Unit 4 Pretest Review Unit 4
MPM2D
Jensen

1) Use finite differences to classify each relationship as linear, quadratic, or neither.

a)

x	y
0	10
1	7
2	4
3	1
4	−2

−3, −3, −3, −3

Linear

b)

x	y
0	0
1	3
2	44
3	231
4	744

3, 41, 187, 513
38, 146, 326

Neither

c)

x	y
0	−5
1	−1
2	7
3	19
4	35

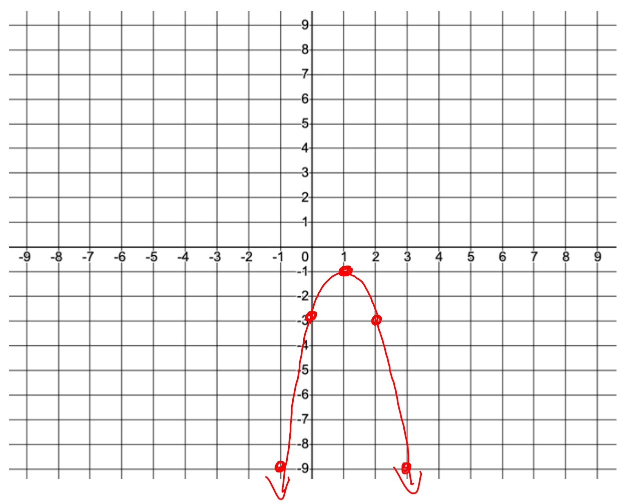
4, 8, 12, 16
4, 4, 4

Quadratic

2) State the direction of opening and y-intercept of the given quadratic, then make a table of values and sketch the graph to verify.

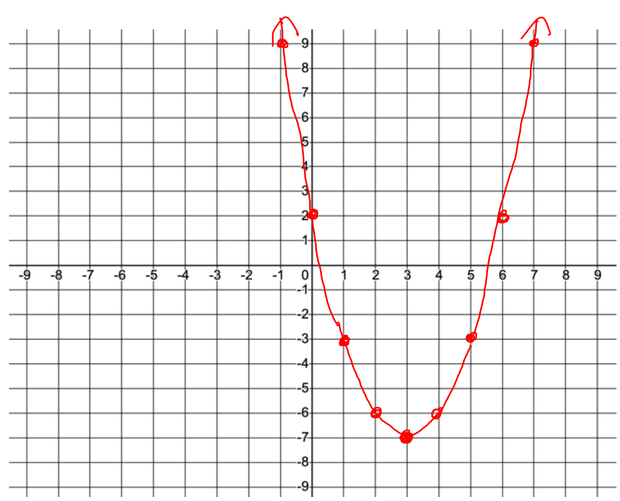
a) $y = -2x^2 + 4x - 3$

x	y
−2	−19
−1	−9
0	−3
1	−1
2	−3
3	−9
4	−19



b) $y = x^2 - 6x + 2$

x	y
0	2
1	−3
2	−6
3	−7
4	−6
5	−3
6	2



3) Complete the table of properties for each quadratic

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

Vertex	$(3,0)$
Axis of Symmetry	$x=3$
Direction of Opening	up
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \geq 0\}$

b) $y = -3(x+5)^2 - 1$

Vertex	$(-5,-1)$
Axis of Symmetry	$x=-5$
Direction of Opening	Down
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \leq -1\}$

c) $y = 2x^2 + 7$ $= 2(x-0)^2+7$

Vertex	$(0,7)$
Axis of Symmetry	$x=0$
Direction of Opening	up
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \geq 7\}$

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

Vertex	$(2,4)$
Axis of Symmetry	$x=2$
Direction of Opening	Down
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \leq 4\}$

4) The graph of $y = x^2$ is compressed vertically by a factor of 1/2, reflected vertically in the x-axis, and then translated 3 units down and 1 unit right. Write the equation of the parabola.

$a = -\frac{1}{2}$

$h = 1$

$k = -3$

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

5) Write an equation for the parabola with vertex at $(\overset{h}{-5},\overset{k}{1})$, opening upward, and with a vertical stretch by a factor of 4.

$a = 4$

$h = -5$

$k = 1$

$$\boxed{y = 4(x+5)^2 + 1}$$

6) For each of the following functions, **i)** describe the transformations compared to $y = x^2$, **ii)** complete the table of properties, **iii)** graph the function by making a table of values

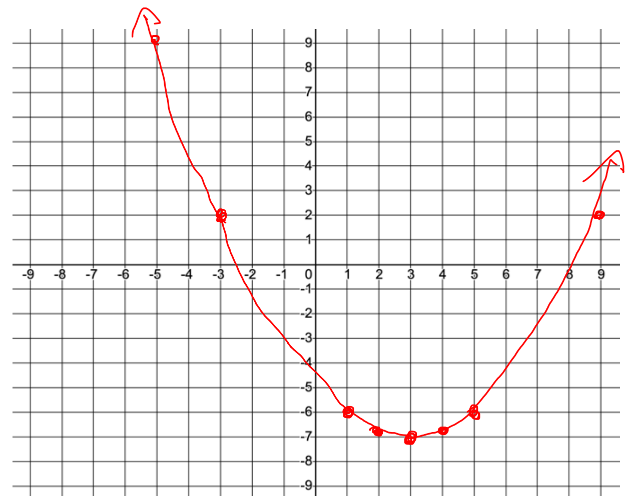
a) $y = \frac{1}{4}(x-3)^2 - 7$

Transformations:

- vertical compression by a factor of $\frac{1}{4}$
- shift right 3 units
- shift down 7 units

Vertex	$(3,-7)$
Axis of Symmetry	$x=3$
Direction of Opening	up
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \geq -7\}$

x	y
1	-6
2	-6.75
3	-7
4	-6.75
5	-6



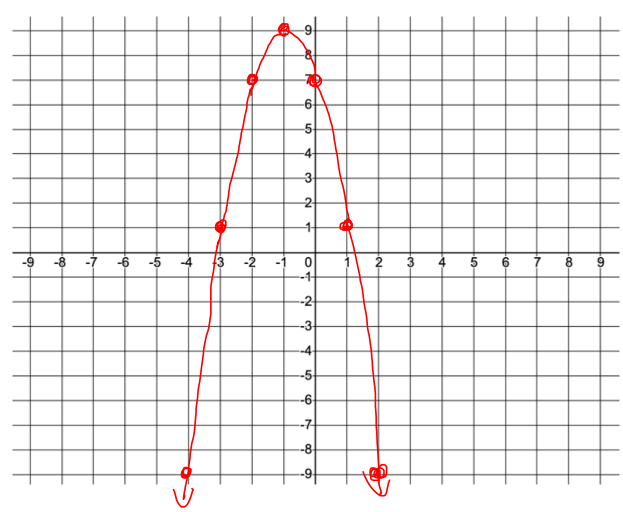
a) $y = -2(x+1)^2 + 9$

Transformations:

- vertical stretch by a factor of 2
- vertical reflection in the x-axis
- shift left 1 unit
- shift up 9 units

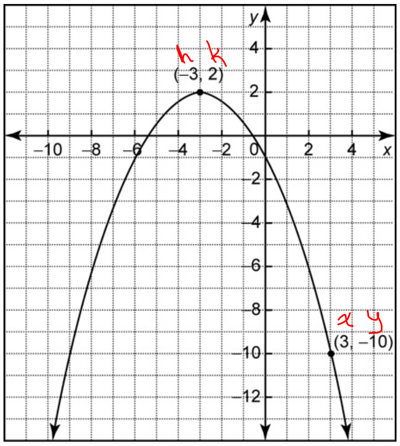
Vertex	$(-1,9)$
Axis of Symmetry	$x=-1$
Direction of Opening	Down
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \leq 9\}$

x	y
-3	1
-2	7
-1	9
0	7
1	1



7) Determine the vertex form equation of each of the following quadratic functions.

a)



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

$-10=a[3-(-3)]^2+2$

$-10=a(6)^2+2$

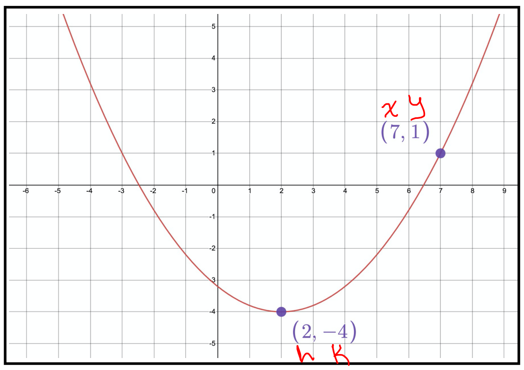
$-12=36a$

$\frac{-12}{36}=a$

$a=\frac{-1}{3}$

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

b)



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

$1=a(7-2)^2-4$

$1=a(5)^2-4$

$5=25a$

$\frac{5}{25}=a$

$a=\frac{1}{5}$

$\boxed{y=\frac{1}{5}(x-2)^2-4}$

8) The height, h meters, of a batted baseball as a function of the time, t seconds, since the ball was hit can be modelled by the function $h=-2.1(t-2.4)^2+13$

a) What was the max height of the ball?

13 meters

b) What was its height when it was hit, to the nearest tenth of a meter?

$h=-2.1(0-2.4)^2+13$

$h\simeq 0.9m$

c) How many seconds after it was hit did the ball hit the ground, to the nearest tenth of a second?

$$0 = -2.1(t-2.4)^2 + 13$$

$$\frac{-13}{-2.1} = (t-2.4)^2$$

$$\sqrt{\frac{13}{2.1}} = t - 2.4$$

$$2.4 + \sqrt{\frac{13}{2.1}} = t$$

$$t \approx 4.9 \text{ seconds}$$

d) What was the height of the ball, to the nearest tenth of a meter, 1 second after it was hit?

$$h = -2.1(1-2.4)^2 + 13$$

$$h \approx 8.9 \text{ m}$$

9) A touch football quarterback passed the ball to a receiver 40 meters downfield. The path of the ball can be described by the function $h = -0.01(d-20)^2 + 6$, where h is the height of the ball in meters, and d is the horizontal distance of the ball from the quarterback in meters.

a) What was the max height of the ball?

6 m

b) What was the horizontal distance of the ball from the quarterback at its max height?

20m

c) What was the height of the ball when it was thrown? When it was caught?

Thrown

$$h = -0.01(0-20)^2 + 6$$

$$h = 2 \text{ m}$$

Caught

$$h = -0.01(40-20)^2 + 6$$

$$h = 2 \text{ m}$$

d) If a defensive back was 2 meters in front of the receiver, how far was the defensive back from the quarterback?

38 m

e) How high would the defensive back have needed to reach to knock down the pass?

$h = -0.01(38-20)^2+6$

$h = 2.76m$

10) Rewrite each relation in the form $y = a(x-h)^2 + k$ by completing the square. Then state the vertex and if it is a max or min point.

a) $y = x^2 + 6x$

$y = (x^2+6x)$

$y = (x^2+6x+9-9)$

$y = (x^2+6x+9)-9$

$y = (x+3)^2-9$

vertex: $(-3,-9)$ is a min.

b) $y = x^2 - 10x + 15$

$y = (x^2-10x)+15$

$y = (x^2-10x+25-25)+15$

$y = (x^2-10x+25)-25+15$

$y = (x-5)^2-10$

vertex $(5,-10)$ is a min.

c) $y = -3x^2 - 12x + 7$

$y = (-3x^2-12x)+7$

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

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

$y = -3(x^2+4x+4)+12+7$

$y = -3(x+2)^2+19$

Vertex $(-2,19)$ is a Max.

d) $y = \frac{1}{4}x^2 - 6x - 22$

$y = (\frac{1}{4}x^2-6x)-22$

$y = \frac{1}{4}(x^2-24x)-22$

$y = \frac{1}{4}(x^2-24x+144-144)-22$

$y = \frac{1}{4}(x^2-24x+144)-36-22$

$y = \frac{1}{4}(x-12)^2-58$

Vertex $(12,-58)$ is a Min.

11) For each of the following functions, **i)** convert to vertex form by completing the square, **ii)** complete the table of properties, **iii)** graph the function by making a table of values

a) $y = 2x^2 + 4x - 1$

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

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

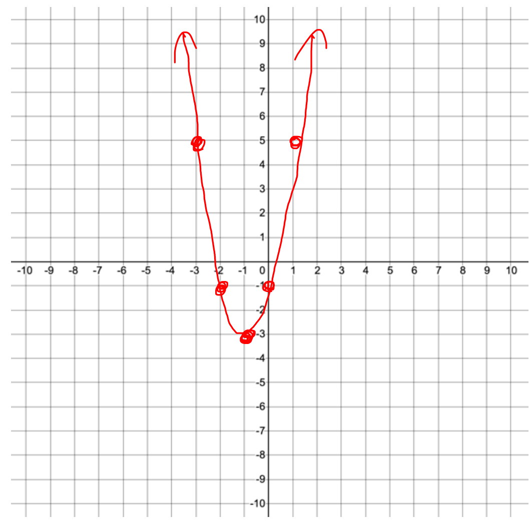
$y = 2(x^2 + 2x + 1 - 1) - 1$

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

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

Vertex	$(-1, -3)$
Axis of Symmetry	$x = -1$
Direction of Opening	up
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \geq -3\}$

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



b) $y = -3x^2 - 24x - 40$

$y = (-3x^2 - 24x) - 40$

$y = -3(x^2 + 8x) - 40$

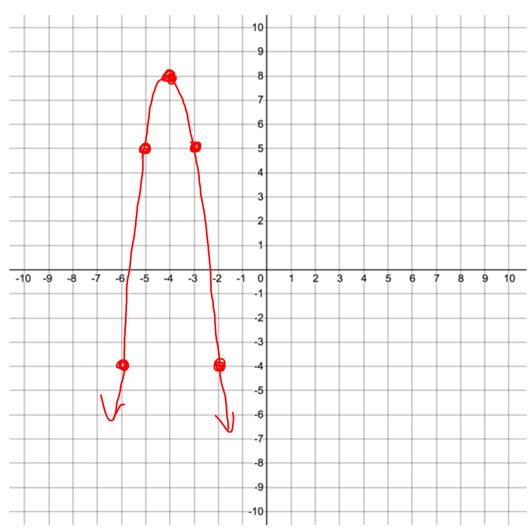
$y = -3(x^2 + 8x + 16 - 16) - 40$

$y = -3(x^2 + 8x + 16) + 48 - 40$

$y = -3(x+4)^2 + 8$

Vertex	$(-4, 8)$
Axis of Symmetry	$x = -4$
Direction of Opening	Down
Values x may take (domain)	$\{x \in \mathbb{R}\}$
Values y may take (range)	$\{y \in \mathbb{R} \mid y \leq 8\}$

x	y
-6	-4
-5	5
-4	8
-3	5
-2	-4



12) The path of a basketball shot can be modelled by the equation $h = -0.09d^2 + 0.9d + 2$, where h is the height of the ball in meters, and d is the horizontal distance of the ball from the player in meters.

a) What is the max height reached by the ball?

$h = (-0.09d^2 + 0.9d) + 2$

$h = -0.09(d^2 - 10d) + 2$

$h = -0.09(d^2 - 10d + 25 - 25) + 2$

$h = -0.09(d^2 - 10d + 25) + 2.25 + 2$

$h = -0.09(d - 5)^2 + 4.25$

The vertex $(5, 4.25)$ is a maximum point.

Therefore, the maximum height is 4.25 meters.

b) What is the horizontal distance of the ball from the player when it reaches its max height?

5 meters

c) How far from the floor is the ball when the player releases it?

$h = -0.09(0)^2 + 0.9(0) + 2$

$h = 2m$

13) Given the following quadratic equations, determine the **i)** x-intercepts using the zero product rule, **ii)** the axis of symmetry, **iii)** the vertex **iv)** graph the quadratic

a) $y = (x+6)(x-2)$

i) $0 = (x+6)(x-2)$

$x+6=0 \quad x-2=0$

$x=-6 \quad x=2$

$(-6,0) \quad (2,0)$

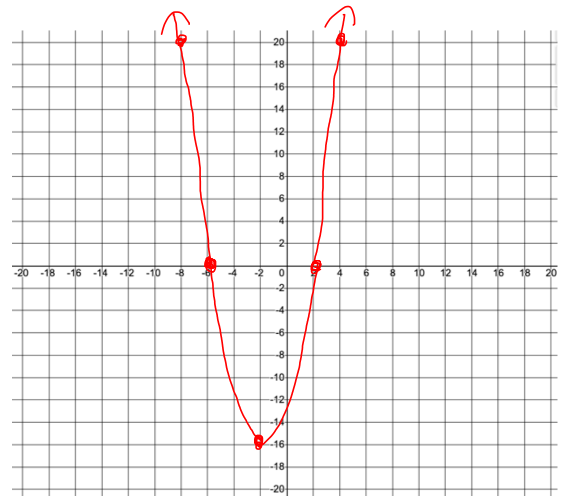
ii) aos: $x = \frac{-6+2}{2}$

$x=-2$

iii) x-vertex $= -2$

y-vertex $= -16$

$(-2,-16)$



b) $y = -\frac{1}{2}x(x-6)$

i) $0 = -\frac{1}{2}x(x-6)$

$x=0 \quad x-6=0$

$x=6$

$(0,0) \quad (6,0)$

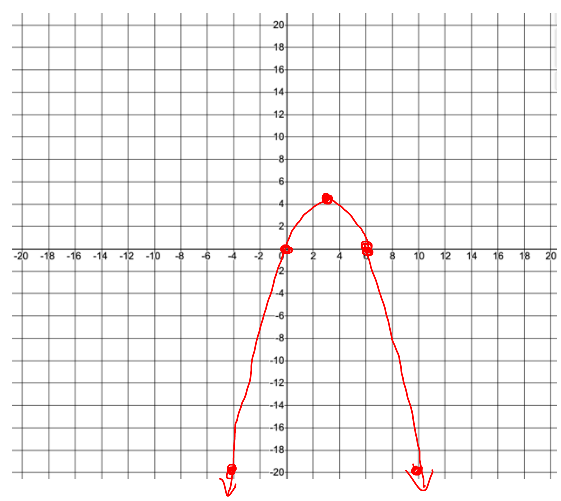
ii) aos: $x = \frac{0+6}{2}$

$x=3$

iii) x-vertex $=3$

y-vertex $= -\frac{1}{2}(3)(3-6) = 4.5$

$(3, 4.5)$



c) $y = 2(x+7)(x+3)$

i) $0 = 2(x+7)(x+3)$

$x+7=0 \quad x+3=0$

$x=-7 \quad x=-3$

$(-7,0) \quad (-3,0)$

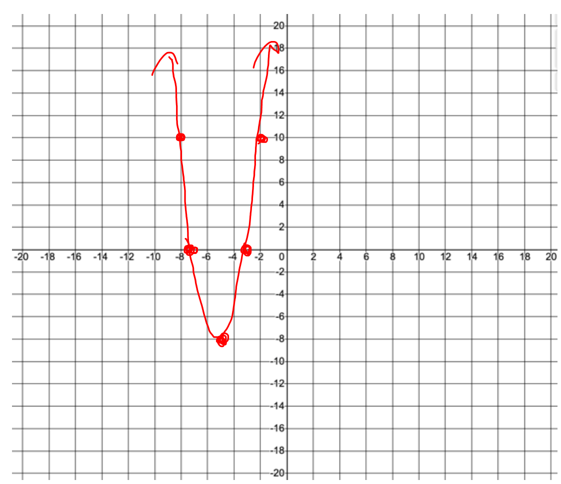
iii) aos: $x = \frac{-7+(-3)}{2}$

$x=-5$

iii) x-vertex $= -5$

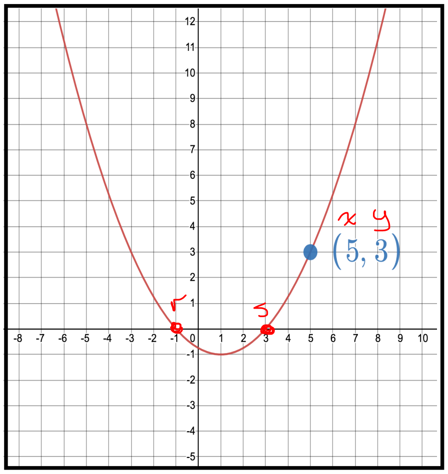
y-vertex $= -8$

$(-5,-8)$



14) Determine the factored form equation of each of the following quadratic functions.

a)



$y = a(x-r)(x-s)$

$3 = a[5-(-1)](5-3)$

$3 = a(6)(2)$

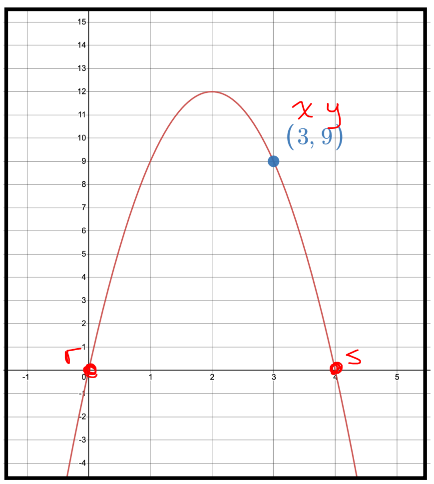
$3 = 12a$

$\frac{3}{12} = a$

$a = \frac{1}{4}$

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

b)



$y = a(x-r)(x-s)$

$9 = a(3-0)(3-4)$

$9 = a(3)(-1)$

$9 = -3a$

$\frac{9}{-3} = a$

$a = -3$

$\boxed{y = -3x(x-4)}$

15) A parabola has x-intercepts $\overset{r}{-3}$ and $\overset{s}{2}$, and has vertex $(\overset{x}{-4},\overset{y}{2})$. Determine the equation of this parabola in factored form.

$y = a(x-r)(x-s)$

$2 = a[-4-(-3)](-4-2)$

$2 = a(-1)(-6)$

$2 = 6a$

$\frac{2}{6} = a$

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

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

16) For each quadratic function, determine the x-intercepts and the vertex.

a) $y = x^2 + 6x + 8$

$\underline{2} \times \underline{4} = 8$
$\underline{2} + \underline{4} = 6$

$0 = (x+2)(x+4)$

$x+2=0 \qquad x+4=0$
$x=-2 \qquad x=-4$

$\boxed{x\text{-int}: (-2,0) \text{ and } (-4,0)}$

$x\text{-vertex} = \frac{-2+(-4)}{2} = -3$

$y\text{-vertex} = (-3)^2+6(-3)+8 = -1$

$\boxed{\text{vertex}: (-3,-1)}$

b) $y = 4x^2 - 12x + 5$

$\underline{-10} \times \underline{-2} = 20$
$\underline{-10} + \underline{-2} = -12$

$y = 4x^2 - 10x - 2x + 5$

$y = 2x(2x-5) - 1(2x-5)$

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

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

$\boxed{x\text{-int}: (2.5,0) \text{ and } (0.5,0)}$

$x\text{-vertex} = \frac{2.5+0.5}{2} = 1.5$

$y\text{-vertex} = 4(1.5)^2 - 12(1.5) + 5 = -4$

$\boxed{\text{vertex}: (1.5,-4)}$