

Algebra 1 EOC Review Answers

1) $x = \text{small}$
 $y = \text{large}$

$$\begin{array}{l} 20x + 60y \leq 3200 \\ 4x + 10y \leq 500 \end{array} \begin{array}{l} \xrightarrow{\div 20} \\ \xrightarrow{\div 2} \end{array} \begin{array}{l} x + 3y \leq 160 \\ 2x + 5y \leq 250 \end{array}$$

2) $x = \text{blueberries}$
 $y = \text{blackberries}$

$$\begin{array}{l} x + y \leq 10 \\ y \leq 3 \\ x > 0 \end{array}$$

3) $-5x + 2(3x + 5) = -2$ $-5x + 6x + 10 = -2$

Distributive Property

4) $x^2 + 24x + 144 = -15 + 144$ $\left(\frac{b}{2}\right)^2 = \left(\frac{24}{2}\right)^2 = 12^2 = 144$

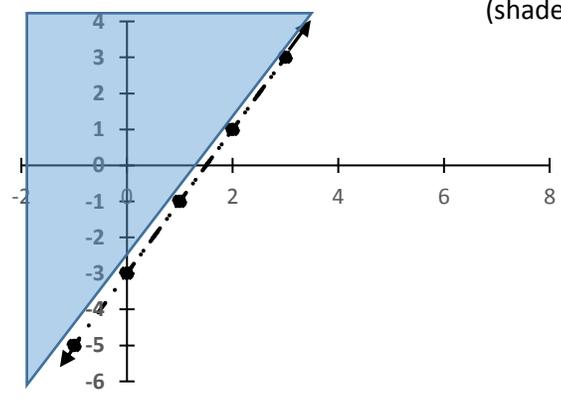
5) $x = \text{drinks}$ $3x + 2y = 7.75$ $3x + 2y = 7.75$ $1.25 + y = 3.25$ $\text{drinks} = \$1.25$
 $y = \text{burgers}$ $-2(x + y) = 3.25$ $-2x - 2y = -6.50$ $\frac{-1.25}{-1.25} \quad \frac{-1.25}{-1.25}$ $\text{burgers} = \$2.00$
 $x = 1.25$ $y = 2.00$

6) $\begin{array}{l} 1^{\text{st}} \text{ month} \\ 2^{\text{nd}} \text{ month} \\ 3^{\text{rd}} \text{ month} \end{array}$

$$x + x + 2x = 120 \xrightarrow{\div 4} \frac{4x}{4} = \frac{120}{4} x = 30 \xrightarrow{\text{3rd month}} 2x \xrightarrow{\cdot 2} 2(30) = 60 \text{ miles}$$

7) $2x - 3 < y \xrightarrow{\text{rewrite in slope-intercept form}} y > 2x - 3$

dashed line slope y-intercept
 (shade above)



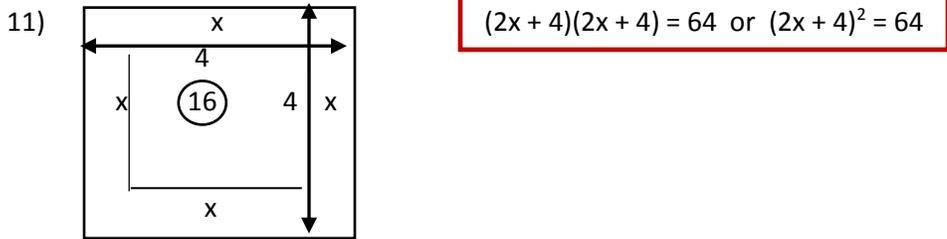
8) $(-2x^3 + 3x^2 + x + 5) - 3(4x^3 - 2x + 1)$
 $-2x^3 + 3x^2 + x + 5 - 12x^3 + 6x - 3$
 $-14x^3 + 3x^2 + 7x + 2$

9) Polynomials are closed under addition, subtraction, and multiplication, but **not division.**

Example: $\frac{6x^2y^4}{3x^3y^5} \rightarrow 2x^{-1}y^{-1} \rightarrow \frac{2}{xy}$

To be a polynomial there must be no negative exponents, nor variables in the denominator!

10) $6 < -2x - 2 \leq 10$
 $\frac{+2}{-2} < \frac{-2x}{-2} \leq \frac{+2}{-2} \rightarrow -4 > x \geq -6 \rightarrow -6 \leq x < -4$



12)

x	f(x)	g(x)
-2	1	-15
-1	-2	-8
0	-3	-3
1	-2	0
2	1	1

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

13) Where they intersect $x = -1.5$ $x = 1$

14) $x^2 + 16x + 4 = 0$
 $x^2 + 16x \quad \quad = -4$
 $x^2 + 16x + 64 = -4 + 64$
 $(x + 8)^2 = 60$
 $-60 = -60$
 $y = (x + 8)^2 - 60$

$\left(\frac{b}{2}\right)^2 = \left(\frac{16}{2}\right)^2 = 8^2 = 64$

15) $3x^2 + 10x - 8$

	3x	-2
x	3x ²	-2x
+4	12x	-8

$(3x - 2)(x + 4)$

16) $-f(x)$ \rightarrow multiplied by a negative means **reflected over the x axis.**

17) to the **right** \rightarrow a number must be **subtracted** from x **within** the parenthesis $f(x - 2)$ $f(x - 3) + 4$
 $-f(x - \frac{1}{2}) - (-5)$

18) to the **left** \rightarrow a number must be **added** to x **within** the parenthesis. $f(x+4)$ $2f(x+4) - 2$
 $-\frac{1}{2}f(x+1)$

19) **up** → a number is **added** on the **outside** of the parenthesis. $f(x-3) + 4$ $-f(x - \frac{1}{2}) - (-5)$
 $-f(x - \frac{1}{2}) + 5$

20) $x^4 y^5 (2y^3)^0 \rightarrow x^4 y^5 (2^0 y^0) \rightarrow x^4 y^5 (1) = x^4 y^5$

21) $(x^4)^{-3} \cdot 2x^4 \rightarrow x^{-12} \cdot 2x^4 \rightarrow 2x^{-8} \rightarrow \frac{2}{x^8}$

22) $\frac{2x^2 y^4 \cdot 4x^2 y^4 \cdot 3x}{3x^{-3} y^2} \rightarrow \frac{24x^5 y^8}{3x^{-3} y^2} \rightarrow 8x^8 y^6$ When multiplying- multiply #'s and add exponents
 When dividing – divide #'s and subtract exponents

23) $\sqrt{24x^2 y^3} \rightarrow \sqrt{2 \cdot 2 \cdot 2 \cdot 3 \cdot x \cdot x \cdot y \cdot y \cdot y} \rightarrow 2xy\sqrt{6y}$

24) $\sqrt[3]{48m^3} \rightarrow \sqrt[3]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot m \cdot m \cdot m} \rightarrow 2m\sqrt[3]{6}$

25) $\sqrt[4]{128n^8} \rightarrow \sqrt[4]{2 \cdot 2 \cdot n \cdot n} \rightarrow 2n^2\sqrt[4]{8}$

26) $9\sqrt{3} + 5\sqrt{3} = 14\sqrt{3}$

27) $\sqrt{20} + \sqrt{48} - \sqrt{45} \rightarrow \sqrt{2 \cdot 2 \cdot 5} + \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3} - \sqrt{3 \cdot 3 \cdot 5} \rightarrow 2\sqrt{5} + 4\sqrt{3} - 3\sqrt{5} \rightarrow -\sqrt{5} + 4\sqrt{3}$

28) $\sqrt[3]{135} + \sqrt[3]{40} + \sqrt[3]{5} \rightarrow \sqrt[3]{3 \cdot 3 \cdot 3 \cdot 5} + \sqrt[3]{2 \cdot 2 \cdot 2 \cdot 5} + \sqrt[3]{5} \rightarrow 3\sqrt[3]{5} + 2\sqrt[3]{5} + \sqrt[3]{5} \rightarrow 6\sqrt[3]{5}$

29) $5\sqrt{10y} \cdot 2\sqrt{2} \rightarrow 10\sqrt{20y} \rightarrow 10\sqrt{2 \cdot 2 \cdot 5 \cdot y} \rightarrow 20\sqrt{5y}$

30) $\frac{\sqrt{162x^7 y^5}}{\sqrt{2xy}} \rightarrow$ Divide numbers and subtract exponents $\rightarrow \sqrt{81x^6 y^4} \rightarrow 9x^3 y^2$

31) $\sqrt{3a} \cdot \sqrt{12} \rightarrow \sqrt{36a} \rightarrow \sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot a} \rightarrow 6\sqrt{a}$

32) $6(x-3) = 30 \rightarrow 6x - 18 = 30$
 $\begin{array}{r} 6x - 18 = 30 \\ + 18 \quad +18 \\ \hline 6x = 48 \\ \frac{6x}{6} = \frac{48}{6} \end{array} \rightarrow x = 8$

33) $8(x+4) = 6(x+11) \rightarrow 8x + 32 = 6x + 66$
 $\begin{array}{r} 8x + 32 = 6x + 66 \\ -6x \quad -6x \\ \hline 2x + 32 = 66 \\ -32 \quad -32 \\ \hline 2x = 34 \\ \frac{2x}{2} = \frac{34}{2} \end{array} \rightarrow x = 17$

$$34) \quad \frac{3}{3x+4} = \frac{2}{x-4} \quad \rightarrow \quad 2(3x+4) = 3(x-4) \quad \rightarrow \quad 6x+8 = 3x-12$$

(Set cross products equal)

$$\begin{array}{r} -3x \quad -3x \\ 3x+8 = -12 \\ \hline -8 \quad -8 \\ \hline 3x = -20 \\ \hline 3 \quad 3 \end{array}$$

$$x = -\frac{20}{3}$$

$$35) \quad \frac{x+1}{x+2} = \frac{4}{7} \quad \rightarrow \quad 7(x+1) = 4(x+2) \quad \rightarrow \quad 7x+7 = 4x+8$$

(Set cross products equal)

$$\begin{array}{r} -4x \quad -4x \\ 3x+7 = 8 \\ \hline -7 \quad -7 \\ \hline 3x = 1 \\ \hline 3 \quad 3 \end{array}$$

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

$$36) \quad \frac{2}{3}x + 4 = 6 \quad \rightarrow \quad \left(\frac{3}{2}\right)\frac{2}{3}x = 2\left(\frac{3}{2}\right) \quad \rightarrow \quad x = \frac{6}{2}$$

$$x = 3$$

$$\begin{array}{r} -4 \quad -4 \\ \hline \frac{2}{3}x = 2 \end{array}$$

$$37) \quad \frac{1}{2}x + 8 = 10 \quad \rightarrow \quad \left(\frac{2}{1}\right)\frac{1}{2}x = 2\left(\frac{2}{1}\right) \quad \rightarrow \quad x = \frac{4}{1}$$

$$x = 4$$

$$\begin{array}{r} -8 \quad -8 \\ \hline \frac{1}{2}x = 2 \end{array}$$

$$38) \quad 3 < -5x + 2x \quad \rightarrow \quad -5x + 2x > 3 \quad \rightarrow \quad \frac{-3x}{-3} > \frac{3}{-3}$$

$$x < -1$$

Divided by a negative so flip the sign.



$$39) \quad x + 8 \geq 9 \quad \text{and} \quad \frac{x}{7} \leq 1$$

$$\begin{array}{r} -8 \quad -8 \\ \hline x \geq 1 \end{array}$$

and

$$\left(\frac{7}{1}\right)\frac{x}{7} \leq 1\left(\frac{7}{1}\right)$$

$$x \leq 7$$

$$1 \leq x \leq 7$$



$$40) \quad x - 2 < -8 \quad \text{or} \quad \frac{x}{8} > 1$$

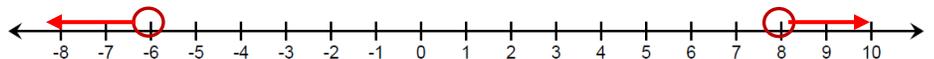
$$\begin{array}{r} +2 \quad +2 \\ \hline x < -6 \end{array}$$

or

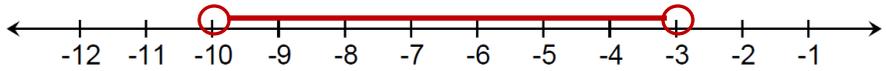
$$\left(\frac{8}{1}\right)\frac{x}{8} > 1(8)$$

$$x > 8$$

$$x < -6 \text{ or } x > 8$$



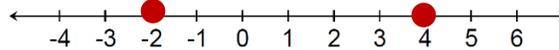
41) $-36 < 3x - 6 < -15$
 $\frac{-30}{3} < \frac{3x}{3} < \frac{-9}{3}$
 $-10 < x < -3$



42) $2 - 5 | 5x - 5 | = -73$
 $\frac{-2}{-5} | 5x - 5 | = \frac{-75}{-5}$
 $| 5x - 5 | = 15$

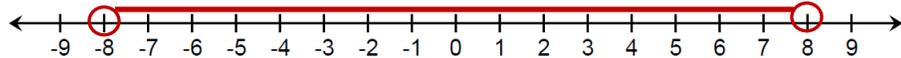
$5x - 5 = 15$
 $\frac{+5}{5} \frac{+5}{5}$
 $5x = 20$
 $x = 4$

$5x - 5 = -15$
 $\frac{+5}{5} \frac{+5}{5}$
 $5x = -10$
 $x = -2$



43) $|x| + 4 < 12$
 $\frac{-4}{-4} \frac{-4}{-4}$
 $|x| < 8$

$x < 8$ $x > -8$ *less than "and"*
 $-8 < x < 8$



44) $\frac{2(x+a)}{2} = \frac{4b}{2}$

$x + a = 2b$
 $\frac{-x}{-x}$
 $a = 2b - x$

45) $2x + 5y = 12$
 $\frac{-2x}{-2x} \frac{-2x}{-2x}$
 $\frac{5y}{5} = \frac{-2x}{5} + \frac{12}{5}$
 $y = -\frac{2}{5}x + \frac{12}{5}$

$(3x^2 + 6)(x - 1)$

	$3x^2$	$+ 6$
x	$3x^3$	$+ 6x$
-1	$-3x^2$	$- 6$

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

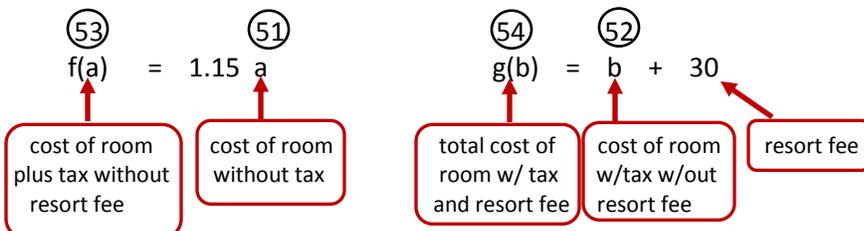
46) **4 terms**

47) **3rd degree**

48) **3 is the leading coefficient**

49) **-6 is the constant**

50) **Polynomials are not closed under division.**



Notice $f(a) = b$

55) $y = 2x^2 - 3$ $[-3, -1]$ **Plug in both x values to determine the ordered pairs

$$\begin{array}{ll} y = 2(-3)^2 - 3 & y = 2(-1)^2 - 3 \\ y = 2(9) - 3 & y = 2(1) - 3 \\ y = 18 - 3 & y = 2 - 3 \\ y = 15 & y = -1 \\ (-3, 15)_1 & (-1, -1)_2 \end{array}$$

Now find the slope (rate of change) $\frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - 15}{-1 - (-3)} = -\frac{16}{2} = \boxed{-8}$ *Average rate of change*

56) $y = 3^x + 1$ $[0, 2]$

$$\begin{array}{ll} y = 3^0 + 1 & y = 3^2 + 1 \\ y = 1 + 1 & y = 9 + 1 \\ y = 2 & y = 10 \\ (0, 2)_1 & (2, 10)_2 \end{array}$$

Now find the slope (rate of change) $\frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 2}{2 - 0} = \frac{8}{2} = \boxed{4}$ *Average rate of change*

57) $y = -3x^2 + 5x - 3$ $[-1, 1]$

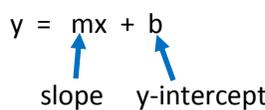
$$\begin{array}{ll} y = -3(-1)^2 + 5(-1) - 3 & y = -3(1)^2 + 5(1) - 3 \\ y = -3(1) + 5(-1) - 3 & y = -3(1) + 5(1) - 3 \\ y = -3 - 5 - 3 & y = -3 + 5 - 3 \\ y = -11 & y = -1 \\ (-1, -11)_1 & (1, -1)_2 \end{array}$$

Now find the slope (rate of change) $\frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - (-11)}{1 - (-1)} = \frac{10}{2} = \boxed{5}$ *Average rate of change*

58) $(-3, 5)_2$ $(3, 1)_1 \rightarrow \frac{5-1}{-3-3} = \frac{4}{-6} = \boxed{\frac{2}{-3}}$

59) $(4, 7)_2$ $(2, 4)_1 \rightarrow \frac{7-4}{4-2} = \boxed{\frac{3}{2}}$

60) $(-2, 3)_2$ $(2, -1)_1 \rightarrow \frac{3-(-1)}{-2-2} = \frac{4}{-4} = \boxed{-1}$

61) $y = mx + b$ $y = 3x + 2$ slope = 3
y-intercept = 2


62) $4x + 2y = 8$ *solve for y*

$$\begin{array}{r} 4x + 2y = 8 \\ -4x \quad -4x \\ \hline 2y = -4x + 8 \\ \frac{2y}{2} = \frac{-4x}{2} + \frac{8}{2} \\ y = -2x + 4 \end{array}$$
slope = -2 y-intercept = 4

63) $-8x - 4y = 2$ solve for y

$$\begin{array}{r} -8x - 4y = 2 \\ +8x \quad +8x \\ \hline -4y = 8x + 2 \\ -4 \quad -4 \quad -4 \\ \hline y = -2x - \frac{1}{2} \end{array}$$

$\text{slope} = -2 \quad \text{y-intercept} = -\frac{1}{2}$

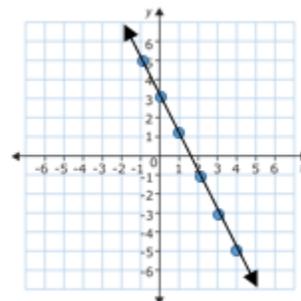
64) $-3 + y = -2x$

$$\begin{array}{r} -3 + y = -2x \\ +3 \quad +3 \\ \hline y = -2x + 3 \end{array}$$

slope = -2
y-int. = 3

$$\begin{array}{r} 0 = -2x + 3 \\ -3 \quad -3 \\ \hline -3 = -2x \\ -2 \quad -2 \\ \hline \frac{3}{2} = x \quad (\text{x-intercept}) \end{array}$$

x	y
-1	5
0	3
1	1



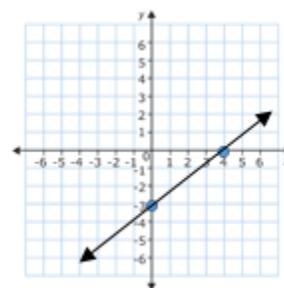
65) $3x = 4y + 12$

$$\begin{array}{r} 3x = 4y + 12 \\ -12 \quad -12 \\ \hline 3x - 12 = 4y \\ 4 \quad 4 \quad 4 \\ \hline y = \frac{3}{4}x - 3 \end{array}$$

slope = $\frac{3}{4}$
y-int. = -3

$$\begin{array}{r} 0 = \frac{3}{4}x - 3 \\ +3 \quad +3 \\ \hline \left(\frac{4}{3}\right) 3 = \frac{3}{4}x \left(\frac{4}{3}\right) \\ 4 = x \quad (\text{x-Intercept}) \end{array}$$

x	y
-1	$-3\frac{3}{4}$
0	-3
1	$-2\frac{1}{4}$



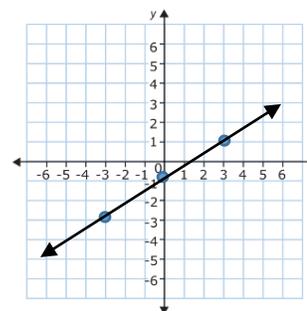
66) $2x - 3y = 3$

$$\begin{array}{r} 2x - 3y = 3 \\ -2x \quad -2x \\ \hline -3y = -2x + 3 \\ -3 \quad -3 \quad -3 \\ \hline y = \frac{2}{3}x - 1 \end{array}$$

slope = $\frac{2}{3}$
y-int. = -1

$$\begin{array}{r} 0 = \frac{2}{3}x - 1 \\ +1 \quad +1 \\ \hline \left(\frac{3}{2}\right) 1 = \left(\frac{3}{2}\right) \frac{2}{3}x \\ \frac{3}{2} = x = 1.5 \quad (\text{x-int.}) \end{array}$$

x	y
-1	$-1\frac{2}{3}$
0	-1
1	$-\frac{1}{3}$



67) $y = 3x$ ① substitute 3x for y in the other equation and solve for x.

$$\begin{array}{r} x + y = -32 \\ \downarrow \\ x + 3x = -32 \\ \frac{4x}{4} = \frac{-32}{4} \\ \hline x = -8 \end{array}$$

② now substitute -8 for x in either equation and solve for y.

$$\begin{array}{r} y = 3x \\ y = 3(-8) \\ \hline y = -24 \end{array}$$

③ (x, y) is the solution (-8, -24)

68) $y = x - 2$
 $2x + y = 4$

$$\begin{array}{r} 2x + x - 2 = 4 \\ 3x - 2 = 4 \\ \hline +2 \quad +2 \\ \hline 3x = 6 \\ 3 \quad 3 \\ \hline x = 2 \end{array}$$

$y = x - 2$ $y = 2 - 2$
 $y = 0$

$(2, 0)$

69) $2x + y = -1$
 $-x + y = -7$

$$\begin{array}{r} +x \quad +x \\ \hline y = x - 7 \end{array}$$

$$\begin{array}{r} 2x + y = -1 \\ 2x + x - 7 = -1 \\ \hline 3x - 7 = -1 \\ \hline +7 \quad +7 \\ \hline 3x = 6 \\ 3 \quad 3 \\ \hline x = 2 \end{array}$$

$y = x - 7$ $y = 2 - 7$
 $y = -5$

$(2, -5)$

70) $x + y = 2$
 $+2x - y = 7$

$$\begin{array}{r} 3x = 9 \\ 3 \quad 3 \\ \hline x = 3 \end{array}$$

- ① Eliminate y 's by adding the equations
- ② Solve for x
- ③ Plug x into one of the equations and solve for y
- ④ (x, y) is the solution

$$\begin{array}{r} x + y = 2 \\ 3 + y = 2 \\ \hline -3 \quad -3 \\ \hline y = -1 \end{array}$$

$(3, -1)$

71) $3x + y = -15$ \longrightarrow $3(3x + y = -15)$ \longrightarrow $9x + 3y = -45$
 $2x - 3y = 23$ \longrightarrow $2x - 3y = 23$

$$\begin{array}{r} 11x = -22 \\ 11 \quad 11 \\ \hline x = -2 \end{array}$$

- ① Multiply the top equation by 3, so the y 's cancel out when adding the equations. Solve for x .
- ② Plug x into either equation and solve for y .

$$\begin{array}{r} 2x - 3y = 23 \\ 2(-2) - 3y = 23 \\ -4 - 3y = 23 \\ \hline +4 \quad +4 \\ \hline -3y = 27 \\ -3 \quad -3 \\ \hline y = -9 \end{array}$$

$(-2, -9)$

72) $3x - 3y = -1$ \longrightarrow $-4(3x - 3y = -1)$ \longrightarrow $-12x + 12y = 4$
 $12x - 2y = 16$ \longrightarrow $12x - 2y = 16$

$$\begin{array}{r} 10y = 20 \\ 10 \quad 10 \\ \hline y = 2 \end{array}$$

$$12x - 2y = 16$$

$$12x - 2(2) = 16$$

$$12x - 4 = 16$$

$$\begin{array}{r} +4 \quad +4 \\ \hline 12x = 20 \\ \frac{12}{12} = \frac{20}{12} \end{array}$$

$$x = \frac{5}{3}$$

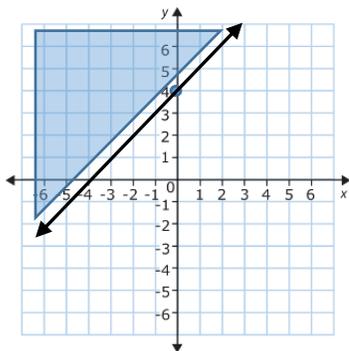
$$x = \frac{5}{3}$$

$$x = \frac{5}{3}$$

$$\left(\frac{5}{3}, 2\right)$$

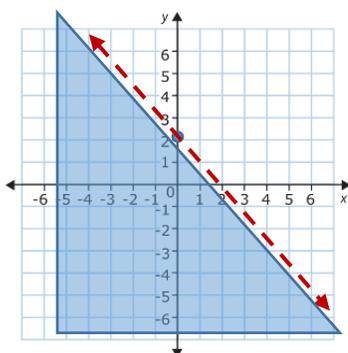
73) $y \geq x + 4$

Slope = 1
y-intercept = 4
solid line
shade above



74) $y < -x + 2$

Slope = -1
y-intercept = 2
dashed line
shade below



75) $2x + 3y > 6$

x int → 3 dashed line
y int → 2 shade above

$$2(0) + 3y > 6$$

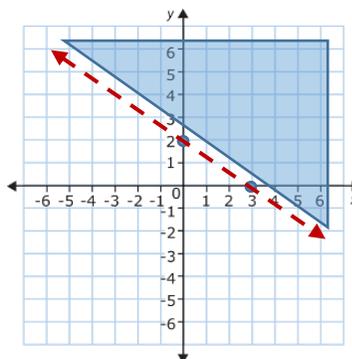
$$\frac{3y > 6}{3 \quad 3}$$

$$y > 2$$

$$2x + 3(0) > 6$$

$$\frac{2x > 6}{2 \quad 2}$$

$$x > 3$$

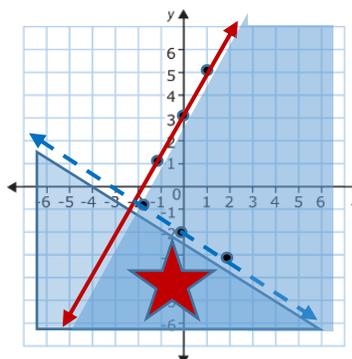


76) $y \leq 2x + 3$

Slope = 2
y-int. = 3
solid line
shade below

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

slope = $-\frac{1}{2}$
y-int. = -2
dashed line
shade below

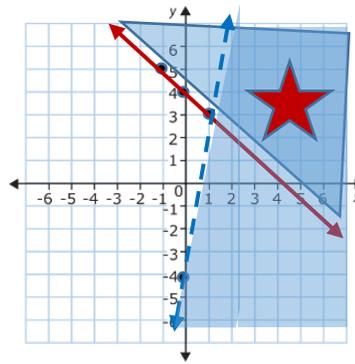


77) $y \geq -x + 4$

Slope = -1
y-int. = 4
solid line
shade above

$y < 7x - 4$

slope = 7
y-int. = -4
dashed line
shade below

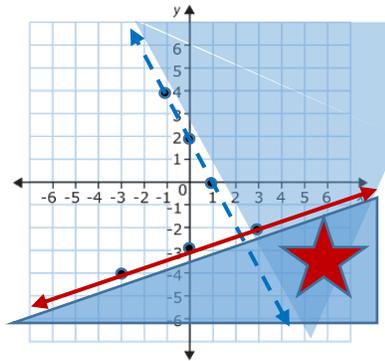


78) $y \leq \frac{1}{3}x - 3$

Slope = $\frac{1}{3}$
y-int. = -3
solid line
shade below

$y > -2x + 2$

slope = -2
y-int. = 2
dashed line
shade above

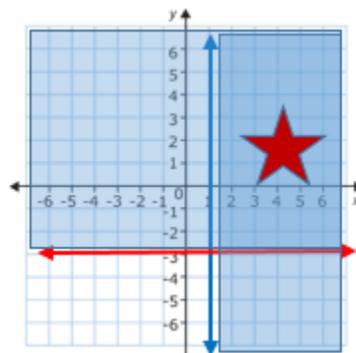


79) $y \geq -3$

horizontal line
y-int. = -3
solid line
shade above

$x \geq 1$

vertical line
x-int. = 1
solid line
shade right



80) Part 1 $\boxed{\begin{matrix} x = \text{small} \\ y = \text{large} \end{matrix}}$

Part 2 $\begin{matrix} \div 4 & \div 4 & \div 4 \\ 4x + 12y = 144 & \text{or} & x + 3y = 36 \\ 11x + 11y = 176 & & 11x + 11y = 176 \end{matrix}$

Part 3 $\begin{matrix} -11(x + 3y = 36) \\ 11x + 11y = 176 \end{matrix}$

$$\begin{array}{r} -11x - 33y = -396 \\ \underline{11x + 11y = 176} \\ -22y = -220 \\ -22 \quad -22 \\ y = 10 \end{array}$$

$$\begin{array}{r} x + 3y = 36 \\ x + 3(10) = 36 \\ x + 30 = 36 \\ \underline{-30 \quad -30} \\ x = 6 \end{array}$$

$\boxed{\begin{matrix} \text{small box} = \$6 \\ \text{large box} = \$10 \end{matrix}}$

81) *axis of symmetry = $-\frac{b}{2a}$ This is the x-coordinate of the vertex. Plug in x and solve for y to get the complete vertex.

$y = -x^2 + 6x + 1 \rightarrow \frac{b}{2a} = \frac{-6}{2(-1)} = \frac{-6}{-2} = 3 = x \rightarrow \boxed{x = 3 \text{ axis of symmetry } (3, 10) \text{ vertex}}$

$y = -1(3)^2 + 6(3) + 1 \rightarrow y = -9 + 18 + 1 \rightarrow y = -9 + 18 + 1 = 10 \quad y = 10$

82) $y = \frac{1}{2}x^2 - 5x + 4 \rightarrow x = -\frac{b}{2a} = \frac{5}{2(\frac{1}{2})} = \frac{5}{1} = 5 \rightarrow \boxed{x = 5 \text{ axis of symmetry } (5, -8.5) \text{ vertex}}$

$y = \frac{1}{2}(5)^2 - 5(5) + 4 \rightarrow y = \frac{1}{2}(25) - 25 + 4 \rightarrow y = 12.5 - 25 + 4 = -8.5 \quad y = -8.5$

83) $8(x^2 + x - 6) = 0$

$\begin{array}{r l} + & x \\ 1 & -6 \\ \hline & \boxed{3, -2} \end{array}$	$8(x+3)(x-2) = 0$	$8 \neq 0$	$\begin{array}{r} x+3=0 \\ -3 \quad -3 \\ \hline \boxed{x = -3} \end{array}$	$\begin{array}{r} x-2=0 \\ +2 \quad +2 \\ \hline \boxed{x = 2} \end{array}$
--	-------------------	------------	--	---

84) $25x^2 + 20x + 4 = 0$

Perfect square trinomial will factor $(5x + 2)^2$, so

$5x + 2 = 0$
$-2 \quad -2$
$\underline{5x = -2}$
$5 \quad 5$
$\boxed{x = -\frac{2}{5}}$

85) $x^2 + 9x + 14 = 0$

$\begin{array}{r l} + & x \\ 1 & 14 \\ \hline & \boxed{2, 7} \end{array}$	$(x+2)(x+7) = 0$	$\begin{array}{r} x+2=0 \\ -2 \quad -2 \\ \hline \boxed{x = -2} \end{array}$	$\begin{array}{r} x+7=0 \\ -7 \quad -7 \\ \hline \boxed{x = -7} \end{array}$
---	------------------	--	--

86) $25x^2 - 9 = 0$

Difference of Squares will factor $(5x + 3)(5x - 3) = 0$

$5x + 3 = 0$	$5x - 3 = 0$
$-3 \quad -3$	$+3 \quad +3$
$\underline{5x = -3}$	$\underline{5x = 3}$
$5 \quad 5$	$5 \quad 5$
$\boxed{x = -\frac{3}{5}}$	$\boxed{x = \frac{3}{5}}$

87) $8x^2 - 7 = 793$

$+7 \quad +7$
$\underline{8x^2 = 800}$
$8 \quad 8$
$\sqrt{x^2} = \sqrt{100}$
$\boxed{x = \pm 10}$

88) $7x^2 + 3 = 451$

$-3 \quad -3$
$\underline{7x^2 = 448}$
$7 \quad 7$
$\sqrt{x^2} = \sqrt{64}$
$\boxed{x = \pm 8}$

89) $x^2 - 14x + 49 = -48 + 49$ Perfect Square Trinomial

$$\frac{b^2}{2} = \left(\frac{-14}{2}\right)^2 = (-7)^2 = 49$$

$$x^2 - 14x + 49 = 1$$

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

$$x-7 = 1$$

$$\frac{+7}{+7} \quad \frac{+7}{+7}$$

$$\boxed{x = 8}$$

$$x-7 = -1$$

$$\frac{+7}{+7} \quad \frac{+7}{+7}$$

$$\boxed{x = 6}$$

90) $x^2 - 12x + 36 = -35 + 36$

$$\frac{b^2}{2} = \left(\frac{-12}{2}\right)^2 = (-6)^2 = 36$$

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

$$x-6 = 1$$

$$\frac{+6}{+6} \quad \frac{+6}{+6}$$

$$\boxed{x = 7}$$

$$x-6 = -1$$

$$\frac{+6}{+6} \quad \frac{+6}{+6}$$

$$\boxed{x = 5}$$

91) $x^2 - x - 6 = 0$

a = 1

b = -1

c = -6

$$\frac{1 \pm \sqrt{1-4(1)(-6)}}{2(1)}$$

$$\frac{1 \pm \sqrt{25}}{2}$$

$$\frac{1+5}{2} = \frac{6}{2} = \boxed{x = 3}$$

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

92) $x^2 - 2x + 1 = 0$

a = 1

b = -2

c = 1

$$\frac{2 \pm \sqrt{4-4(1)(1)}}{2(1)}$$

$$\frac{2 \pm \sqrt{0}}{2}$$

$$\frac{2 \pm 0}{2} = \frac{2}{2} = \boxed{x = 1}$$

93) **(1.5, 60)**

94) The diver reached a max height of **60 feet at 1.5 seconds**

95) **40 feet**

96) The diving **platform** was **40 feet high**

97) **4 seconds**

98) The diver hit the **water at 4 seconds**

99) **60 feet**

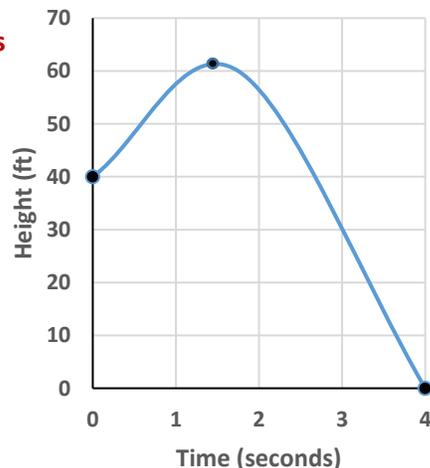
100) **1.5 seconds**

101) **0 < x < 1.5**

102) **1.5 < x < 4**

103) **0 ≤ x ≤ 4**

104) **0 ≤ y ≤ 60**



105) $y = 2x^2 + 8x + 12$
 $y - 12 = 2(x^2 + 4x + 4)$
 $\quad + 8$
 $y - 4 = 2(x + 2)^2 + 4$
 $\quad + 4$
 $y = 2(x + 2)^2 + 4$

106) $y = x^2 + 4x + 2$
 $y - 2 = x^2 + 4x + 4$
 $\quad + 4$
 $y + 2 = (x + 2)^2 - 2$
 $\quad - 2$
 $y = (x + 2)^2 - 2$

107) $y = -2(x + 2)^2 - 1$
 vertex = $(-2, -1)$
 $a = -2$
 Plug in $x = 0$
 $y = -2(0 + 2)^2 - 1$
 $y = -2(2)^2 - 1$
 $y = -2(4) - 1$
 $y = -9$

108) $y = (x - 2)^2 + 3$
 vertex = $(2, 3)$
 $a = 1$
 Plug in $x = 0$
 $y = (0 - 2)^2 + 3$
 $y = (-2)^2 + 3$
 $y = 4 + 3$
 $y = 7$

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

x	$+4$
x^2	$+4x$
$+4$	$+16$

$y = -(x^2 + 8x + 16) + 3$
 $y = -x^2 - 8x - 16 + 3$
 $y = -x^2 - 8x - 13$

110) $y = -3(x - 5)^2$

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

$y = -3(x^2 - 10x + 25)$
 $y = -3x^2 + 30x - 75$

111) $m(x) = -2(x - 3)^2 + 2$

reflect (pointing to -2), stretch (pointing to -2), right 3 (pointing to -3), up 2 (pointing to +2)

112) $p(x) = \frac{1}{2}(x + 3)^2 - 8$

compress (pointing to 1/2), left 3 (pointing to +3), down 8 (pointing to -8)

113) $c(x) = x^2 - 12x + 36$ Must put in vertex form by Completing the square.
 $c(x) - 36 = x^2 - 12x + 36$
 $\quad + 36$ $(\frac{b}{2})^2 = (\frac{-12}{2})^2 = (-6)^2 = 36$ Add 36 to both sides

$c(x) = (x - 6)^2$
 right 6

Factor perfect square trinomial

114) $a(x) = -2x^2 + 4x - 5$ Must put in vertex form by Completing the square.
 $a(x) + 5 = -2x^2 + 4x \leftarrow$ Pull out "a"
 $a(x) + 5 = -2(x^2 - 2x + 1) \leftarrow \left(\frac{b}{2}\right)^2 = 1$ add to the right side
 Must add $(1)(-2)$ or -2 to the left side
 $a(x) + 3 = -2(x-1)^2 - 3$
 $a(x) = -2(x-1)^2 - 3$
 reflect stretch right! down 3

115) $F(n) = A_1(r)^{n-1} \rightarrow F(n) = -200\left(\frac{1}{4}\right)^{n-1}$
 $F(16) = -200\left(\frac{1}{4}\right)^{15}$ $A_{16} = -.000000186$

116) Geometric Recursive $\rightarrow A_n = r(A_{n-1})$
 $r = \frac{1}{4}$, so $A_n = \frac{1}{4}(A_{n-1})$

117) Geometric Explicit $\rightarrow F(n) = A_1(r)^{n-1}$
 $A_1 = -200$ $r = \frac{1}{4}$, so $F(n) = -200\left(\frac{1}{4}\right)^{n-1}$

118) $r = \frac{1}{2}$
 $2, 1, \frac{1}{2}$
 $\frac{1}{4}, \frac{1}{8}, \frac{1}{16}$

119) Geometric Recursive $\rightarrow A_n = r(A_{n-1})$
 $r = \frac{1}{2}$, so $A_n = \frac{1}{2}(A_{n-1})$

120) Geometric Explicit $\rightarrow F(n) = A_1(r)^{n-1}$
 $A_1 = 2$ $r = \frac{1}{2}$, so $F(n) = 2\left(\frac{1}{2}\right)^{n-1}$

121) $f(x) = 60(.75)^x$ $x =$ bounce number, so for this question, $x = 5$
 $f(5) = 60(.75)^5$
 $f(5) = 14.238281 \rightarrow$ nearest foot $\rightarrow 14$ ft

122) $f(x) = -1 \cdot 3^x$ \leftarrow y -int = -1
 * multiply each y value by 3 as you move each x value to the right.
 * divide each y value by 3 as you move each x value to the left
 $As x \rightarrow \infty, y \rightarrow -\infty$
 $As x \rightarrow -\infty, y \rightarrow 0$

123) $f(x) = \left(\frac{1}{3}\right)^x \rightarrow f(x) = \left(\frac{1}{3}\right)^x$ \leftarrow y intercept is 1
 * multiply each y value by $\frac{1}{3}$ (Divide by 3) as you move each x value to the right
 * multiply each y value by 3 as you move each x value to the left
 $As x \rightarrow \infty, y \rightarrow 0$
 $As x \rightarrow -\infty, y \rightarrow \infty$

124) $y = 2^x \rightarrow y = 1 \cdot 2^x$ * y intercept is 1
 * Multiply each y -value by 2 as you move each x -value to the right
 * Divide each y -value by 2 as you move each x -value to the left
 $As x \rightarrow \infty, y \rightarrow \infty$
 $As x \rightarrow -\infty, y \rightarrow 0$

125) $y = -\left(\frac{1}{2}\right)^x \rightarrow y = -1\left(\frac{1}{2}\right)^x$ * y intercept is -1
 * Multiply each y -value by $\frac{1}{2}$ (Divide by 2) as you move each x -value to the right
 * Multiply each y -value by 2 as you move each x -value to the left.
 $As x \rightarrow \infty, y \rightarrow 0$
 $As x \rightarrow -\infty, y \rightarrow -\infty$

126) Growth Function $y = a(1+r)^t$ $r =$ decimal
 $y = 200(1.03)^6 = 238.8 \rightarrow 239$ athletes

127) Compound Interest $A = P\left(1 + \frac{r}{n}\right)^{nt}$ $r =$ decimal
 $n =$ number of times compounded per year
 $A = 1000\left(1 + \frac{.017}{4}\right)^{4(15)}$
 $A = 1000(1.00425)^{60} = \1289.76

128) Half Life $A = P(.5)^t$ $t =$ time \div half life
 2.5 hrs = 150 min
 $A = 100(.5)^{\frac{150}{30}}$
 $A = 100(.5)^5 = 3.125$ g

129) Decay Function $y = a(1-r)^t$ $r =$ decimal
 $y = 30,000(1-.11)^5$
 $y = 30,000(.89)^5 = \$16,752.18$

130) Stretch \downarrow right 3 Compare to $f(x) = 2^x$
 $y = 4^{x-3} + 8 \leftarrow$ up 8

131) reflect \downarrow left 3 Compare to $f(x) = 2^x$
 $y = -\left(\frac{1}{2}\right)^{x+3}$ \leftarrow left 3
 \uparrow compress

132) $f(x) = k(x-k)^2 + k$ when $k = -4$

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

↑ reflect stretch left 4 ↓ down 4

133) $y = 2(x^2) + 5x + 6$ Quadratic

134) $f(x) = 2(5)^x$ Exponential

135) $y = 3x - 2$

$y = mx + b$ → Linear

136)

x	y
-1	7
0	2
1	-1
2	-2
3	-1

Common 2nd difference
Quadratic

137)

x	y
2	5
4	8
6	11
8	14
10	17

Constant Rate of Change = $\frac{3}{2}$ (slope)
Linear

138)

Year	0	1	2	3
Sales	10,000	9,500	9,025	8573.75

$\frac{9,500}{10,000} = 0.95$

A) Sales are decreasing by 5% each year.

B) $y = a \cdot b^x \rightarrow y = 10,000(0.95)^x$

C) $y = 10,000(0.95)^7 = 6983.37$

139) $a_1 = 25$ $d = 5$ Arithmetic Sequence

Recursive = $a_n = a_{n-1} + d$ Explicit = $F(n) = a_1 + d(n-1)$

$a_n = a_{n-1} + 5$ $F(n) = 25 + 5(n-1)$

Price for 10 people → $F(10) = 25 + 5(9) = 70$

140) $a_1 = 50$ $r = 2$ Geometric Sequence

Recursive: $a_n = r(a_{n-1})$ Explicit: $F(n) = a_1(r)^{n-1}$ After 20 hours: $F(20) = 50(2)^{19} = 26,214,400$ bacteria

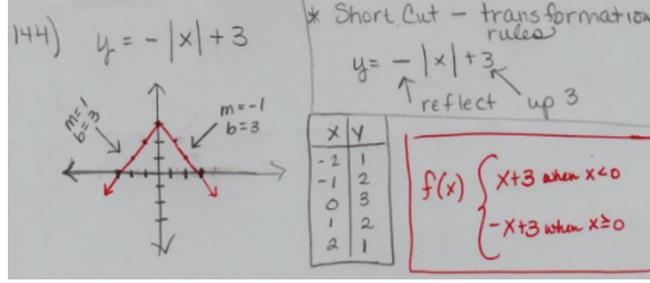
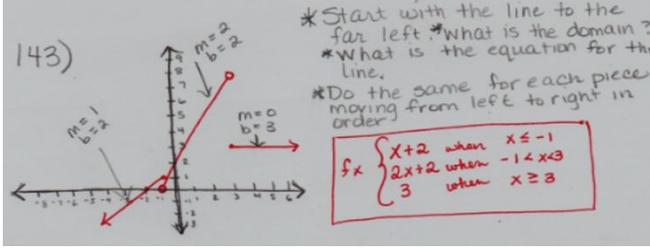
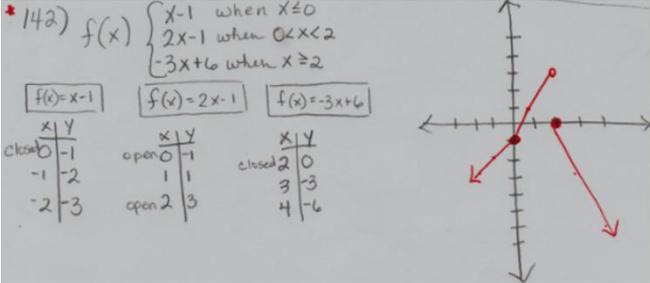
$a_n = 2(a_{n-1})$ $F(n) = 50(2)^{n-1}$

141) Mechanic A → Arithmetic → $a_1 = 50$ $d = 20$

Recursive: $a_n = a_{n-1} + 20$ Explicit: $F(n) = 50 + 20(n-1)$ Price for 12 hours: $F(12) = 50 + 20(11) = 270$

Mechanic B → Geometric → $a_1 = 1$ $r = 2$

Recursive: $a_n = 2(a_{n-1})$ Explicit: $F(n) = 1(2)^{n-1}$ Price for 12 hours: $F(12) = 1(2)^{11} = 2048$

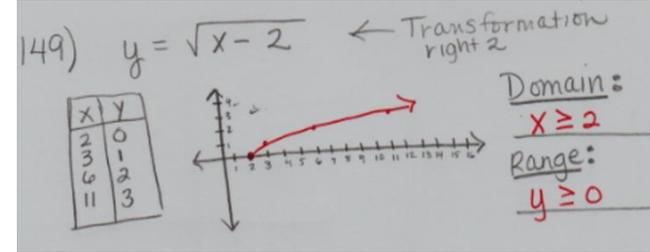


145) $g(x) = -|x|$ reflect

146) $h(x) = -\frac{1}{2}|x|$ compress reflect

147) $j(x) = 2|x| + 3$ stretch up 3

148) $c(x) = |x-2| + 4$ right 2 up 4



150) $y = \sqrt[3]{x-3}$ ← Transformation right 3

x	y
-5	-2
2	-1
3	0
4	1
11	2

Domain: $\{x|x \in \mathbb{R}\}$
 $(-\infty, \infty)$
 Range: $\{y|y \in \mathbb{R}\}$
 $(-\infty, \infty)$

151) $y = x^3 + 2$ ← Transformation up 2

x	y
-2	-6
-1	-1
0	2
1	3
2	10

Domain: $\{x|x \in \mathbb{R}\}$
 $(-\infty, \infty)$
 Range: $\{y|y \in \mathbb{R}\}$
 $(-\infty, \infty)$

152) $g(x) = -2\sqrt{x} + 3$ Compared to $f(x) = \sqrt{x}$

reflect stretch up 3

153) $h(x) = \frac{1}{2}\sqrt[3]{x-3}$ Compared to $f(x) = \sqrt[3]{x}$

Compress right 3

154) $y = 6x^3 - 66x^2 + 144x$ add degree positive

1) Pull out common factor → $y = 6x(x^2 - 11x + 24)$

2) Factor trinomial → $0 = 6x(x-3)(x-8)$

3) Set each factor equal to zero and solve for x

$\frac{6x}{6} = 0 \rightarrow x=0$ $\frac{x-3}{+3+3} = 0 \rightarrow x=3$ $\frac{x-8}{+8+8} = 0 \rightarrow x=8$

odd degree → different direction
 Q is Positive

155) $y = -2x^3 + 12x^2 - 10x$ negative odd degree

1) Pull out GCF → $y = -2x(x^2 - 6x + 5)$

2) Factor trinomial → $0 = -2x(x-1)(x-5)$

3) Set each factor equal to zero and solve for x

$\frac{-2x}{-2} = 0 \rightarrow x=0$ $\frac{x-1}{+1+1} = 0 \rightarrow x=1$ $\frac{x-5}{+5+5} = 0 \rightarrow x=5$

odd degree - different directions
 Q is negative

156) To be a function, the graph must pass the vertical line test

- 157) E Growth formula is exponential.
Q Height over time is usually quadratic
 Key word: squared
L Constant rate of change 60 miles / 1 hour
L Constant rate of change 1st / 1 year
E Decay formula is exponential.

158)

$2 \leq x \leq 4$ decreasing
 $5 \leq x \leq 6$ decreasing
 $4 \leq x \leq 6$ increasing then decreasing
 $7 \leq x \leq 9$ decreasing then increasing

159) $(\sqrt{x^4 y^2 z})(y^3 z)$
 $(x^{\frac{4}{2}} y^{\frac{2}{2}} z^{\frac{1}{2}})(y^3 z)$
 $(x^2 y^1 z^{\frac{1}{2}})(y^3 z^1) = x^2 y^4 z^{\frac{3}{2}}$

exponent root
 add exponents when multiplying the same base

160) *The y coordinate of the vertex is the max value. (2 ways to do this)

① *Find h → $-\frac{b}{2a}$

*Substitute h for x in the equation and solve for y. This y value is "k", the y coordinate of the vertex

$f(x) = -5x^2 + 20x - 3$
 $h = -\frac{b}{2a} = \frac{-20}{2(-5)} = \frac{-20}{-10}$
 $h = 2$

Plug in h for x:
 $y = -5(2)^2 + 20(2) - 3$
 $y = -5(4) + 40 - 3$
 $y = -20 + 40 - 3$
 $y = 20 - 3$
 $y = 17$

The max is the y-coordinate of the vertex (2, 17)

② Convert from standard to vertex form by completing the square. K is the y coordinate of the vertex.

$y = a(x-h)^2 + k$

$f(x) = -5x^2 + 20x - 3$
 $+3$
 $f(x) + 3 = -5x^2 + 20x$
 Divide out "a"
 $f(x) + 3 = -5(x^2 - 4x \quad)$
 Find the number needed to complete the square: $(\frac{b}{2})^2$

$f(x) + 3 = -5(x^2 + 4x + 4)$
 $(\frac{b}{2})^2 = 4$
 Because you pulled out -5, you must add -5(4) to the left
 $f(x) + 3 = -5(x^2 + 4x + 4)$
 -20
 $f(x) - 17 = -5(x+2)^2$
 $+17$
 $f(x) = -5(x+2)^2 + 17$
 K = max

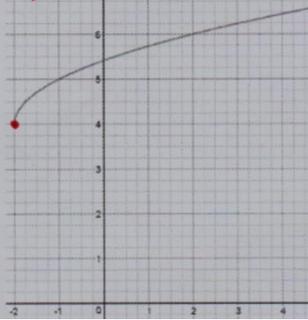
161) What is the equation for the graph? $y = \frac{1}{2}x + 3$

slope = $\frac{1}{2}$
 y-intercept = 3

162) What is the equation for the following exponential graph.

(Use transformation rules as compared to the parent function $f(x) = \sqrt{x}$)

$f(x) = \sqrt{x+2} + 4$



left 2
up 4

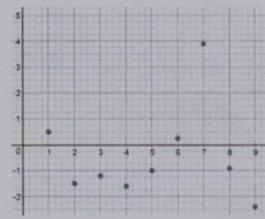
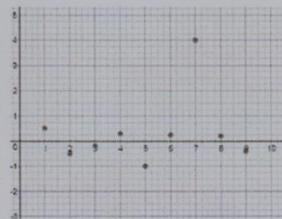
163) Complete the table to prove f(x) is a linear function.

x	0	1	2	3	4	5
f(x)	-8	4	16	28	40	52

+12
+24
+24
+12

Function 1

Function 2

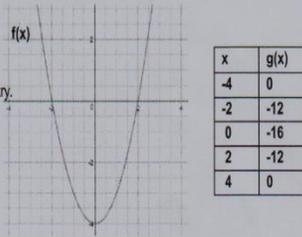


164) Select all that apply to the following residual plots

- Function 1 has smaller residuals than Function 2.
- Both functions show an outlier at $x = 7$
- Function 2 has smaller residuals than Function 1.
- Function 1 is a better fit for the data.
- Function 2 is a better fit for the data.

165) The graph and the table represent two quadratic functions $f(x)$ and $g(x)$. Which statement is true?

- Both $f(x)$ and $g(x)$ have $y = 0$ for the axis of symmetry.
- $f(x)$ has $x = -4$ and $g(x)$ has $x = -16$ for the axis of symmetry.
- Both $f(x)$ and $g(x)$ have $x = -4$ for the axis of symmetry.
- Both $f(x)$ and $g(x)$ have $x = 0$ for the axis of symmetry.



x	g(x)
-4	0
-2	-12
0	-16
2	-12
4	0

166) The graph shows the number of students enrolled in a particular high school each year since 2000. If the trend continues, what do you predict the enrollment to be in the year 2020?



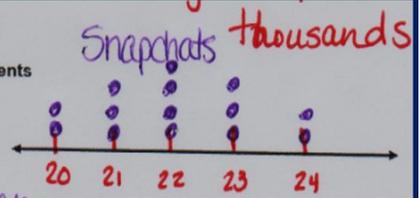
$y = 5x + 10$
 $y = 5(20) + 10$
 $y = 110$, but this is in thousands

Create a dot plot for the data set then answer the questions.

167) Snapchats Sent Per Day by Mrs. Cody's Students

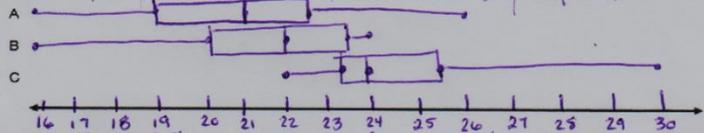
22 20 24 23 28 22 21
28 22 24 21 21 22 20

What is the mean? $\frac{22}{22}$
What is the median? $\frac{22}{22}$
Which measure of center is more appropriate? mean
What is the shape of distribution? normal distribution



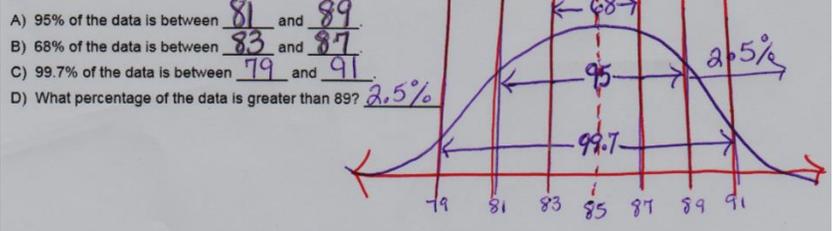
168) Construct a box plot for each set of data on the same number line.

Set A: 16, 18, 20, 21, 21, 22, 23, 26 Set B: 16, 20, 20, 21, 23, 23, 24, 24 Set C: 22, 23, 24, 24, 24, 25, 26, 30

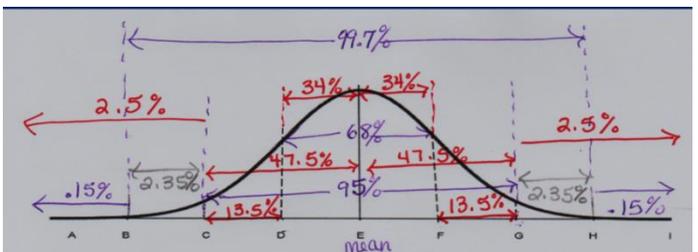


Set A: median 21 IQR 3.5 Shape of Distribution normal distribution
best measure of center mean best measure of spread standard deviation
Set B: median 22 IQR 3.5 Shape of Distribution skewed left
best measure of center median best measure of spread IQR
Set C: median 24 IQR 2 Shape of Distribution skewed right
best measure of center median best measure of spread IQR

169) For a particular normally distributed data set, the mean is 85 and the standard deviation is 2.



- A) 95% of the data is between 81 and 89
- B) 68% of the data is between 83 and 87
- C) 99.7% of the data is between 79 and 91
- D) What percentage of the data is greater than 89? 2.5%



- 170) What does E represent? mean
- 171) What percentage falls between D and F? 68%
- 172) What percentage falls between C and G? 95%
- 173) What percentage falls between B and H? 99.7%
- 174) What percentage is greater than H? 0.15%
- 175) What percentage falls between G and H? 2.35%

- 176) What percentage falls between F and H? 15.85%
- 177) What percentage falls between F and G? 13.5%
- 178) What percentage is greater than G? 2.5%
- 179) What percentage falls between G and E? 47.5%
- 180) What percentage falls between F and E? 34%
- 181) What percentage is less than D? 16%

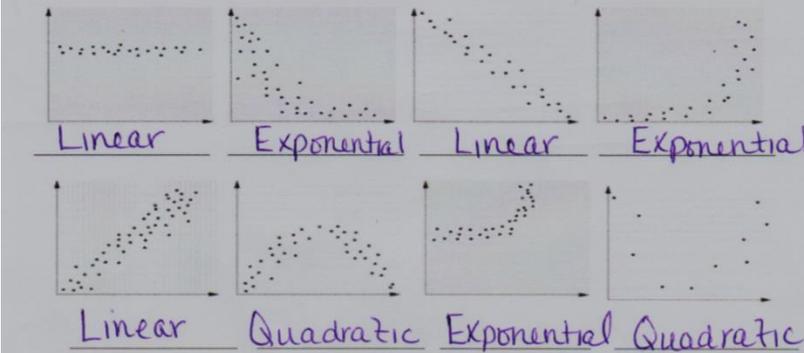
At Pace High School, 643 students were asked which radio station they listen to most often. 23 eleventh graders said they listen to WXBM. There were a total of 329 students who said they prefer WABD. Of the 255 twelfth graders, 31 of them listen to WXBM. There are 181 tenth graders at Pace High. Of the 246 TK101 listeners, 110 of them were 10th graders. There were 188 twelfth graders who listen to WABD. Fill in the table.

	WABD	WXBM	TK101	Total
10 th graders	57	14	110	181
11 th graders	84	23	100	207
12 th graders	188	31	36	255
Total	329	68	246	643

- 182) How many total students listen to WXBM? **68**
- 183) What is the joint frequency for 11th graders listening to WABD? **84**
- 184) What is the marginal frequency for all TK101 listeners? **246**
- 185) Which grade level has the most students? **12th**
- 186) List the highest marginal frequency. **329 - WABD listeners**
- 187) Interpret the marginal relative frequency for 12th grade students. $\frac{255}{643} \approx .397$
- 188) Interpret the conditional relative frequency for all 11th graders who listen to WXBM. $\frac{23}{207} \approx .111$
- 189) What percent of students prefer WABD? $\frac{329}{643} \approx 51.2\%$
- 190) How many students listen to WABD or WXBM? **329 + 68 = 397 students**
- 191) What type of frequency does $\frac{23}{68}$ represent? **conditional of WXBM listeners who are 11th graders**

Correlation Coefficient	Strength of Relationship	Positive or Negative Slope
192) 0.01	weak	positive
193) 1	perfect	positive
194) -0.85	strong	negative
195) -0.4	moderate	negative

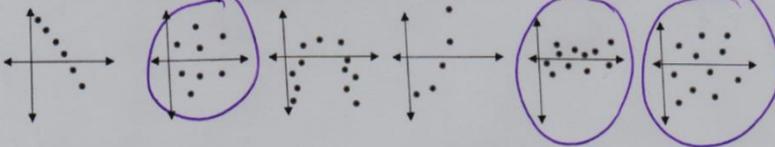
(#196-203) Match the function models to the scatter plots below. (Exponential, Quadratic, Linear)



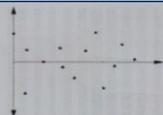
True or False?

- 204) **T** $r = a - p$
- 205) **T** Residuals are calculated by finding the difference between the actual y-value and the predicted y-value.
- 206) **F** When the best fit line for a set of data is linear, the residual plot will have a linear pattern.
- 207) **T** When the best fit function for a set of data is quadratic, the residual plot will have no distinct pattern.
- 208) **F** Residuals should either be all positive or all negative.
- 209) **T** Residual plots determine if a function is a good fit.

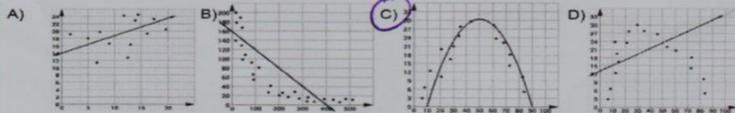
210) The following are residual plots that have been constructed from various scatter plots and their best fit lines. Circle the residual plots that indicate a best fit function.



Consider the following residual plot.



211) Which of the following scatterplots has a line of best fit that corresponds to this residual plot?

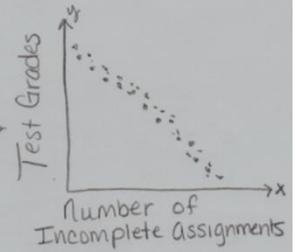


212) $r = -0.95$ **Strong negative Relationship**

Correlation coefficients only deal with linear relationships.

Possible graph

Strong, but not perfect



- 213) **✓** Goals and final score
X People swimming doesn't cause ice cream sales to increase
✓ More batteries are sold because of hurricane threats
X Eating potatoes doesn't cause banana sales to increase
✓ Absences cause grades to be lower

- 214) **✓** Correlation coefficients **DO** show the strength of the relationship between x and y.
— Correlation coefficients have nothing to do with the intercepts
✓ r is the variable used for correlation coefficients
— Negative and positive give the direct NOT the strength.
✓ $-1 \leq r \leq 1$

215) $da^4(4da^8)^{-5}$ 1) Raise everything in parentheses to the power of -5 (multiply exponents)

\downarrow

① $d^4 a^4 \cdot 4 d^{-5} a^{-40}$ ② Add exponents on the same base when you are multiplying.

\downarrow

② $d^{-4} a^{-36} 4^{-5}$ ③ Numbers should be first. Letters in alphabetical order

\downarrow

③ $4^{-5} a^{-36} d^{-4}$

\downarrow

④ $\frac{1}{4^5 a^{36} d^4}$ ④ Negative exponents should be moved to the denominator and become positive.

⑤ **$\frac{1}{1024 a^{36} d^4}$** ⑤ Simplify

216) $\frac{3g^2 h^4 \cdot 6g^2 h^4 \cdot 2g}{3g^{-3} h^3}$ ① Simplify the numerator. Multiply the numbers and add the exponents on each variable.

\downarrow

① $\frac{36g^5 h^8}{3g^{-3} h^3}$ ② Divide the numbers and subtract the exponents on each variable

\downarrow

② $12g^{5-(-3)} h^{8-3} = 12g^8 h^5$

217) $(3x^2y^{-4})^{-1}$

① Take everything in parentheses to the power of -1. (Multiply exponents)

② Negative exponents should be moved to the denominator with positive exponents

① $3^{-1}x^{-2}y^4$

② $\frac{y^4}{3x^2}$

222) $\sqrt{128} + \sqrt{72} - \sqrt{50} - \sqrt{2}$ ① Simplify all radicals

② Combine like terms.

$\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2} + \sqrt{2 \cdot 2 \cdot 2 \cdot 3} - \sqrt{2 \cdot 5 \cdot 5} - \sqrt{2}$

$8\sqrt{2} + 6\sqrt{2} - 5\sqrt{2} - \sqrt{2}$

$14\sqrt{2} - 5\sqrt{2} - \sqrt{2}$

$9\sqrt{2} - \sqrt{2} = 8\sqrt{2}$

218) $\sqrt[3]{216x^8}$ ① Take prime factorization of $216x^8$

② Because it is cubic root, circle all groups of 3 numbers or variables.

③ you can pull out $2 \cdot 3 \cdot x \cdot x$, and you are left with $x \cdot x$ under the radical.

④ Simplify

① $\sqrt[3]{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot x \cdot x}$

② $\sqrt[3]{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 3 \cdot x \cdot x}$

③ $2 \cdot 3 \cdot x \cdot x \sqrt[3]{x \cdot x}$

④ $6x^2 \sqrt[3]{x^2}$

223) $-5\sqrt{5} - (\sqrt{20} - \sqrt{45})$ ① Distribute the understood -1 throughout the parenthesis

② Simplify radicals

③ Combine like terms.

① $-5\sqrt{5} - \sqrt{20} + \sqrt{45}$

② $-5\sqrt{5} - \sqrt{2 \cdot 2 \cdot 5} + \sqrt{3 \cdot 3 \cdot 5}$

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

$-7\sqrt{5} + 3\sqrt{5}$

$-4\sqrt{5}$

219) $\sqrt{84a^7b^2}$

① Prime factorization

② Because it is square root, circle groups of 2 numbers or variables

③ you can pull out $2 \cdot a \cdot a \cdot b$, and you are left with $3 \cdot 7 \cdot a$ under the radical

④ Simplify

① $\sqrt{2 \cdot 2 \cdot 3 \cdot 7 \cdot a \cdot a \cdot a \cdot a \cdot a \cdot b \cdot b}$

② $\sqrt{2 \cdot 2 \cdot 3 \cdot 7 \cdot a \cdot a \cdot a \cdot a \cdot a \cdot b \cdot b}$

③ $2 \cdot a \cdot a \cdot b \sqrt{3 \cdot 7 \cdot a}$

④ $2a^3b\sqrt{21a}$

224) $\sqrt{108} - \sqrt{12}$ ① Simplify radicals

② Combine like terms

① $\sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 3} - \sqrt{2 \cdot 2 \cdot 3}$

$6\sqrt{3} - 2\sqrt{3}$

② $4\sqrt{3}$

220) $\sqrt{325m^3n^2}$ ① Prime factorization

② Circle groups of 2 numbers or variables

③ you can pull out $5 \cdot m \cdot n$, and $13 \cdot m$ will be left under the radical.

④ Simplify

① $\sqrt{5 \cdot 5 \cdot 13 \cdot m \cdot m \cdot m \cdot n \cdot n}$

② $\sqrt{5 \cdot 5 \cdot 13 \cdot m \cdot m \cdot m \cdot n \cdot n}$

③ $5 \cdot m \cdot n \sqrt{13 \cdot m}$

④ $5mn\sqrt{13m}$

225) $\sqrt[3]{24} - \sqrt[3]{81}$ ① Simplify radicals (groups of 3 numbers or letters)

② Combine like terms

① $\sqrt[3]{2 \cdot 2 \cdot 2 \cdot 3} - \sqrt[3]{3 \cdot 3 \cdot 3 \cdot 3}$

$2\sqrt[3]{3} - 3\sqrt[3]{3}$

② $-\sqrt[3]{3}$

22) Simplified form is $3xy^2\sqrt[3]{xy^2}$ to find the original term work backwards.

① In order to pull out a 3, there must have been 3 of them under the radical

② In order to pull out an x, there must have been 3 more under the radical.

③ In order to pull out 2 y's there must have been 2 groups of 3 y's under the radical (6 of them) in addition to what you couldn't pull out.

So $\sqrt[3]{3 \cdot 3 \cdot 3 \cdot x \cdot x \cdot x \cdot y \cdot y}$

Simplify: $\sqrt[3]{27x^4y^8}$

226) $\sqrt{5} \cdot \sqrt{15}$ ① Find the prime factorization of each radical and combine them together under the same radical sign

② Simplify

① $\sqrt{5} \cdot \sqrt{3 \cdot 5}$

$\sqrt{3 \cdot 5 \cdot 5}$

② $5\sqrt{3}$

227) $3\sqrt{15} \cdot 2\sqrt{6}$ ① Find the prime factorization of each radical

② Combine the prime factorizations under one radical sign. Multiply the out side numbers together.

③ Simplify

① $3\sqrt{3 \cdot 5} \cdot 2\sqrt{2 \cdot 3}$

② $3 \cdot 2 \sqrt{2 \cdot 3 \cdot 3 \cdot 5}$

③ $3 \cdot 2 \cdot 3 \sqrt{2 \cdot 5}$

$18\sqrt{10}$

228) $(\sqrt{2} + 3\sqrt{7})(\sqrt{2} - 3\sqrt{7})$ * To multiply 2 binomials, use the box method.

	$\sqrt{2}$	$+3\sqrt{7}$
$\sqrt{2}$	$\sqrt{2} \cdot \sqrt{2} = \sqrt{4}$ 2	$\sqrt{2} \cdot 3\sqrt{7} = 3\sqrt{14}$ $+3\sqrt{14}$
$-3\sqrt{7}$	$\sqrt{2} \cdot 3\sqrt{7} = -3\sqrt{14}$ $-3\sqrt{14}$	$-3\sqrt{7} \cdot 3\sqrt{7} = -9\sqrt{49}$ $-9 \cdot 7$ -63

- ① Box method $2 + 3\sqrt{14} - 3\sqrt{14} - 63$
 ② Combine like terms $2 - 63 = -61$

229) $(5 - 2\sqrt{3})(7 - 2\sqrt{3})$ * To multiply binomials, use the box method.

	5	$-2\sqrt{3}$
7	$7(5) = 35$ $+35$	$7(-2\sqrt{3}) = -14\sqrt{3}$ $-14\sqrt{3}$
$-2\sqrt{3}$	$5(-2\sqrt{3}) = -10\sqrt{3}$ $-10\sqrt{3}$	$-2\sqrt{3}(-2\sqrt{3}) = 4\sqrt{9}$ $4 \cdot 3$ $+12$

- ① Use box method $35 - 14\sqrt{3} - 10\sqrt{3} + 12$
 ② Combine like terms $47 - 24\sqrt{3}$ or $-24\sqrt{3} + 47$

230) $(\sqrt{ab} + 1)^2$ means $(\sqrt{ab} + 1)(\sqrt{ab} + 1)$ * Use box method

	\sqrt{ab}	$+1$
\sqrt{ab}	$\sqrt{ab}(\sqrt{ab}) = \sqrt{a \cdot a \cdot b \cdot b}$ ab	$1(\sqrt{ab}) = +1\sqrt{ab}$
$+1$	$1(\sqrt{ab}) = +1\sqrt{ab}$	$1(1) = 1$

- ① Box Method $ab + 1\sqrt{ab} + 1\sqrt{ab} + 1$
 ② Combine like terms $ab + 2\sqrt{ab} + 1$