SM2H

SM2H Graphing Quadratics Test #4 Review 2018-19

No Graphing Calculators

Name: Key Date: _____ Period: _____

- State which form the quadratic function is in: vertex, standard, or factored form.
- Find the vertex. Show all work.
- Find the x-intercepts and the y-intercept. Show all work.

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

form: standard

vertex: $(-2, -1)$

x-intercept(s): $(-3, 0)$; $(-1, 0)$

y-intercept: $(0, 3)$

vertex: $x: \frac{-b}{2a} = \frac{-4}{2(1)} = -2$

$(-2, -1)$ $y: (-2)^2 + 4(-2) + 3$
$= 4 - 8 + 3 = -1$

x-int: $0 = (x+3)(x+1)$
$x = -3, -1$

y-int: $0^2 + 4(0) + 3 = 3$

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

form: vertex

vertex: $(-3, -2)$

x-intercept(s): $(-3+\sqrt{2}, 0)$; $(-3-\sqrt{2}, 0)$

y-intercept: $(0, 7)$

x-int: $0 = (x+3)^2 - 2$
$+2 \quad +2$
$\sqrt{2} = \sqrt{(x+3)^2}$
$\pm\sqrt{2} = x + 3$
$-3 \quad -3$
$-3 \pm \sqrt{2} = x$

y-int: $(0+3)^2 - 2 = 9 - 2 = 7$

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

form: standard

vertex: $(-1, -4)$

x-intercept(s): $(0, 0)$; $(-2, 0)$

y-intercept: $(0, 0)$

vertex: $x: \frac{-b}{2a} = \frac{-8}{2(4)} = -1$

$(-1, -4)$ $y: 4(-1)^2 + 8(-1)$
$= 4 - 8 = -4$

x-int: $0 = 4x(x+2)$
$x = 0, -2$

y-int: $4(0)^2 + 8(0) = 0$

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

form: standard or vertex

vertex: $(0, 0)$

x-intercept(s): $(0, 0)$

y-intercept: $(0, 0)$

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

form: standard

vertex: (2, -4)

x-intercept(s): none

y-intercept: (0, -8)

vertex: $x: \frac{-b}{2a} = \frac{-4}{2(-1)} = \frac{-4}{-2} = 2$

(2, -4) $y: -(2)^2 + 4(2) - 8 = -4 + 8 - 8 = -4$

x-int: * no x-intercepts since the graph opens down and is below the x-axis.

y-int: $-0^2 + 4(0) - 8 = -8$

p: -1 q: 5/2

6. $f(x) = (x + 1)(2x - 5)$

form: factored

vertex: (3/4, -49/8)

x-intercept(s): (-1, 0); (5/2, 0)

y-intercept: (0, -5)

vertex: $x: \frac{p+q}{2} = \frac{-1+5/2}{2} = \frac{3/2}{2} = 3/4$

$\left(\frac{3}{4}, \frac{-49}{8}\right)$ $y: \left(\frac{3}{4}+1\right)\left(2\left(\frac{3}{4}\right)-5\right) = \left(\frac{7}{4}\right)\left(-\frac{14}{4}\right) = \frac{-49}{8}$

x-int: x-intercepts are p & q.

y-int: $(0+1)(2(0)-5) = (1)(-5) = -5$

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

form: vertex

vertex: (-4, -2)

x-intercept(s): (-3, 0); (-5, 0)

y-intercept: (0, 30)

x-int: $0 = 2(x+4)^2 - 2$, $+2 \quad +2$, $\frac{2}{2} = \frac{2}{2}(x+4)^2 \rightarrow \sqrt{1} = \sqrt{(x+4)^2}$, $\pm 1 = x + 4$, $-4 \quad -4$, $x = -4 \pm 1 = -3, -5$

y-int: $2(0+4)^2 - 2 = 2(4)^2 - 2 = 30$

p: -4 q: 7

8. $f(x) = -(x + 4)(x - 7)$

form: factored

vertex: (3/2, 121/4)

x-intercept(s): (-4, 0); (7, 0)

y-intercept: (0, 28)

vertex: $x: \frac{p+q}{2} = \frac{-4+7}{2} = \frac{3}{2}$

$\left(\frac{3}{2}, \frac{121}{4}\right)$ $y: -\left(\frac{3}{2}+4\right)\left(\frac{3}{2}-7\right) = -\left(\frac{11}{2}\right)\left(-\frac{11}{2}\right) = \frac{121}{4}$

x-int: x-intercepts are p & q.

y-int: $-(0+4)(0-7) = -(4)(-7) = 28$

Fill in the requested information. Then graph the function. Plot at least 5 points.

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

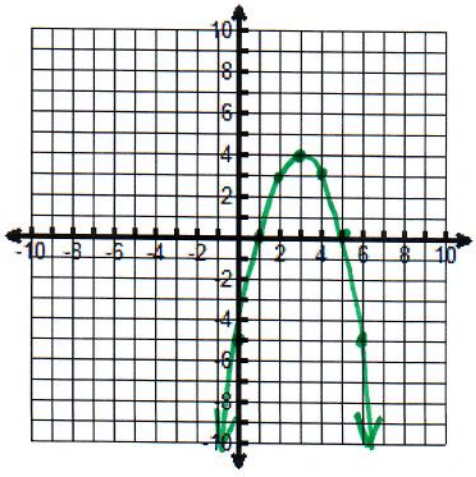
Vertex: (3, 4)

Axis of Symmetry: x = 3

Direction of Opening: down

Domain: $(-\infty, \infty)$

Range: $(-\infty, 4]$



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

$x: \frac{-b}{2a} = \frac{2}{2(-1)} = -1$ $y: -(-1)^2 - 2(-1) + 3$ $= -1 + 2 + 3 = 4$

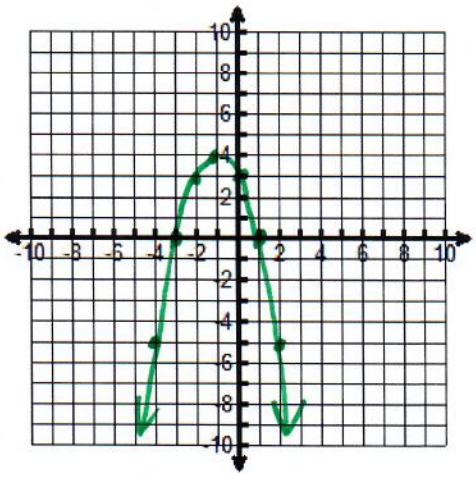
Vertex: $(-1, 4)$

Axis of Symmetry: $x = -1$

Direction of Opening: down

Domain: $(-\infty, \infty)$

Range: $(-\infty, 4]$



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

$x: \frac{-b}{2a} = \frac{-4}{2(1)} = -2$ $y: (-2)^2 + 4(-2) + 6$ $= 4 - 8 + 6 = 2$

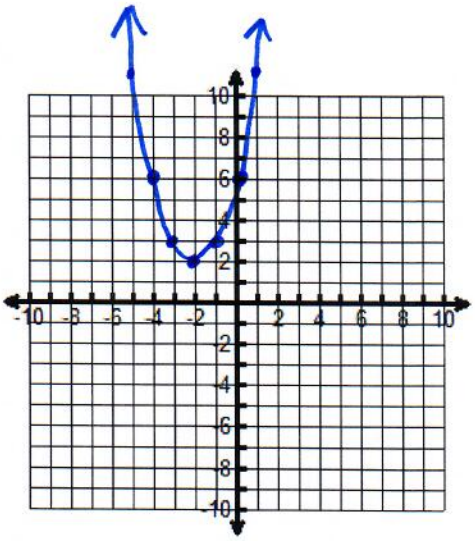
Vertex: $(-2, 2)$

Axis of Symmetry: $x = -2$

Direction of Opening: up

Domain: $(-\infty, \infty)$

Range: $[2, \infty)$



$p: -1$ $q: 3$

12. $f(x) = (x + 1)(x - 3)$

$x: \frac{p+q}{2} = \frac{-1+3}{2} = 1$ $y: (1+1)(1-3) = (2)(-2)$ $= -4$

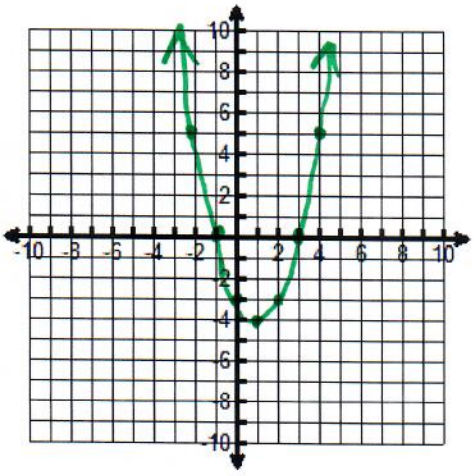
Vertex: $(1, -4)$

Axis of Symmetry: $x = 1$

Direction of Opening: up

Domain: $(-\infty, \infty)$

Range: $[-4, \infty)$



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

$x: \frac{-b}{2a} = \frac{4}{2(-1)} = -2$ $y: -(-2)^2 - 4(-2)$ $= -4 + 8 = 4$

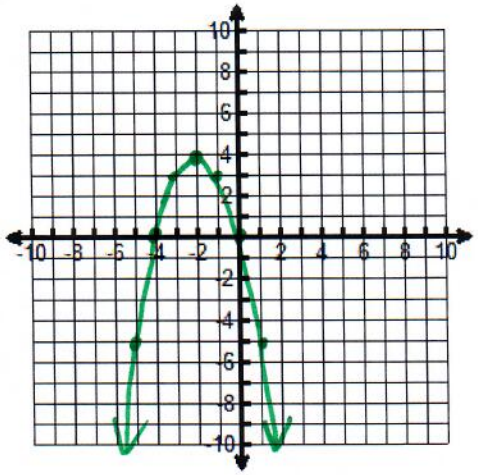
Vertex: $(-2, 4)$

Axis of Symmetry: $x = -2$

Direction of Opening: down

Domain: $(-\infty, \infty)$

Range: $(-\infty, 4]$



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

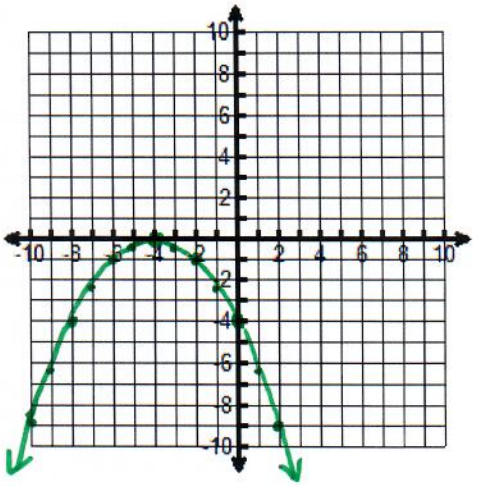
Vertex: $(-4, 0)$

Axis of Symmetry: $x = -4$

Direction of Opening: down

Domain: $(-\infty, \infty)$

Range: $(-\infty, 0]$



15. $f(x) = -(x+2)(x-4)$

$p: -2$ $q: 4$

$x: \frac{p+q}{2} = \frac{-2+4}{2} = \frac{2}{2} = 1$ $y: -(1+2)(1-4)$ $= -(3)(-3) = 9$

Vertex: $(1, 9)$

Axis of Symmetry: $x = 1$

Direction of Opening: down

Is the vertex a maximum or a minimum? maximum

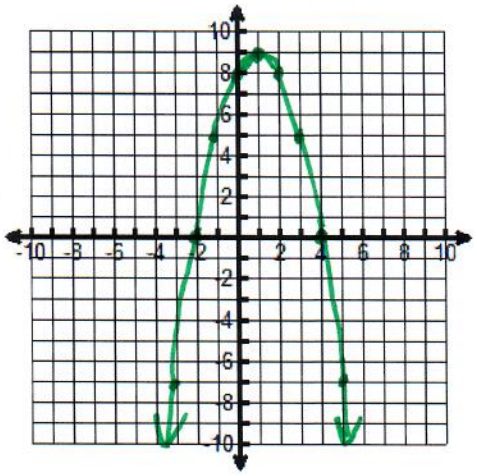
What is the maximum/minimum value? 9

$-(0+2)(0-4) = -(2)(-4) = 8$

y-intercept: $(0, 8)$

zeros: $-2, 4$

What are the x-intercepts? $(-2, 0); (4, 0)$



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

$x: \frac{-b}{2a} = \frac{-6}{2(1)} = -3$ $\quad y: (-3)^2 + 6(-3) + 3 = 9 - 18 + 3 = -6$

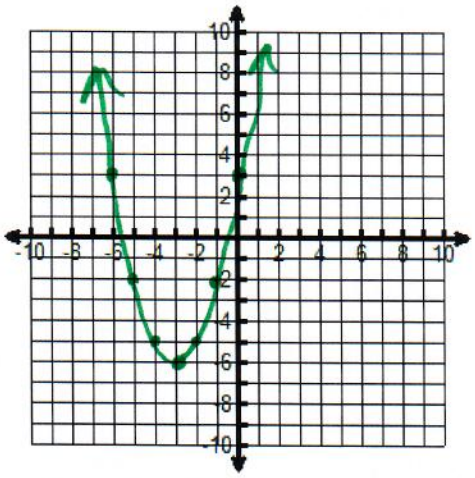
Vertex: $(-3, -6)$

Axis of Symmetry: $x = -3$

Direction of Opening: up

Is the vertex a maximum or a minimum? minimum

What is the maximum/minimum value? -6



$0^2 + 6(0) + 3 = 3$

y-intercept: $(0, 3)$

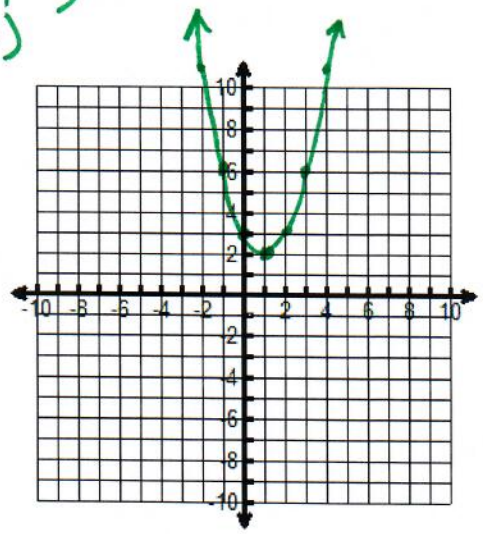
zeros: $-3 \pm \sqrt{6}$ * use quadratic formula to find zeros.

What are the x-intercepts? $(-3-\sqrt{6}, 0)$; $(-3+\sqrt{6}, 0)$

$(-5.45, 0)$; $(-0.55, 0)$

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

Vertex: $(1, 2)$



Axis of Symmetry: $x = 1$

Direction of Opening: up

Is the vertex a maximum or a minimum? minimum

What is the maximum/minimum value? 2

$(0-1)^2 + 2 = (-1)^2 + 2 = 3$

y-intercept: $(0, 3)$

zeros: $1 \pm i\sqrt{2}$ * set equal to zero & solve by taking square roots.

What are the x-intercepts? none

18. Write a quadratic equation in **factored form** with x-intercepts $(-9, 0)$ & $(4, 0)$ and passes through $(-6, 10)$.

$y = a(x+9)(x-4)$

$10 = a(-6+9)(-6-4)$

$10 = a(3)(-10)$

$\frac{10}{-30} = \frac{a(-30)}{-30}$ $\quad a = -\frac{1}{3}$

$y = -\frac{1}{3}(x+9)(x-4)$

19. Write a quadratic equation in **vertex form** with vertex: $(-12, -3)$ and passes through $(-8, 21)$.

$y = a(x+12)^2 - 3$

$21 = a(-8+12)^2 - 3$

$21 = a(4)^2 - 3$

$+3 \quad +3$

$\frac{24}{16} = \frac{a(16)}{16}$ $\quad \frac{3}{2} = a$

$y = \frac{3}{2}(x+12)^2 - 3$

20. Write a quadratic equation in **factored form** with zero's $x=\sqrt{3}$ & $x=-\sqrt{3}$ and passes through $(5,11)$.

$y=a(x-\sqrt{3})(x+\sqrt{3})$
$11=a(5-\sqrt{3})(5+\sqrt{3})$
$11=a(25+5\sqrt{3}-5\sqrt{3}-\sqrt{9})$
$11=a(25-3)$
$\frac{11}{22}=\frac{a(22)}{22}$
$\frac{1}{2}=a$

$y=\frac{1}{2}(x-\sqrt{3})(x+\sqrt{3})$

21. Write a quadratic equation in **standard form** with x-intercepts $(10,0)$ & $(-4,0)$ and passes through $(-1, 11)$.

$y=a(x-10)(x+4)$
$11=a(-1-10)(-1+4)$
$11=a(-11)(3)$
$\frac{11}{-33}=\frac{a(-33)}{-33}$
$-\frac{1}{3}=a$

$y=-\frac{1}{3}(x-10)(x+4)$
$=-\frac{1}{3}(x^2+4x-10x-40)$
$=-\frac{1}{3}(x^2-6x-40)$

$y=-\frac{1}{3}x^2+2x+\frac{40}{3}$

22. An object in launched directly upward at 64 feet per second (ft/s) from a platform. Its altitude is modeled by $h(t)=-16t^2+64t+80$, where t, is the time in seconds and h(t) is the height of the object in feet. Show your work on parts a-e if necessary.

a. What is the height of the platform?

$h(0)=-16(0)^2+64(0)+80$ = 80 feet

b. What is the height of the firework when t=4 seconds?

$h(4)=-16(4)^2+64(4)+80$
$=-16(16)+256+80$ = 80 feet

c. How long does it take the firework to reach its maximum height?

find the vertex! $x=\frac{-b}{2a}=\frac{-64}{2(-16)}=\frac{-64}{-32}=2$

* x-value is time, y-value is height.

2 seconds

d. What is the maximum height of the firework?

$h(2)=-16(2)^2+64(2)+80$
$=-16(4)+128+80$ = 144 feet

e. When is the firework at 130 feet?

$130=-16t^2+64t+80$
$-130 \quad -130$
$0=-16t^2+64t-50$

$a=-16$
$b=64$
$c=-50$

$x=\frac{-64\pm\sqrt{64^2-4(-16)(-50)}}{2(-16)}$
$=\frac{-64\pm\sqrt{4096-3200}}{-32}=\frac{-64\pm\sqrt{896}}{-32}$
$=\frac{-64\pm 29.93}{-32}$ = 1.06, 2.94

1.06 seconds & 2.94 seconds

f. When does the firework hit the ground?

$0=-16t^2+64t+80$
$0=-16(t^2-4t-5)$
$0=-16(t-5)(t+1)$
$t=5 \quad t=-1$

* solve by factoring or by using the quadratic formula

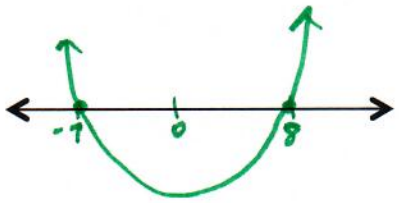
5 seconds

Solve the following inequalities. Write your answers in interval notation.
NO GRAPHING CALCULATORS!!!

23. $(x-8)(x+7)>0$

zeros: 8, -7

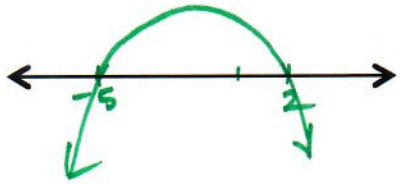
$(-\infty,-7)\cup(8,\infty)$



24. $-(x+5)(x-2)\le 0$

zeros: -5, 2

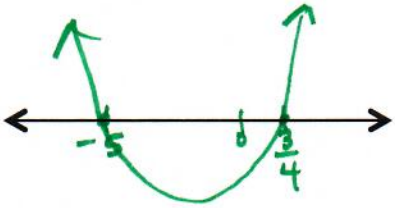
$(-\infty,-5]\cup[2,\infty)$



25. $(4x-3)(x+5)\ge 0$

zeros: 3/4, -5

$(-\infty,-5]\cup[3/4,\infty)$

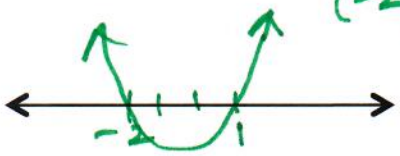


26. $x^2+x-2<0$

$(x+2)(x-1)<0$

zeros: -2, 1

$(-2,1)$

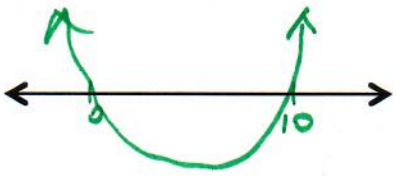


27. $x^2-10x\ge 0$

$x(x-10)\ge 0$

zeros: 0, 10

$(-\infty,0]\cup[10,\infty)$



28. $5x^2-9x-2>0$

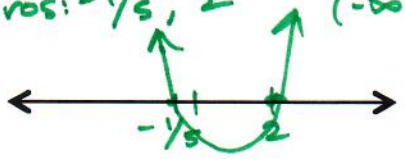
$5x^2-10x+x-2$

$5x(x-2)+1(x-2)$

$(5x+1)(x-2)>0$

zeros: $-1/5$, 2

$(-\infty,-1/5)\cup(2,\infty)$



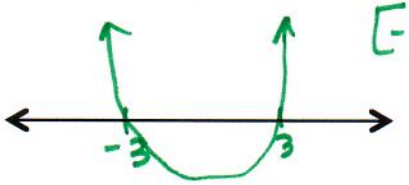
29. $3x^2-27\le 0$

$3(x^2-9)\le 0$

$3(x+3)(x-3)\le 0$

zeros: -3, 3

$[-3,3]$



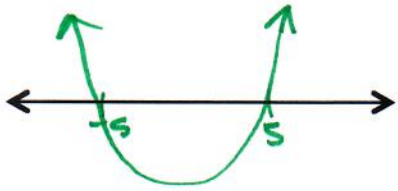
30. $x^2>25$

$x^2-25>0$

$(x+5)(x-5)>0$

zeros: -5, 5

$(-\infty,-5)\cup(5,\infty)$



Solve each system of equations by graphing. Write the solutions as ordered pairs.
NO GRAPHING CALCULATOR!!!

31.

$2y - 8 = 2x$

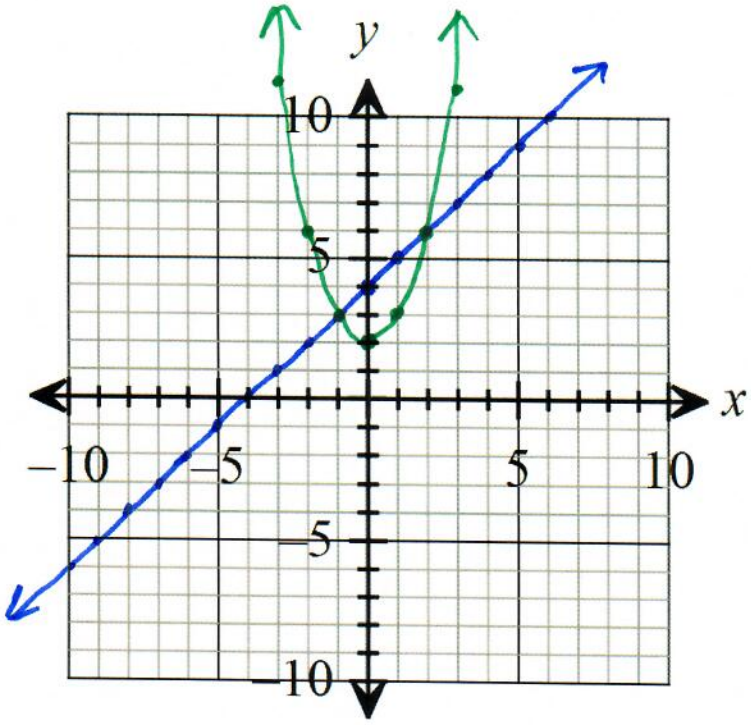
$y = x^2 + 2$

$2y - 8 = 2x$
$+8 \quad +8$

$\frac{2y}{2} = \frac{2x}{2} + \frac{8}{2}$

$y = x + 4$

$(-1, 3)$
$(2, 6)$



32.

$x - y = 3$

$y = x^2 - 3$

$-x \quad -x$

$\frac{-y}{-1} = \frac{-x}{-1} + \frac{3}{-1}$

$y = x - 3$

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