = \sqrt{511.56}$$

$$d(B,C) = \sqrt{(37.8-8.4)^2 + (0-12.6)^2} = \sqrt{1023.12}$$

$$d(A,C) = \sqrt{(16.8-8.4)^2 + (-8.4-12.6)^2} = \sqrt{511.56}$$

So, it is also $\boxed{\text{isosceles}}$.

26. Symmetric with respect to the origin, x-axis, and y-axis, as seen below.



Chapter 2 Cumulative Review ---

1.

$$\frac{7-2}{7+3}=\frac{5}{10}=\boxed{\frac{1}{2}}$$

2.

$$\frac{\left(5x^{3/4}\right)^4}{25x^{-1/4}}=\frac{625x^3}{25x^{-1/4}}=\boxed{25x^{13/4}}$$

3.

$$\begin{aligned}(x-4)^2(x+4)^2&=[(x-4)(x+4)]^2\\&=\left[x^2-16\right]^2\\&=\boxed{x^4-32x^2+256}\end{aligned}$$

4.

$$\begin{aligned}8x^3-27y^3&=(2x)^3-(3y)^3\\&=\boxed{(2x-3y)\left(4x^2+6xy+9y^2\right)}\end{aligned}$$

5.

$$\frac{\frac{1}{x}-\frac{1}{5}}{\frac{1}{x}+\frac{1}{5}}=\frac{\frac{5-x}{5x}}{\frac{5+x}{5x}}=\boxed{\frac{5-x}{5+x}}$$

6.

$$\begin{aligned}x^3-5x^2-4x+20&=0\\x^2(x-5)-4(x-5)&=0\\\left(x^2-4\right)(x-5)&=0\\(x-2)(x+2)(x-5)&=0\\x&=\boxed{\pm2,5}\end{aligned}$$

7. $\sqrt{-36}\,(5-2i)=6i\,(5-2i)=30i-12i^2=\boxed{12+30i}$

8.

$$\begin{aligned}15-[5+3x-4(2x-6)]&=4(6x-7)-[5(3x-7)-6x+10]\\15-[5+3x-8x+24]&=24x-28-[15x-35-6x+10]\\15-(29-5x)&=24x-28-(9x-25)\\15-29+5x&=24x-28-9x+25\\-14+5x&=15x-3\\-11&=10x\\\boxed{-\tfrac{11}{10}=x}\end{aligned}$$

9. $\frac{5}{4x+1}-\frac{3}{4x-1}=0 \Rightarrow \frac{5(4x-1)-3(4x+1)}{(4x-1)(4x+1)}=0 \Rightarrow \frac{8x-8}{(4x-1)(4x+1)}=0$ $\Rightarrow \frac{8(x-1)}{(4x-1)(4x+1)}=0$ So, $\boxed{x=1}$.	
10. Let x = amount invested in 5% CD. Solve: $0.05x+0.08(17000-x)=1075$ $0.05x+1360-0.08x=1075$ $-0.03x=-285$ $x=9500$ $\boxed{\text{\$9500 was invested in CD and \$7500 in stock.}}$	**11.** $5x^2-45=0$ $5\left(x^2-9\right)=0$ $5(x-3)(x+3)=0$ $\boxed{x=\pm 3}$
12. $3x^2+6x-7=0$ $3\left(x^2+2x\quad\right)-7=0$ $3\left(x^2+2x+1\right)-7-3=0$ $3(x+1)^2=10$ $(x+1)^2=\frac{10}{3}$ $x=\boxed{-1\pm\sqrt{\frac{10}{3}}}$	**13.** Discriminant is equal to 4 – 4(5)(7) = $-136<0$. Hence, the equation has two complex conjugate solutions.
14. $r=\pm\sqrt{p^2+q^2}$	**15.** $\sqrt{x^2+3x-10}=x-2$ $x^2+3x-10=(x-2)^2$ $x^2+3x-10=x^2-4x+4$ $7x-14=0$ $\boxed{x=2}$

16.

$$\frac{1}{(x+2)^2}-\frac{5}{x+2}+4=0,\quad x\neq -2$$

$$\frac{1-5(x+2)+4(x+2)^2}{(x+2)^2}=0$$

$$\frac{4x^2+11x+7}{(x+2)^2}=0$$

$$\frac{(4x+7)(x+1)}{(x+2)^2}=0$$

$$\boxed{x=-\tfrac{7}{4},\,-1}$$

17.

$$6<\tfrac{1}{4}x+6<9$$

$$0<\tfrac{1}{4}x<3$$

$$0<x<12$$

$$\boxed{(0,12)}$$

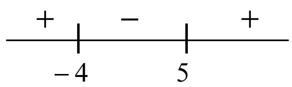
18.

$$x^2-x\geq 20$$

$$x^2-x-20\geq 0$$

$$(x-5)(x+4)\geq 0$$

CPs: $x=-4,5$



So, the solution set is $\boxed{(-\infty,-4]\cup[5,\infty)}$

19.

$$-4<2-x<4$$

$$-6<-x<2$$

$$6>x>-2$$

$$\boxed{(-2,6)}$$

20.

$5-4x=23$ or $5-4x=-23$

$-4x=18$ $\quad$ $-4x=-28$

$\boxed{x=-\tfrac{9}{2}}$ $\quad$ $\boxed{x=7}$

21. <u>x-axis symmetry</u>: Substitute $-y$ for y. This yields $y=-4x$, which is not equivalent to the original equation. Hence, not symmetric about x-axis.
<u>y-axis symmetry</u>: Substitute $-x$ for x. This yields $y=-4x$, which is not equivalent to the original equation. Hence, not symmetric about y-axis.
<u>origin symmetry</u>: Substitute $-y$ for y and $-x$ for x. This yields $y=4x$, which is equivalent to the original equation. Hence, symmetric about $\boxed{\text{origin}}$.

22. $m=\frac{4}{5}$
<u>y-intercept</u>: To find b, use the fact that $(5,1)$ is on the line:

$$1=\tfrac{4}{5}(5)+b\ \Rightarrow\ b=-3$$

So, equation of the line is $\boxed{y=\tfrac{4}{5}x-3}$.

23. Since the line passes through $(5,3)$ and is perpendicular to the x-axis, the line must be vertical and so, its equation is $\boxed{x=5}$.

24. $m = \dfrac{\frac{5}{3}-\left(-\frac{2}{3}\right)}{\frac{1}{7}-\left(-\frac{6}{7}\right)} = \dfrac{7}{3}$ y-intercept: To find b, use the fact that $\left(\frac{1}{7},\frac{5}{3}\right)$ is on the line: $\frac{5}{3} = \frac{7}{3}\left(\frac{1}{7}\right)+b \Rightarrow b = \frac{4}{3}$ So, equation of the line is $\boxed{y=\frac{7}{3}x+\frac{4}{3}}$.	**25.** The equation of the circle can be written as $(x-(-5))^2+(y-(-3))^2=\left(\sqrt{30}\right)^2$ So, the center is $(-5,-3)$ and the radius is $\sqrt{30}$.
26. $d=\sqrt{\left(5-\sqrt{7}\right)^2+\left(-\sqrt{11}-2\right)^2}\approx\boxed{5.8}$ $M=\left(\dfrac{-\sqrt{11}+2}{2},\dfrac{5+\sqrt{7}}{2}\right)\approx\boxed{(-0.7,3.8)}$	**27.** Slope of $y_1 = 0.32x+1.5$ is 0.32. Slope of $y_2 = -\frac{5}{16}x+\frac{1}{14}$ is $-\frac{5}{16}$. Since $(0.32)(-\frac{5}{16})=-0.1$, the lines are $\boxed{\text{neither}}$ parallel nor perpendicular.