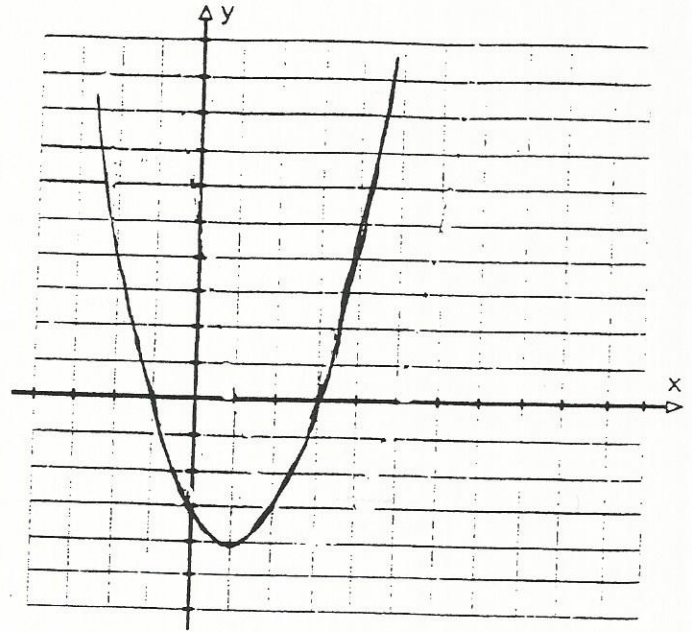


Answers to Graphing a Second-Degree Function

① By referring to the following graph, determine the characteristics listed below.

Scale
x-axis:
0.5 cm $\hat{=}$ 1 unit
y-axis:
0.5 cm $\hat{=}$ 1 unit



Coordinates of the vertex:

(1, -4)

Zero(s):

-1 and 3

Equation of the axis of symmetry:

$x = 1$

y-intercept:

-3

Minimum:

-4

2) Graph the equation below:

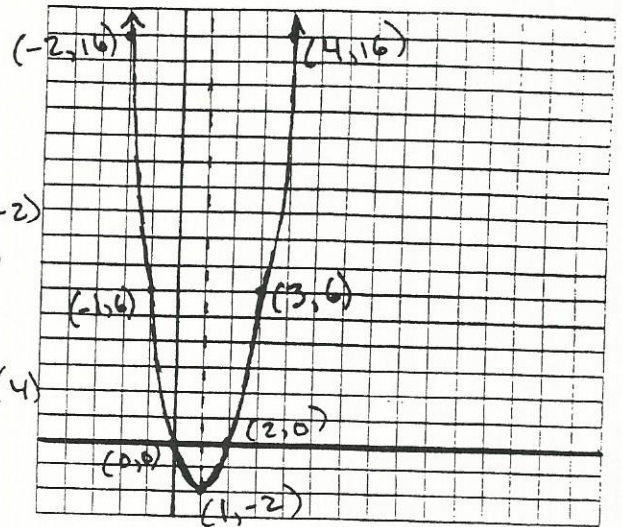
$$y = 2x^2 - 4x$$

Then determine the characteristics listed below and draw the axis of symmetry.

$$\begin{aligned}x = -1: \\ y &= 2(1) - 4(-1) \\ &= 2 + 4 = 6 \\ x = 3: \\ y &= 2(9) - 4(3) \\ &= 18 - 12 = 6\end{aligned}$$

x	y
-1	6
3	6
-2	16
4	16

$$\begin{aligned}x = -2: \\ y &= 2(4) - 4(-2) \\ &= 8 + 8 = 16 \\ x = 4: \\ y &= 2(16) - 4(4) \\ &= 32 - 16 \\ &= 16\end{aligned}$$



$$\begin{aligned}\Delta &= b^2 - 4ac \\ &= 16 - 4(2)(0) \\ &= 16\end{aligned}$$

Opens up

Coordinates of the vertex: $\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right) = \left(\frac{4}{4}, \frac{-16}{8}\right) = (1, -2)$

Coordinates of the y-intercept: $(0, 0)$

Coordinates of the point symmetric with the y-intercept: $(2, 0)$

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

Coordinates of the zeros: 0 and 2

Equation of the axis of symmetry: $x = 1$

3) Graph the equation below:

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

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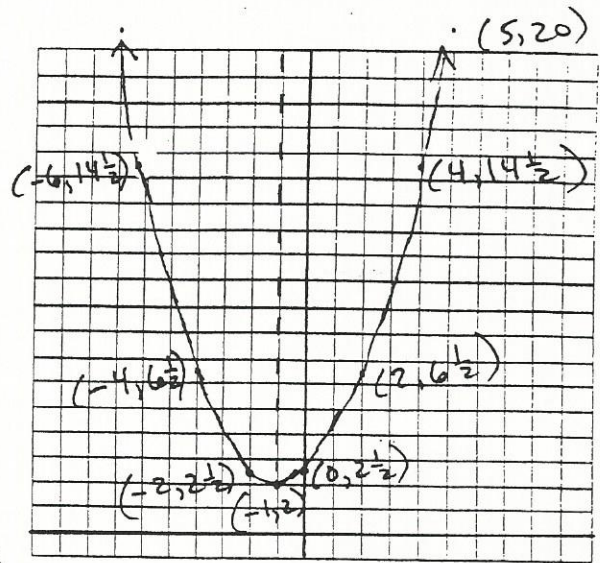
$$a = \frac{1}{2} \quad b = 1 \quad c = \frac{5}{2}$$

Then determine the characteristics listed below and draw the axis of symmetry.

$$x = 2: \quad y = \frac{1}{2}(2)^2 + 2 + \frac{5}{2} \\ = 2 + 2 + \frac{5}{2} = 6\frac{1}{2}$$

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

x	y
2	$6\frac{1}{2}$
-4	$6\frac{1}{2}$
4	$14\frac{1}{2}$
-6	$14\frac{1}{2}$
5	20



$$\Delta = b^2 - 4ac = 1 - 4\left(\frac{1}{2}\right)\left(\frac{5}{2}\right)$$

$$= 1 - 5$$

$$= -4 \rightarrow \text{no zeros}$$

Opens \uparrow

Coordinates of the vertex: $\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right) = \left(\frac{-1}{1}, \frac{4}{2}\right), (-1, 2)$

Coordinates of the y-intercept: $\left(0, \frac{5}{2}\right)$ or $\left(0, 2\frac{1}{2}\right)$

Coordinates of the point symmetric with the y-intercept: $\left(-2, 2\frac{1}{2}\right)$

Coordinates of the zeros: none

Equation of the axis of symmetry: $x = -1$

4) Graph the equation below:

$$y = \frac{1}{4}x^2 - 2x + 6$$

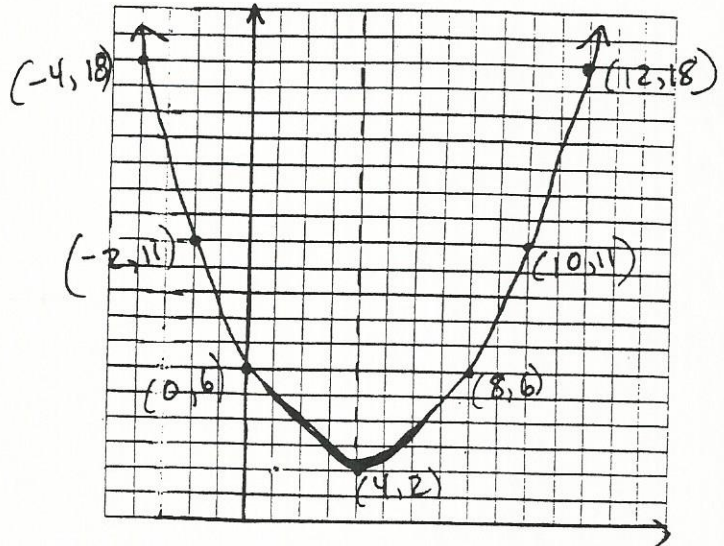
$$a = \frac{1}{4} \quad b = -2 \quad c = 6$$

Then determine the characteristics listed below and draw the axis of symmetry.

$$x = -2$$

$$y = \frac{1}{4}(-2)^2 - 2(-2) + 6 \\ = 1 + 4 + 6 = 11$$

x	y
-2	11
10	11
12	18
-4	18



$$\Delta = b^2 - 4ac \\ = (-2)^2 - 4\left(\frac{1}{4}\right)(6) \\ = 4 - 6 \\ = -2 \quad (\text{No zeros})$$

Coordinates of the vertex: $\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right) = \left(\frac{2}{2\left(\frac{1}{4}\right)}, \frac{2}{1}\right) = (4, 2)$

Coordinates of the y-intercept: $(0, 6)$

Coordinates of the point symmetric with the y-intercept: $(8, 6)$

Coordinates of the zeros: No zeros

Equation of the axis of symmetry: $x = 4$

$$x = 10 \left\{ \begin{aligned} y &= \frac{1}{4}(10)^2 - 2(10) + 6 \\ &= \frac{1}{4}(100) - 20 + 6 \\ &= 25 - 20 + 6 = 11 \end{aligned} \right.$$

$$x = 12 \left\{ \begin{aligned} y &= \frac{1}{4}(144) - 2(12) + 6 \\ &= 18 \end{aligned} \right.$$

5) Graph the equation below:

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

$$a = -1$$

$$b = 5$$

$$c = -4$$

$$-x^2 + 5x - 4 = 0$$

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

$$-x(x-4) + 1(x-4)$$

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

zeros: 1 and 4

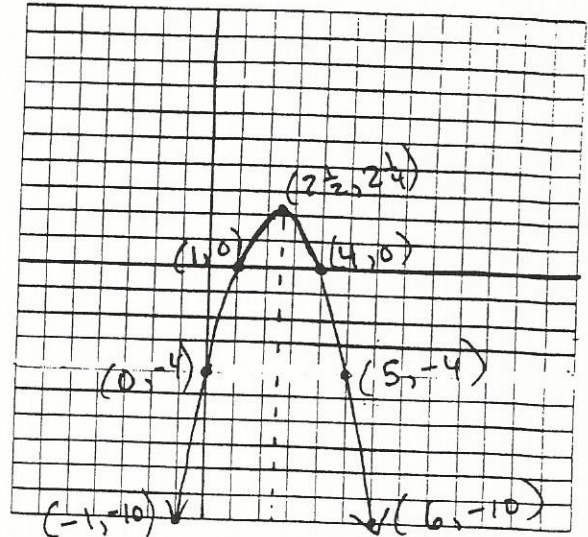
prod = +

sum = +

+4, +1

Then determine the characteristics listed below and draw the axis of symmetry.

x	y
-1	-10
6	-10



$$\Delta = b^2 - 4ac$$

$$= 25 - 4(-1)(-4)$$

$$= 25 - 16 = 9$$

Coordinates of the vertex: $\left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right), \left(\frac{-5}{-2}, \frac{-9}{-4}\right), \left(2\frac{1}{2}, 2\frac{1}{4}\right)$

Coordinates of the y-intercept: $(0, -4)$

Coordinates of the point symmetric with the y-intercept: $(5, -4)$

Coordinates of the zeros: $(1, 0)$ and $(4, 0)$

Equation of the axis of symmetry: $x = 2\frac{1}{2}$ or $x = \frac{5}{2}$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

⑥ Graph the equation below:

$$y = 2x^2 + 4x - \frac{3}{2}$$

$$a = 2$$

$$b = 4$$

$$c = -\frac{3}{2}$$

$$\frac{-4 \pm \sqrt{16 - 4(2)(-\frac{3}{2})}}{2(2)}$$

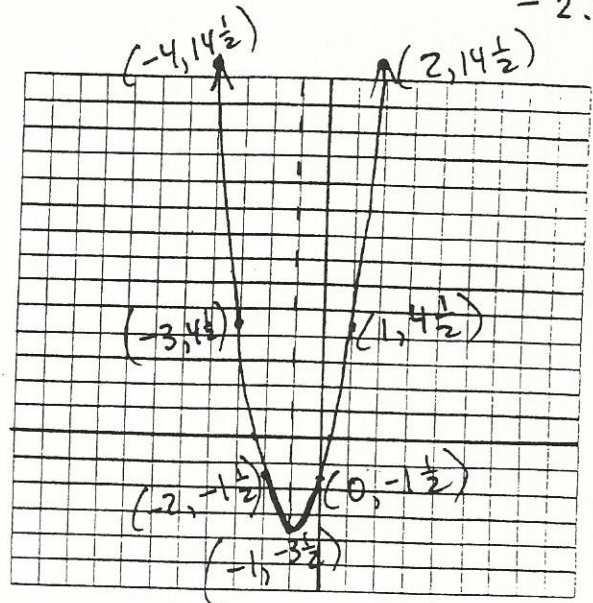
$$\frac{-4 \pm \sqrt{16 + 12}}{2(2)} = \frac{-4 \pm \sqrt{28}}{4}$$

$$= 0.32$$

Then determine the characteristics listed below and draw the axis of symmetry. OR

$$-2.32$$

x	y
1	$4\frac{1}{2}$
-3	$4\frac{1}{2}$
-4	$14\frac{1}{2}$
2	$14\frac{1}{2}$



$$\begin{aligned} \Delta &= b^2 - 4ac = 4^2 - 4(2)(-\frac{3}{2}) \\ &= 16 + 12 \\ &= 28 \end{aligned}$$

Coordinates of the vertex: $(\frac{-b}{2a}, \frac{-\Delta}{4a})$, $(\frac{-4}{4}, \frac{-28}{8})$, $(-1, -3\frac{1}{2})$

Coordinates of the y-intercept: $(0, -1\frac{1}{2})$

Coordinates of the point symmetric with the y-intercept: $(-2, -1\frac{1}{2})$

Coordinates of the zeros: $(0.32, 0)$, $(-2.32, 0)$

Equation of the axis of symmetry: $x = -1$