# *Placement Test – Level III– Answer Key*

**Directions:** Each problem is worth one point. When you are done grading, add the points for the number of correct answers together. If you scored from 0 – 39, then you placed into Intermediate Algebra. If you scored from 40 – 60, then you placed into either College Algebra, Algebra and Trigonometry, or Precalculus. Which of these courses you choose is dependent on your intended college major. Please see the website for more details.

1. Solve. $8[-12 + 4(3x - 7)] = 9[5(x - 2) - 6(3x - 1)]$

$$8[-12+12x-28] = 9[5x-10-18x+6]$$

$$8[12x-40] = 9[-13x-4]$$

$$96x-320 = -117x-36$$

$$+117x+320 \qquad +117x+320$$

$$\frac{213x}{213} = \frac{284}{213}$$

$$x = \frac{\cancel{284}^{4}}{\cancel{213}_{3}}$$

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

2. Find three consecutive odd integers whose sum is -243.

let $x$ = the first odd integer

$x+2$ = the next odd integer

$x+4$ = the third odd integer

$$x+x+2+x+4=-243$$

$$3x+6=-243$$

$$-6 \qquad -6$$

$$\frac{3x}{3} = \frac{-249}{3}$$

$$x=-83$$

$$x+2=-83+2$$
$$=-81$$

$$x+4=-83+4$$
$$=-79$$

$$\boxed{-79, -81, -83}$$

3. Solve the formula $A = \frac{1}{2}h(b_1 + b_2)$ $for\ b_2$.

$2(A) = \left(\frac{1}{2}h(b_1+b_2)\right)2$

$2A = h(b_1+b_2)$

$2A = hb_1 + hb_2$

$-hb_1 \quad -hb_1$

$2A - hb_1 = hb_2$

$\frac{2A - hb_1}{h} = \frac{hb_2}{h}$

$\boxed{\frac{2A - hb_1}{h} = b_2}$

or

$\boxed{\frac{2A}{h} - b_1 = b_2}$

4. Harry is making 15 pounds of nut mixture with cashews and almonds. The cashews cost \$6 per pound and the almonds cost \$4.50 per pound. How many pounds of each should Harry use for the mixture to cost \$5.40 per pound?

let x = the number of pounds of cashews
y = the number of pounds of almonds

1. $x + y = 15$
2. $6x + 4.50y = (15)(5.40)$

1. $x + y = 15$
$-x \quad -x$
$y = 15 - x$

$6x + 4.50(15 - x) = 81$

$6x + 67.5 - 4.50x = 81$

$1.50x + 67.5 = 81$
$-67.5 \quad -67.5$

$\frac{1.50x}{1.50} = \frac{13.50}{1.50}$

$\boxed{x = 9 \text{ lbs. of cashews}}$

$y = 15 - 9$

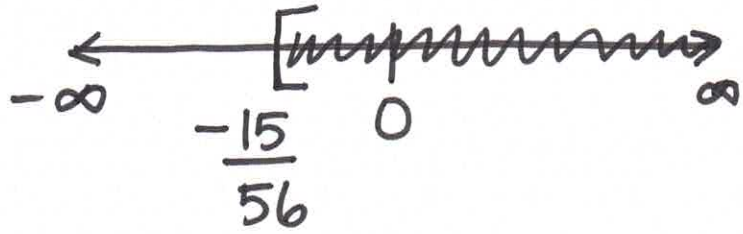
$\boxed{y = 6 \text{ pounds of almonds}}$

5. Solve, graph the solution on a number line, and write the solution in interval notation.

$$-\frac{8}{5}x \le \frac{3}{7}$$

$$\left(\frac{5}{-8}\right)\left(-\frac{8}{5}x\right) \le \left(\frac{3}{7}\right)\left(\frac{5}{-8}\right)$$

$$x \ge \frac{15}{-56}$$




$$\boxed{\left[-\frac{15}{56}, \infty\right)}$$

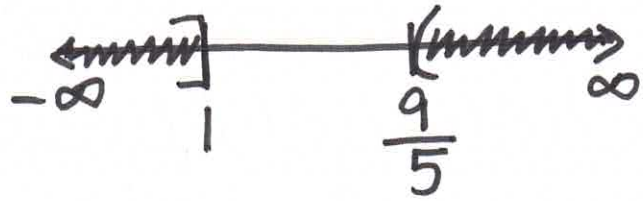
6. Solve, graph the solution on a number line, and write the solution in interval notation.

$$5x - 3 > 6 \quad or \quad 4x - 1 \le 3$$

$$+3 \quad +3 \qquad +1 \quad +1$$

$$\frac{5x}{5} > \frac{9}{5} \qquad \frac{4x}{4} \le \frac{4}{4}$$

$$x > \frac{9}{5} \quad \text{or} \quad x \le 1$$




$$\boxed{(-\infty, 1] \cup \left(\frac{9}{5}, \infty\right)}$$

7. Solve. $|4x - 3| + 7 = 12$

$$-7 \quad -7$$

$$|4x-3| = 5$$

$$4x - 3 = 5 \quad \text{or} \quad 4x - 3 = -5$$

$$+3 \quad +3 \qquad +3 \quad +3$$

$$\frac{4x}{4} = \frac{8}{4} \qquad \frac{4x}{4} = \frac{-2}{4}$$

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

8. Graph the line. $4x + 2y = 8$

| x | y |
|---|---|
| 0 | 4 |
| 2 | 0 |

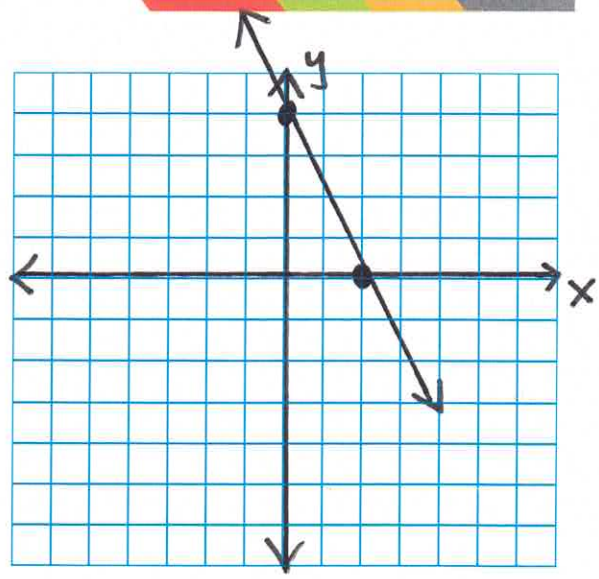
$\underline{x=0}$: $4(0)+2y=8$

$\frac{\cancel{2}y}{\cancel{2}}=\frac{8}{2}$

$y=4$

$\underline{y=0}$: $4x+2(0)=8$

$\frac{\cancel{4}x}{\cancel{4}}=\frac{8}{4}$ $\rightarrow x=2$




9. Identify the slope and y-intercept of the line. $7x + 3y = 9$

$\cancel{7x}+3y=9$

$-\cancel{7x}$ $\quad -7x$

$\frac{\cancel{3}y}{\cancel{3}}=\frac{-7x}{3}+\frac{9}{3}$

$y=-\frac{7}{3}x+3$

$y=-\frac{7}{3}x+3$

$\boxed{m=\frac{-7}{3}}$ $b=3$

$\boxed{\text{y-intercept: } (0,3)}$

10. Find the equation of the line passing through the given points. The slope formula is: $m = \frac{y_2-y_1}{x_2-x_1}$. The point-slope equation is: $y - y_1 = m(x - x_1)$.

(-3, -1) and (4, 7)

$x_1$ $y_1$ $\quad x_2$ $y_2$

$m=\frac{7-(-1)}{4-(-3)}$

$m=\frac{8}{7}$

$y-(-1)=\frac{8}{7}(x-(-3))$

$y+1=\frac{8}{7}(x+3)$

$y+\cancel{1}=\frac{8}{7}x+\frac{24}{7}$

$\cancel{-1}$ $\quad -1$

$y=\frac{8}{7}x+\frac{24}{7}-\frac{1}{1}\cdot\frac{7}{7}$

$y=\frac{8}{7}x+\frac{24}{7}-\frac{7}{7}$

$\boxed{y=\frac{8}{7}x+\frac{17}{7}}$

11. Determine whether the ordered pair is a solution to the inequality:

$y > x - 4$ ; $(-5, -6)$

x y

$-6 > -5 - 4$

$-6 > -9$

True $\Rightarrow$ $\boxed{\text{Yes, } (-5,-6) \text{ is a solution}}$

12. Determine the domain and range of the given relation.

$\{(2,5),(4,9),(5,12),(7,13),(8,20)\}$

<u>Domain</u>: $\{2,4,5,7,8\}$

<u>Range</u>: $\{5,9,12,13,20\}$

13. Graph the function. $f(x) = \sqrt{x-3}$

$x - 3 \geq 0$

$+3 \quad +3$

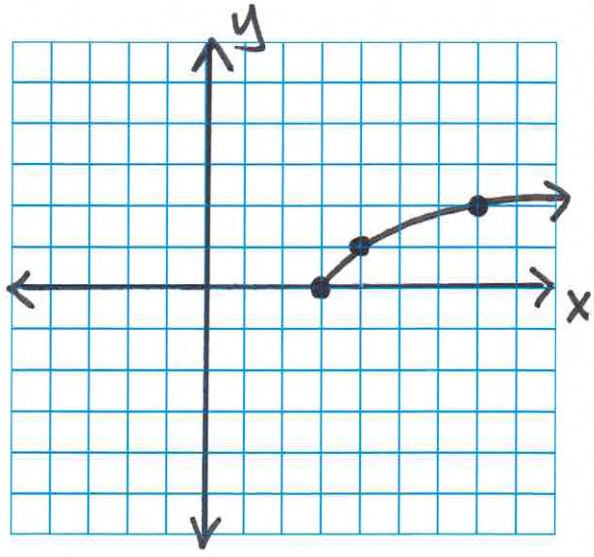
$x \geq 3$

| x | f(x) |
|---|---|
| 3 | 0 |
| 4 | 1 |
| 7 | 2 |

$f(3) = \sqrt{3-3}$
$= \sqrt{0}$
$= 0$

$f(4) = \sqrt{4-3}$
$= \sqrt{1}$
$= 1$

$f(7) = \sqrt{7-3}$
$= \sqrt{4}$
$= 2$



14. Solve the system of equations. ① $5x + 3y = 11$
② $-3x + y = -1$

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

$5x + 3(3x - 1) = 11$
$5x + 9x - 3 = 11$
$14x - 3 = 11$
$+3 \quad +3$
$14x = 14$

$\frac{14x}{14} = \frac{14}{14}$
$\boxed{x = 1}$

$y = 3x - 1$
$y = 3(1) - 1$
$y = 3 - 1$
$\boxed{y = 2}$

$\boxed{(1, 2)}$

15. The difference of two complementary angles is 28 degrees. Find the measure of the angles.

let x = the measure of the first angle
y = the measure of the other angle

① $x + y = 90°$
② $x - y = 28°$

$x + y = 90°$
$+ \quad x - y = 28°$

$\frac{2x}{2} = \frac{118°}{2}$
$\boxed{x = 59°}$

$x + y = 90°$
$59° + y = 90°$
$-59° \quad -59°$
$\boxed{y = 31°}$

16. Sophia is preparing 15 liters of a 20% saline solution. She has only 35% and 15% solutions in her lab. How many liters of the 35% and 15% solutions must be mixed to make the 20% solution?

let $x$ = number of liters of 15% solution
$y$ = number of liters of 35% solution

① $x+y=15$

② $.15x+.35y=(.20)(15)$

$x+y=15$
$-x \quad -x$
$y=15-x$

$.15x+.35(15-x)=3$

$.15x+5.25-.35x=3$

$-0.20x+5.25=3$

$-5.25 \quad -5.25$

$\frac{-0.20x}{-0.20}=\frac{-2.25}{-0.20}$

$\boxed{x=11.25\text{ L}}$

$y=15-x$

$y=15-11.25$

$\boxed{y=3.75\text{ L}}$

17. Solve the system by graphing. ① $y \geq -2x+5$ ② $y < x-1$

① $y \geq -2x+5$
$m=-2 \quad b=5$
$(0,5)$

Test: $(0,0)$

$0 \geq -2(0)+5$

$0 \geq 5$

False

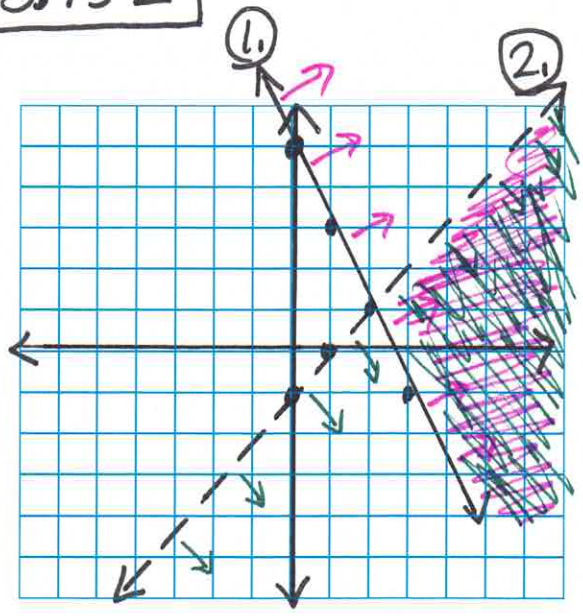
② $y < x-1$
$m=1 \quad b=-1$
$(0,-1)$

Test: $(0,0)$

$0 < 0-1$

$0 < -1$

False



18. A boy drops a ball off a 100-foot cliff into the ocean. The polynomial $h(t) = -16t^2 + 100$ gives the height of the ball, in feet, t seconds after it is was dropped. Find the height after t = 2 seconds.

$$h(2) = -16(2)^2 + 100$$
$$= -16(4) + 100$$
$$= -64 + 100$$
$$= \boxed{36 \text{ feet high}}$$

19. Simplify. $\left(\frac{3x^2y^{-3}}{2z^4}\right)^2 = \frac{3^2(x^2)^2(y^{-3})^2}{2^2(z^4)^2}$

$$= \frac{9x^4y^{-6}}{4z^8} = \boxed{\frac{9x^4}{4y^6z^8}}$$

20. Multiply. $(2x^2 - 7)(9x^2 + 3x - 1)$

$$= 18x^4 + 6x^3 - 2x^2 - 63x^2 - 21x + 7$$
$$= \boxed{18x^4 + 6x^3 - 65x^2 - 21x + 7}$$

21. Divide. $(y^3 - 343) \div (y - 7)$ $= \boxed{y^2+7y+49}$

$$
\begin{array}{r}
y^2 + 7y + 49 \\
y-7 \overline{\big) \cancel{y^3} + 0y^2 + 0y - 343} \\
y^2(y-7) \rightarrow \underline{-\cancel{y^3} \pm 7y^2} \\
7\cancel{y^2} + 0y - 343 \\
7y(y-7) \rightarrow \underline{-\cancel{7y^2} \pm 49y} \\
49\cancel{y} - 343 \\
49(y-7) \rightarrow \underline{-\cancel{49y} \pm \cancel{343}} \\
0
\end{array}
$$

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

$\frac{7y^2}{y} = 7y$

$\frac{49y}{y} = 49$

22. Factor. $\underbrace{xy - 5y} - \underbrace{x^2 + 5x}$

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

$= \boxed{(x-5)(y-x)}$

23. Factor. $18x^2 - 37xy + 15y^2$

$= \boxed{(9x-5y)(2x-3y)}$

24. Factor. The difference of cubes formula is: $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$.

$27x^3 - 125y^3$

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

$a = 3x \quad b = 5y$

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

$= \boxed{(3x - 5y)(9x^2 + 15xy + 25y^2)}$

25. Factor. $60x^2y - 75xy + 30y$

$= \boxed{15y(4x^2 - 5x + 2)}$

26. Solve. $3x^2 + 8x = 9 + 2x$

$3x^2 + 8x = 9 + 2x$

$-2x - 9 \quad -9 - 2x$

$3x^2 + 6x - 9 = 0$

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

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

$x - 1 = 0 \quad x + 3 = 0$

$+1 \; +1 \quad -3 \; -3$

$\boxed{x = 1} \quad \boxed{x = -3}$

27. Multiply. $\frac{5x^2-180}{10x^2-10} \cdot \frac{20x+20}{2x-12}$ $= \frac{5(x^2-36)}{10(x^2-1)} \cdot \frac{20(x+1)}{2(x-6)}$

$= \frac{5\cancel{(x-6)}(x+6)}{\cancel{10}(x-1)\cancel{(x+1)}} \cdot \frac{\cancel{20}\cancel{(x+1)}}{\cancel{2}\cancel{(x-6)}}$

$= \boxed{\frac{5(x+6)}{x-1}}$

28. Add. $\frac{6}{y^2+12y+35} + \frac{3y}{y^2+y-42}$

$(y+5)(y+7) \quad (y-6)(y+7)$

LCD: $(y+5)(y-6)(y+7)$

$= \frac{6}{(y+5)(y+7)} \cdot \frac{(y-6)}{(y-6)} + \frac{3y}{(y-6)(y+7)} \cdot \frac{(y+5)}{(y+5)}$

$= \frac{6(y-6)+3y(y+5)}{(y+5)(y+7)(y-6)}$

$= \frac{6y-36+3y^2+15y}{(y+5)(y+7)(y-6)}$

$= \boxed{\frac{3y^2+21y-36}{(y+5)(y+7)(y-6)}}$ or $\boxed{\frac{3(y^2+7y-6)}{(y+5)(y+7)(y-6)}}$

29. Simplify. $\left(\dfrac{\frac{3}{x}+\frac{1}{2x}}{\frac{1}{3x}-\frac{3}{4x}}\right)\left(\dfrac{12x}{12x}\right) = \dfrac{12\cancel{x}\left(\frac{3}{\cancel{x}}\right)+\cancel{12}^{6}\cancel{x}\left(\frac{1}{\cancel{12}_{1}\cancel{x}}\right)}{\cancel{12}^{4}\cancel{x}\left(\frac{1}{\cancel{3}_{1}\cancel{x}}\right)-\cancel{12}^{3}\cancel{x}\left(\frac{3}{\cancel{4}_{1}\cancel{x}}\right)}$

LCD: $12x$

$$= \frac{36+6}{4-9}$$

$$= \boxed{\frac{42}{-5}}$$

30. Solve. $\dfrac{4}{x-3}+\dfrac{2x}{x^2-9}=\dfrac{1}{x+3}$ $\leftarrow x \neq -3,\ x \neq 3$

$(x-3)(x+3)$

LCD: $(x-3)(x+3)$

$(x-3)(x+3)$

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

$$\cancel{(x-3)}(x+3)\left(\frac{4}{\cancel{x-3}}\right)+\cancel{(x-3)}\cancel{(x+3)}\left(\frac{2x}{\cancel{(x-3)}\cancel{(x+3)}}\right)=\left(\frac{1}{\cancel{x+3}}\right)(x-3)\cancel{(x+3)}$$

$$4(x+3)+2x=1(x-3)$$
$$4x+12+2x=x-3$$
$$6x+12=x-3$$
$$-x-12 \quad -x-12$$
$$5x=-15$$

$$\frac{5x}{5}=\frac{-15}{5}$$
$$x=-3$$

But $x$ cannot equal $-3$ here, so $\boxed{\text{no solution}}$.

31. Bobby can weed the garden in 6 hours, while his wife can do it in 4 hours. How long would it take them if they worked together?

let $t$ = the time it takes if they work together

$$\frac{t}{6}+\frac{t}{4}=1$$

LCD: 12

$$12\left(\frac{t}{6}+\frac{t}{4}\right)=(1)(12)$$

$$\cancel{12}^{2}\left(\frac{t}{\cancel{6}_{1}}\right)+\cancel{12}^{3}\left(\frac{t}{\cancel{4}_{1}}\right)=12$$

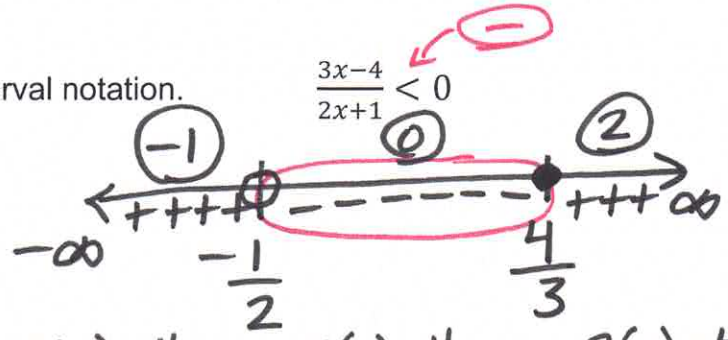
$$2t+3t=12$$

$$\frac{\cancel{5}t}{\cancel{5}}=\frac{12}{5}$$

$$\boxed{t=2\tfrac{2}{5}\text{ hours}}$$

32. Solve and write the solution in interval notation. $\frac{3x-4}{2x+1}<0$

$$3x-\cancel{4}=0 \qquad 2x+\cancel{1}=0$$
$$\underline{+\cancel{4}}\ \underline{+4} \qquad \underline{-\cancel{1}}\ \underline{-1}$$
$$\frac{\cancel{3}x}{\cancel{3}}=\frac{4}{3} \qquad \frac{\cancel{2}x}{\cancel{2}}=\frac{-1}{2}$$
$$x=\frac{4}{3} \qquad x=-\frac{1}{2}$$




$$\frac{3(-1)-4}{2(-1)+1}=\frac{-7}{-1}=7 \qquad \frac{3(0)-4}{2(0)+1}=-4 \qquad \frac{3(2)-4}{2(2)+1}=\frac{6-4}{5}=\frac{2}{5}$$

$$\boxed{\left(-\frac{1}{2},\frac{4}{3}\right]}$$

33. Simplify. $-\sqrt{392x^5y^6}$

392
- 49 → $7^2$
- 8
  - 2
  - 4 → $2^2$

$$=-\sqrt{2\cdot2^2\cdot7^2\cdot x^2\cdot x^2\cdot x\cdot y^2\cdot y^2\cdot y^2}$$

$$=-2\cdot7\cdot x\cdot x\cdot y\cdot y\cdot y\sqrt{2x}$$

$$=\boxed{-14x^2y^3\sqrt{2x}}$$

34. Simplify. $\sqrt[3]{\frac{16x^5y^4}{250xy}} = \sqrt[3]{\frac{\cancel{16}^{8}\, x^{\cancel{5}4}\, y^{\cancel{4}3}}{\cancel{250}_{125}\, \cancel{x}\, \cancel{y}}} = \sqrt[3]{\frac{8x^4y^3}{125}}$

$$= \frac{\sqrt[3]{2^3 \cdot x \cdot x^3 \cdot y^3}}{\sqrt[3]{5^3}}$$

$$= \boxed{\frac{2xy\sqrt[3]{x}}{5}}$$

35. Simplify. $81^{\frac{1}{4}} = (3^4)^{\frac{1}{4}}$

$$= 3^{4 \cdot \frac{1}{4}} = \boxed{3}$$

36. Multiply and simplify. $(2\sqrt{5}-3)(\sqrt{5}+4)$

$$= 2\sqrt{25} + 8\sqrt{5} - 3\sqrt{5} - 12$$

$$= 2(5) + 5\sqrt{5} - 12$$

$$= 10 + 5\sqrt{5} - 12$$

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

37. Rationalize the denominator. $\frac{4}{\sqrt[3]{9x^2}}$

Goal: $\sqrt[3]{3^3x^3}$

$$= \frac{4}{\sqrt[3]{3^2x^2}} \cdot \frac{\sqrt[3]{3x}}{\sqrt[3]{3x}}$$

$$= \frac{4\sqrt[3]{3x}}{\sqrt[3]{3^3x^3}}$$

$$= \boxed{\frac{4\sqrt[3]{3x}}{3x}}$$

38. Solve. $\sqrt{x+4}+2=x$

$$-2 \quad -2$$

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

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

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

$$-x-4 \quad -x-4$$

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

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

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

$$+5 \quad +5$$

$$\boxed{x=5}$$

Check:

$x=0$: $\sqrt{0+4}+2=0$

$\sqrt{4}+2=0$

$2+2=0$

$4=0$ ✗

$x=5$: $\sqrt{5+4}+2=5$

$\sqrt{9}+2=5$

$3+2=5$

$5=5$ ✓

39. Find the domain of the function and write the domain in interval notation.

$f(x)=\sqrt{5x-7}$

$5x-7\geq 0$

$\frac{5x}{5}\geq\frac{7}{5}$

$x\geq\frac{7}{5}$

$\boxed{\text{Domain: } \left[\frac{7}{5},\infty\right)}$

40. Multiply and simplify. $(4-9i)(3+7i)$

$=12+28i-27i-63i^2$

$=12+i-63(-1)$

$=12+i+63$

$=\boxed{75+i}$

41. Solve by completing the square. $z^2 + 4z = -12$

$z^2+4z=-12$

$b=4$

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

$(2)^2=4$

$z^2+4z+4=-12+4$

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

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

$z+2=\pm 2i\sqrt{2}$

$-2 \quad -2$

$\boxed{z=-2\pm 2i\sqrt{2}}$

42. Solve using the Quadratic Formula. The Quadratic Formula is: $x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$.

$x^2 - 2x = 198$

$x^2-2x-198=0$

$a=1 \quad b=-2 \quad c=-198$

$x=\frac{-(-2)\pm\sqrt{(-2)^2-4(1)(-198)}}{2(1)}$

$x=\frac{2\pm\sqrt{4+792}}{2}$

$x=\frac{2\pm\sqrt{796}}{2}$

$x=\frac{2\pm\sqrt{4\cdot 199}}{2}$

$x=\frac{2\pm 2\sqrt{199}}{2}$

$\boxed{x=1\pm\sqrt{199}}$

43. Solve. $2x^4 - 11x^2 + 12 = 0$

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

$2x^2-3=0$

$2x^2=3$

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

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

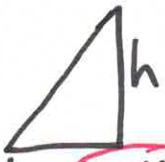
$\boxed{x=\pm\frac{\sqrt{6}}{2}}$

$x^2-4=0$

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

$\boxed{x=\pm 2}$

44. The base of a triangular sail is 4 feet less than the height. The area is 96 square feet. Find the base and height of the sail. The area of a triangle is: $A = \frac{1}{2}bh$.




$A = \frac{1}{2}bh$

$b = h-4$

$96 = \frac{1}{2}h(h-4)$

$2(96) = \left(\frac{1}{2}h^2 - 2h\right)2$

$192 = h^2 - 4h$

$h^2 - 4h = 192$

$-192 \quad -192$

$h^2 - 4h - 192 = 0$

$(h+12)(h-16) = 0$

$h+12=0 \quad h-16=0$

$h = \cancel{-12} \quad \boxed{h = 16 \text{ ft.}}$

$b = h-4$

$b = 16-4$

$\boxed{b = 12 \text{ ft.}}$

45. Find the maximum or minimum value of the function. $f(x) = -x^2 - 8x - 10$

$a=-1 \quad b=-8$

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

$x = -4$

$f(-4) = -(-4)^2 - 8(-4) - 10$

$= -16 + 32 - 10$

$= 6$

$\boxed{\text{Maximum at } y=6}$

46. Graph the quadratic using transformations. $f(x) = 3(x-4)^2 + 1$

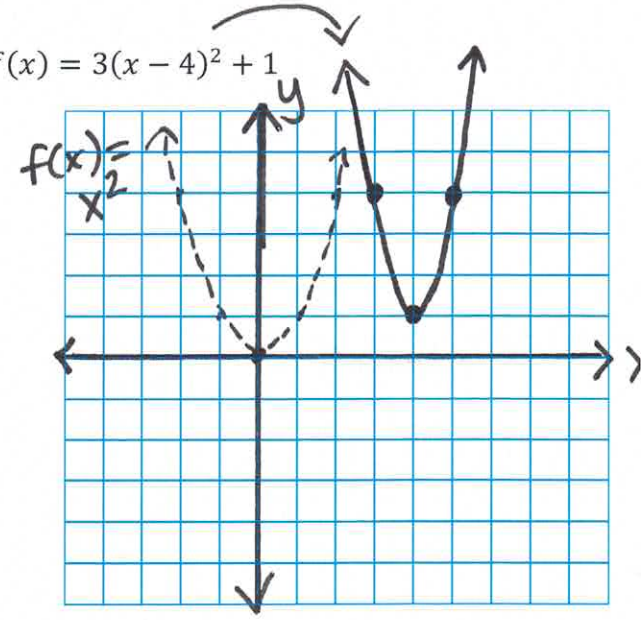
$f(x) = 3(x-4)^2 + 1$

y by 3 right 4 up 1

Key: $(-2,4)(-1,1)(0,0)(1,1)(2,4)$

y by 3: $(-2,12)(-1,3)(0,0)(1,3)(2,12)$

right 4, up 1



47. Solve the inequality and write the solution in interval notation.

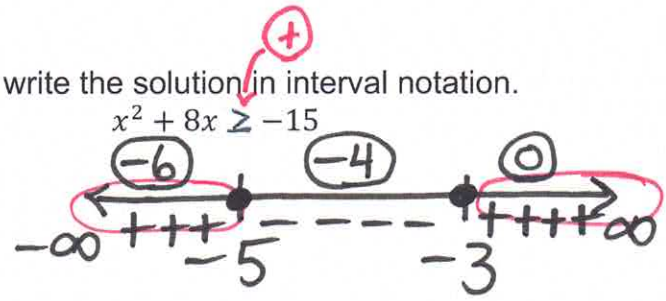
$x^2 + 8x \geq -15$

$x^2+8x+15 \geq 0$

$(x+3)(x+5)=0$

$x+3=0 \quad x+5=0$

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




$(-6)^2+8(-6)+15$
$= 36-48+15$
$= 3$

$(-4)^2+8(-4)+15$
$= 16-32+15$
$= -1$

$0^2+8(0)+15$
$= 15$

$\boxed{(-\infty,-5] \cup [-3,\infty)}$

48. For the functions $f(x) = 3x^2 + 4$ *and* $g(x) = 7x - 2$, find $(f \circ g)(x)$.

$f(g(x)) = 3(7x-2)^2+4$

$= 3(7x-2)(7x-2)+4$

$= 3(49x^2-28x+4)+4$

$= 147x^2-84x+12+4$

$= \boxed{147x^2-84x+16}$

49. Solve. $3^{2x-1} = 81$

$3^{2x-1} = 3^4$

$2x-1=4$

$2x=5$

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

50. Find the exact value of the logarithm without using a calculator.

$log_{\frac{1}{5}}25$

$\log_{\frac{1}{5}} 25 = x$

$\left(\frac{1}{5}\right)^x = 25$

$(5^{-1})^x = 5^2$

$5^{-x} = 5^2$

$-x = 2$

$\boxed{x = -2}$

51. Use the properties of logarithms to condense the logarithm. Simplify if possible.

$2log_3 7 + log_3(x-1)$

$= \log_3 7^2 + \log_3(x-1)$

$= \log_3 49 + \log_3(x-1)$

$= \boxed{\log_3 49(x-1)}$

52. Solve. $e^x = 9$

$\ln e^x = \ln 9$

$x \ln e = \ln 9$

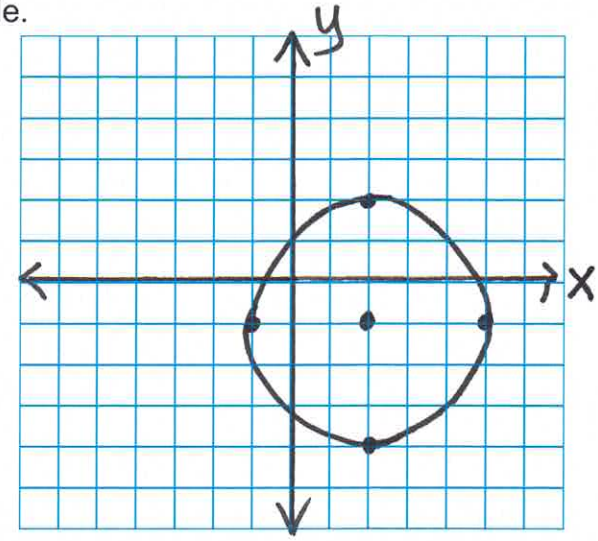
$\boxed{x = \ln 9}$ ← exact

$\boxed{x \approx 2.197}$ ← approximate

53. Identify the center and radius and then graph the circle.
$(x-2)^2+(x+1)^2=9$

center: $(2,-1)$

radius: $r=3$




54. Graph. $\frac{x^2}{16}+\frac{4y^2}{16}=\frac{16}{16}$

$\frac{x^2}{16}+\frac{y^2}{4}=1$

Ellipse; major axis is horizontal

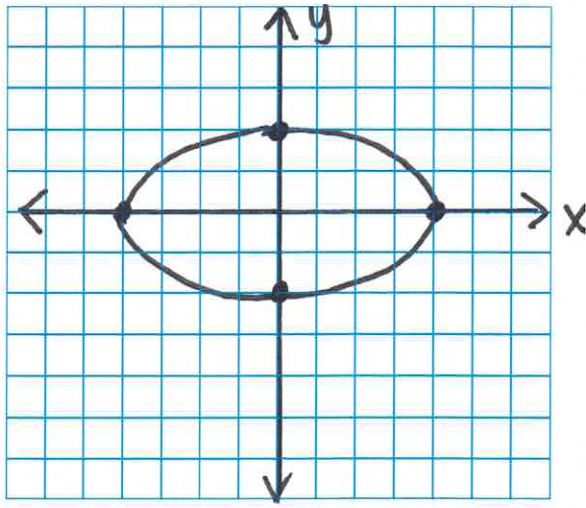
$a^2=16 \quad b^2=4$

$a=\pm 4 \quad b=\pm 2$

center: $(0,0)$

vertices: $(-4,0)$ $(4,0)$

minor axis: $(0,2)$ $(0,-2)$

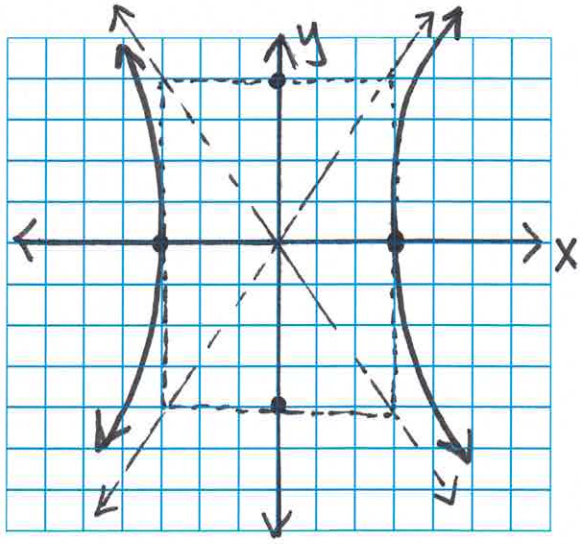



55. Graph. $\frac{x^2}{9}-\frac{y^2}{16}=1$

$a^2=9 \quad b^2=16$ TA is x-axis

$a=\pm 3 \quad b=\pm 4$

vertices: $(-3,0)$ $(3,0)$



56. Write the first five terms of the sequence whose general term is given.

$$a_n = 3n - 5$$

$a_1 = 3(1) - 5 = 3 - 5 = -2$

$a_2 = 3(2) - 5 = 6 - 5 = 1$

$a_3 = 3(3) - 5 = 9 - 5 = 4$

$a_4 = 3(4) - 5 = 12 - 5 = 7$

$a_5 = 3(5) - 5 = 15 - 5 = 10$

$\boxed{-2, 1, 4, 7, 10}$

57. Write the first five terms of the arithmetic sequence with the given first term and common difference. $a_1 = 10 \ and \ d = 4$

$a_1 = 10$

$a_2 = 10 + 4 = 14$

$a_3 = 14 + 4 = 18$

$a_4 = 18 + 4 = 22$

$a_5 = 22 + 4 = 26$

$\boxed{10, 14, 18, 22, 26}$

58. Determine if the sequence is arithmetic, geometric, or neither.

144, 72, 36, 18, 9,.....

$\frac{72}{144} = \frac{1}{2}$ $\frac{36}{72} = \frac{1}{2}$ $\frac{18}{36} = \frac{1}{2}$ etc.

This is geometric with a common ratio of $r = \frac{1}{2}$.

59. Evaluate. 5!

$$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$$

$$= \boxed{120}$$

60. Evaluate. $\binom{9}{2}$

$$= {}_9C_2 = \frac{9!}{2!(9-2)!}$$

$$= \frac{9!}{2!\,7!}$$

$$= \frac{9 \cdot 8 \cdot \cancel{7!}}{2 \cdot 1 \cdot \cancel{7!}}$$

$$= \frac{72}{2}$$

$$= \boxed{36}$$