Name Peltier Period _______ Date _______________

Function Junction Investigation 3 and 4 Additional Practice

1. Solve for x. Give both exact solutions and decimal approximations to the tenths place where appropriate.

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

$+5 \quad +5$

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

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

$-2 \quad -2$

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

$x = 0.2$ and -4.2

b. $(x-3)^2 - 2 = 0$

$+2 \quad +2$

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

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

$+3 \quad +3$

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

$x = 4.4$ and 1.6

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

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

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

$x - 1 = \pm 2$

$+1 \quad +1$

$x = 1 \pm 2$

$x = -1$ and 3

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

$+5 \quad +5$

$\frac{2(x+2)^2}{2} = \frac{5}{2}$

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

$x+2 = \pm\sqrt{2.5}$

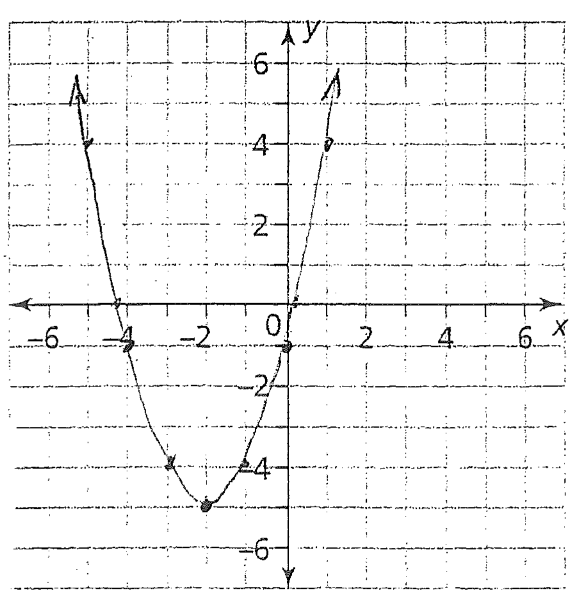
$-2 \quad -2$

$x = -2 \pm \sqrt{2.5}$

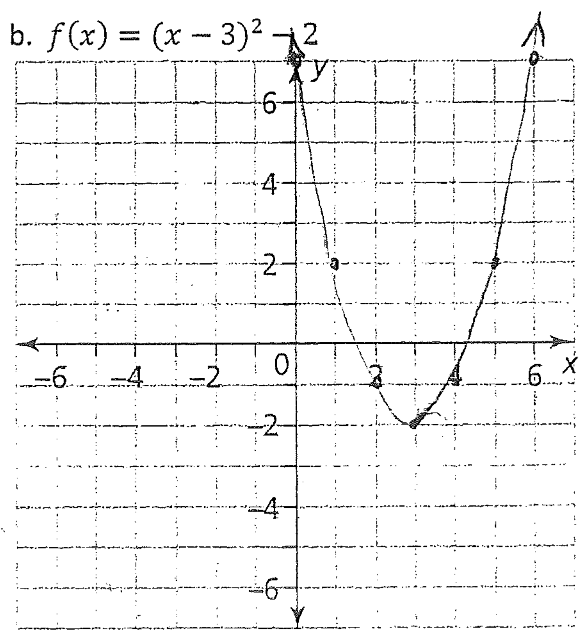
$x = -0.4$ and -3.6

2. Each of the following functions corresponds to an equation above. Use the information about your solutions from above to identify the coordinates of the vertex, x-intercept(s) and y-intercept to plot a graph.

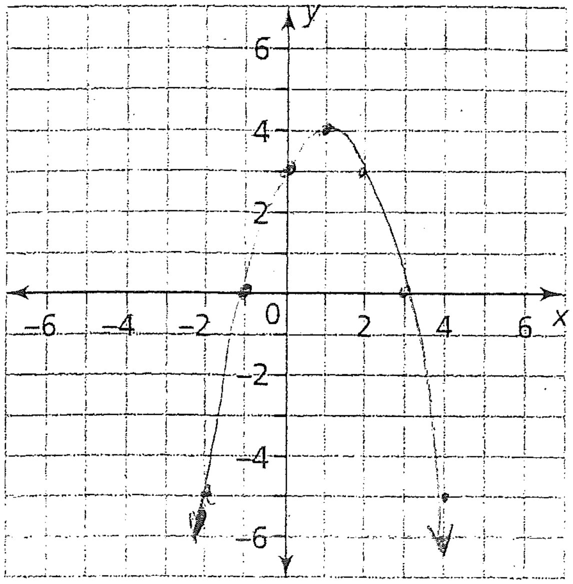
a. $f(x) = (x+2)^2 - 5$



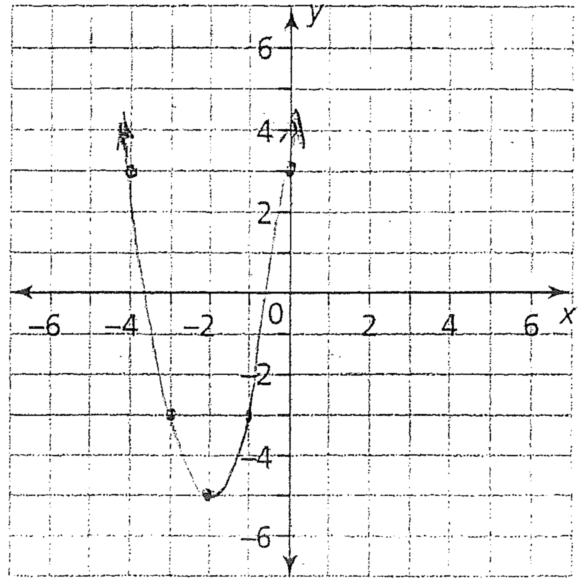
b. $f(x) = (x-3)^2 - 2$



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



d. $f(x) = 2(x+2)^2 - 5$



For numbers 3-12:

- Write the equation in vertex form
- Identify the coordinates of the maximum or minimum
- Identify the x-intercept(s) and y-intercept

3. $f(x) = x^2 + 6x + 9$

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

$\sqrt{0} = \sqrt{(x+3)^2}$

$0 = x + 3$

$-3 \quad -3$

$-3 = x$

Minimum: $(-3, 0)$

x-int: $(-3, 0)$

y-int: $(0, 9)$

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

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

$f(x) = -1(x-1)^2$

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

$-1 \quad -1$

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

$0 = x - 1$

$+1 \quad +1$

$1 = x$

Maximum: $(1, 0)$

x-int: $(1, 0)$

y-int: $(0, -1)$

5. $f(x) = x^2 - 3x$

$f(x) = x^2 - 3x + 2.25 - 2.25$

$f(x) = (x - 1.5)^2 - 2.25$

Minimum: $(1.5, -2.25)$

y-int: $(0, 0)$

x-ints: $(0, 0)$ and $(3, 0)$

$0 = (x-1.5)^2 - 2.25$

$+2.25 \quad +2.25$

$\sqrt{2.25} = \sqrt{(x-1.5)^2}$

$\pm 1.5 = x - 1.5$

$x = 1.5 \pm 1.5$

$= 3$ and 0

6. $f(x) = x^2 + 4x - 12$

$f(x) = x^2 + 4x + 4 - 12 - 4$

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

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

$+16 \quad +16$

$\sqrt{16} = \sqrt{(x+2)^2}$

$\pm 4 = x + 2$

$-2 \quad -2$

$-2 \pm 4 = x$

Minimum: $(-2, -16)$

x-ints: $(-6, 0)$ and $(2, 0)$

y-int: $(0, -12)$

7. $f(x) = -x^2 + 8x - 12$

$f(x) = -1(x^2 - 8x + 16 - 16 + 12)$

$f(x) = -1((x-4)^2 - \cancel{4})$

$f(x) = -1(x-4)^2 + \cancel{4}$

Maximum: $(4, 4)$

y-int: $(0, -12)$

x-ints: $(2, 0)$ and $(6, 0)$

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

$-4 \qquad -4$

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

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

$\pm 2 = x - 4$

$x = 4 \pm 2$
$= 6$ and 2

8. $f(x) = x^2 - x + 2$

$f(x) = x^2 - x + 0.25 - 0.25 + 2$

$f(x) = (x - .5)^2 + 1.75$

Minimum: $(0.5, 1.75)$

y-int: $(0, 2)$

x-ints: not real #'s

$0 = (x - .5)^2 + 1.75$

$-1.75 \qquad -1.75$

$-1.75 = (x - .5)^2$

can't take $\sqrt{\ }$ of a negative #

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

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

$f(x) = 2((x+1)^2 - 2.5)$

$f(x) = 2(x+1)^2 - 5$

Minimum: $(-1, -5)$

y-int: $(0, -3)$

x-ints: $(0.58, 0)$ $(-2.58, 0)$

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

$+5 \qquad +5$

$\frac{5}{2} = \frac{2(x+1)^2}{2}$

$\sqrt{2.5} = \sqrt{(x+1)^2}$

$\pm 1.58 = x + 1$

$x = -1 \pm 1.58$

$x = 0.58$ and -2.58

10. $f(x) = 2x - x^2 - 2$

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

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

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

$f(x) = -1(x-1)^2 - 1$

Maximum: $(1, -1)$

y-int: $(0, -2)$

x-int: none

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

$+1 \qquad +1$

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

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

can't take $\sqrt{\ }$ of a negative #

11. $f(x) = -4x^2 + 8x - 3$

$f(x) = -4(x^2 - 2x + \frac{3}{4} + 1 - 1)$

$f(x) = -4[(x-1)^2 - .25]$

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

Minimum: $(1, 1)$

y-int: $(0, -3)$

x-ints:

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

$-1 \qquad -1$

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

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

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

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

$x = 1.71$ and 0.29

12. $f(x) = 3x^2 - 12x - 1$

$f(x) = 3(x^2 - 4x - \frac{1}{3} + 4 - 4)$

$f(x) = 3[(x-2)^2 - \frac{13}{3}]$

$f(x) = 3(x-2)^2 - 13$

Minimum: $(2, -13)$

y-int: $(0, -1)$

x-ints:

$0 = 3(x-2)^2 - 13$

$+13 \qquad +13$

$\frac{13}{3} = \frac{3(x-2)^2}{3}$

$\sqrt{\frac{13}{3}} \sqrt{(x-2)^2}$

$\pm\sqrt{\frac{13}{3}} = x - 2$

$x = 2 \pm \sqrt{\frac{13}{3}}$

$= 4.08$ and -0.08

For numbers 13-16, rewrite the equations in standard form ($y = ax^2 + bx + c$).

13. $f(x) = (x-4)^2 - 1$

$f(x) = x^2 - 8x + 16 - 1$

$f(x) = x^2 - 8x + 15$

14. $f(x) = (x-1)^2 + 2$

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

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

15. $f(x) = 2(x-3)^2 + 5$

$f(x) = 2(x^2 - 6x + 9) + 5$

$f(x) = 2x^2 - 12x + 18 + 5$

$f(x) = 2x^2 - 12x + 23$

16. $f(x) = -(x+4)^2 + 10$

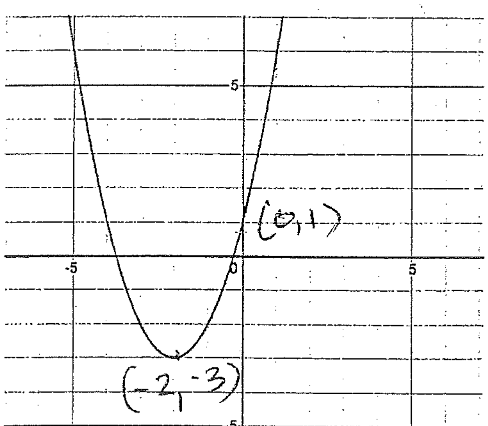
$f(x) = -1(x^2 + 8x + 16) + 10$

$f(x) = -x^2 - 8x - 16 + 10$

$f(x) = -x^2 - 8x - 6$

Describe the transformation of the graph from $y=x^2$ and write the new equation.

17.



Translation $(x,y) \rightarrow (x-2, y-3)$

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

$1 = a(2)^2 - 3$

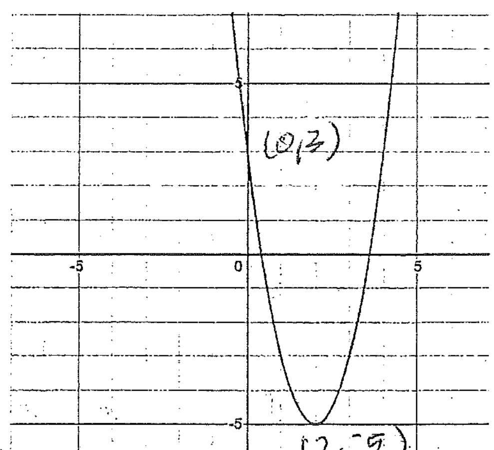
$1 = 4a - 3$
$+3 \quad +3$

$4 = 4a$

$1 = a$

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

18.



Translation: $(x,y) \rightarrow (x+2, y-5)$

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

$3 = a(-2)^2 - 5$

$3 = 4a - 5$
$+5 \quad +5$

$\frac{8}{4} = \frac{4a}{4}$

$2 = a$

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

Write the new equations following the listed transformation(s), in standard form.

19. $f(x) = x^2 + 5x - 3$
Translate 3 units left and
2 units up.

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

$f(x) = x^2 + 6x + 9 + 5x + 15 - 3 + 2$

$f(x) = x^2 + 11x + 23$

20. $f(x) = -2x^2 - x + 1$
Translate 2 units right followed by a dilation
From the origin with scale factor = 1.5

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

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

$f(x) = -2x^2 + 8x - 8 - x + 3$

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

$f(x) = 1.5(-2x^2 + 7x - 5)$

$f(x) = -3x^2 + 10.5x - 7.5$ Dilation $(x,y) \rightarrow (x, 1.5y)$