

★ Must be equal to 0!!

Solve by Factoring

<p>a) <math>(2x - 1)(3x + 5) = 0</math>  <math>2x - 1 = 0</math>   <math>3x + 5 = 0</math>  <math>2x = 1</math>   <math>3x = -5</math>  <math>x = \frac{1}{2}</math>   <math>x = -\frac{5}{3}</math></p>	<p>b) <math>(x - 3)(x + 8) = 12</math>  <math>(x - 3)(x + 8) - 12 = 0</math>  <math>x^2 + 5x - 24 - 12 = 0</math>  <math>x^2 + 5x - 36 = 0</math>  <math>(x - 4)(x + 9) = 0</math>  <math>x = 4, -9</math></p>	<p>c) <math>5x^2 = 12x</math>  <math>5x^2 - 12x = 0</math>  <math>x(5x - 12) = 0</math>  <math>x = 0</math>   <math>5x - 12 = 0</math>  <math>x = 0</math>   <math>x = \frac{12}{5}</math></p>
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Factor →  
 Solutions

Now let's use this concept and have some real fun!! 😊

- 1) The shorter side of a rectangle is 3 less than the longer side. The area is 54 sq cm. Find the length and width.

$x$   
 $x - 3$     $A = 54 \text{ cm}^2$

$l \cdot w = A$   
 $x(x - 3) = 54$   
 $x^2 - 3x = 54$   
 $x^2 - 3x - 54 = 0$   
 $(x - 9)(x + 6) = 0$   
 $x = 9, -6$

Dimensions  
 $9 \text{ cm} \times 6 \text{ cm}$

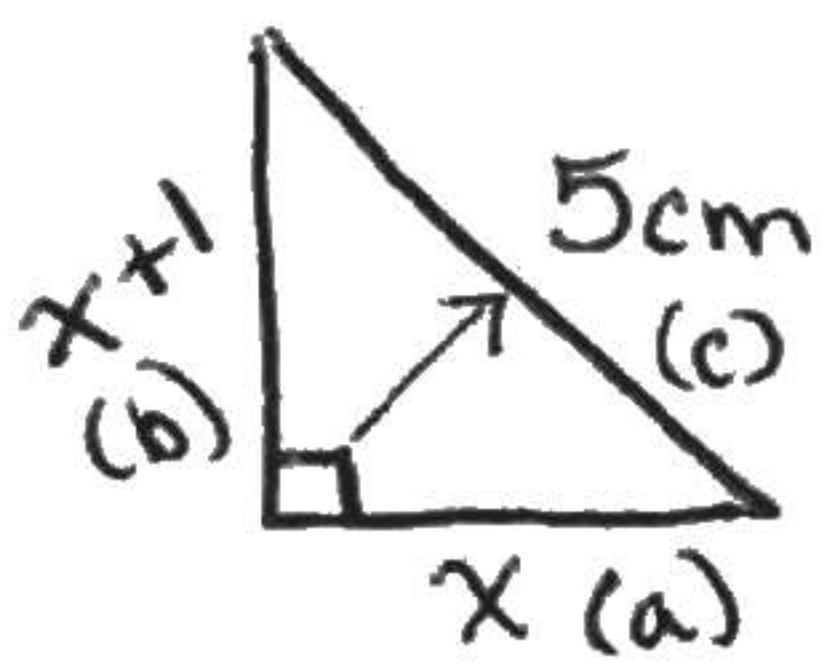
- 2) The length of a rectangle is four feet longer than the width. The area is 21 sq ft. Find the dimensions.

$x + 4$   
 $x$     $A = 21$

$l \cdot w = A$   
 $x(x + 4) = 21$   
 $x^2 + 4x = 21$   
 $x^2 + 4x - 21 = 0$   
 $(x + 7)(x - 3) = 0$   
 $x = -7, 3$

Dimension  
 $7 \text{ ft by } 3 \text{ ft}$

- 3) The leg of a right triangle is 1 cm longer than the other leg. The hypotenuse measures 5 cm. Find the measure of each leg of the triangle.



$a^2 + b^2 = c^2$   
 $x^2 + (x + 1)^2 = 5^2$   
 $x^2 + (x + 1)(x + 1) = 25$   
 $x^2 + x^2 + 2x + 1 = 25$   
 $2x^2 + 2x + 1 = 25$   
 $2x^2 + 2x - 24 = 0$

$2x^2 + 2x - 24 = 0$   
 $2(x^2 + x - 12) = 0$   
 $(x + 4)(x - 3) = 0$   
 $x + 4 = 0$     $x - 3 = 0$   
 $x = -4, 3$

$3, 4, 5$

- 4) The length of a rectangle is 5 meters longer than its width and the area of the rectangle is 84 m<sup>2</sup>. Find the dimensions on the rectangle.

# Parabola

## Notes: Quadratic Functions

$$y = ax^2 + bx + c$$

Quadratic  
y-intercept  
Axis of Symmetry

$$y = x^2 - 2x - 3$$

$$a = 1 \quad b = -2 \quad c = -3$$

$$\text{Factors: } (x - 3)(x + 1)$$

**Axis of Symmetry:**  $(x = \frac{-b}{2a})$

→ the vertical line that divides the parabola into 2 congruent halves (passes through the vertex)

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

**Vertex:** (highest or lowest point)

→ Use the axis of symmetry (x) and plug it into the equation to find y.

$$y = x^2 - 2x - 3$$

$$y = (1)^2 - 2(1) - 3 \quad (1, -4)$$

$$y = -4$$

Find additional points and plot it

x	$x^2 - 2x - 3$	y
-2	$(-2)^2 - 2(-2) - 3$	5
-1	$(-1)^2 - 2(-1) - 3$	0
0	$(0)^2 - 2(0) - 3$	-3
1		-4
2	$(2)^2 - 2(2) - 3$	-3
3	$(3)^2 - 2(3) - 3$	0

**Value of Max or Min:** (y-value of the vertex)

Minimum Value of **-4**

**Zeros:** (where the function hits x-axis)

$(-1, 0)$  and  $(3, 0)$ ,  $x = -1, 3$

**y-intercept:** (where the function hits y-axis)

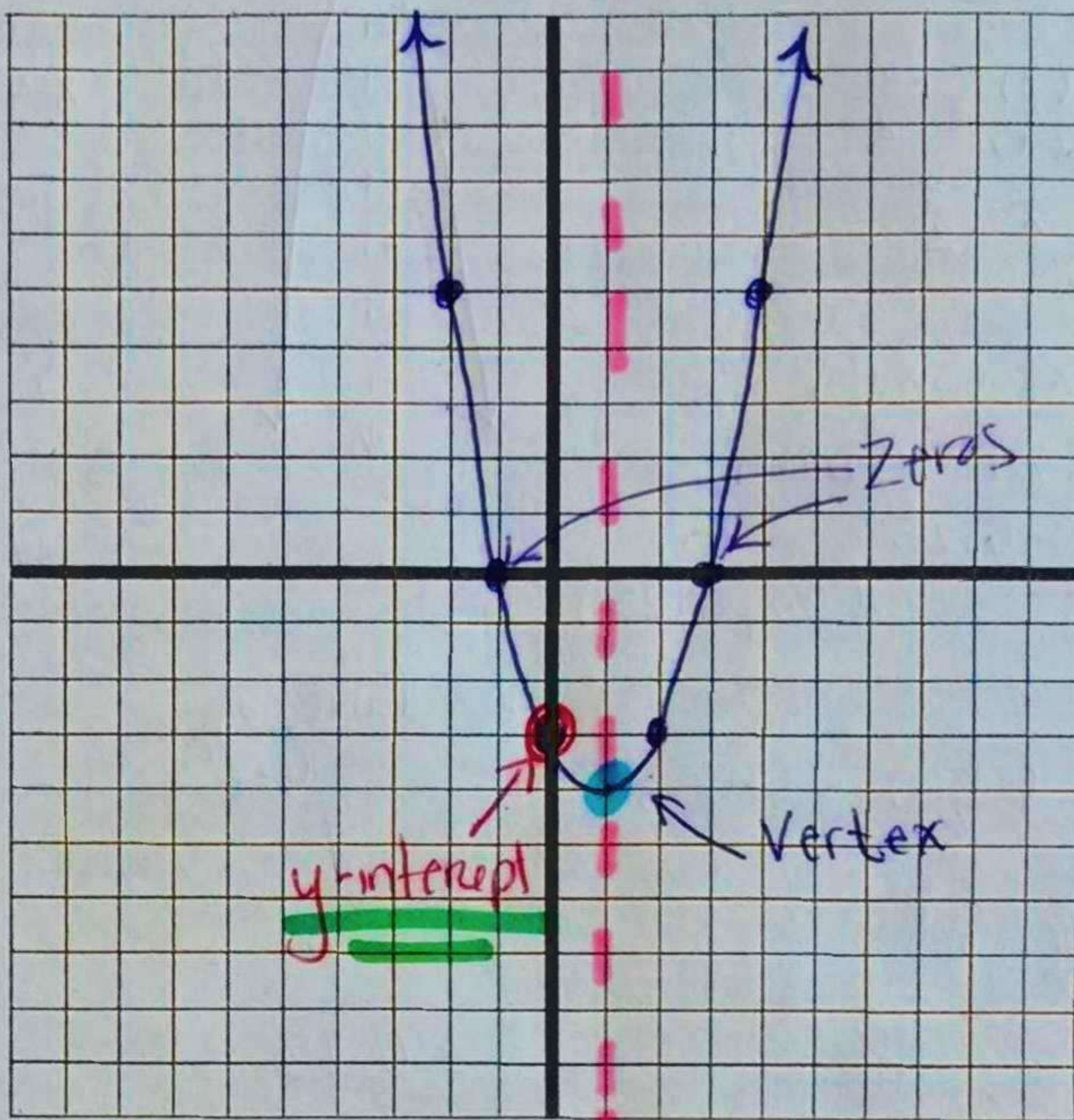
$(0, -3)$

**Domain:** x

All Real #'s ( $\mathbb{R}$ )

**Range:**

$y \geq -4$



What do you notice about the factors and the zeros of the quadratic function?

$(x - 3)(x + 1)$  Factors

$x = 3, -1$  Zeros

How does "a" affect the graph of a parabola?

$a > 0 (+)$   $\cup$  minimum value

$a < 0 (-)$   $\cap$  maximum value

← y-nt

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

$a = -1$   $b = 3$   $c = 4$

Factors:

Axis of symmetry:

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

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

Vertex

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

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

$$y = 6.25$$

$$(\frac{3}{2}, 6.25)$$

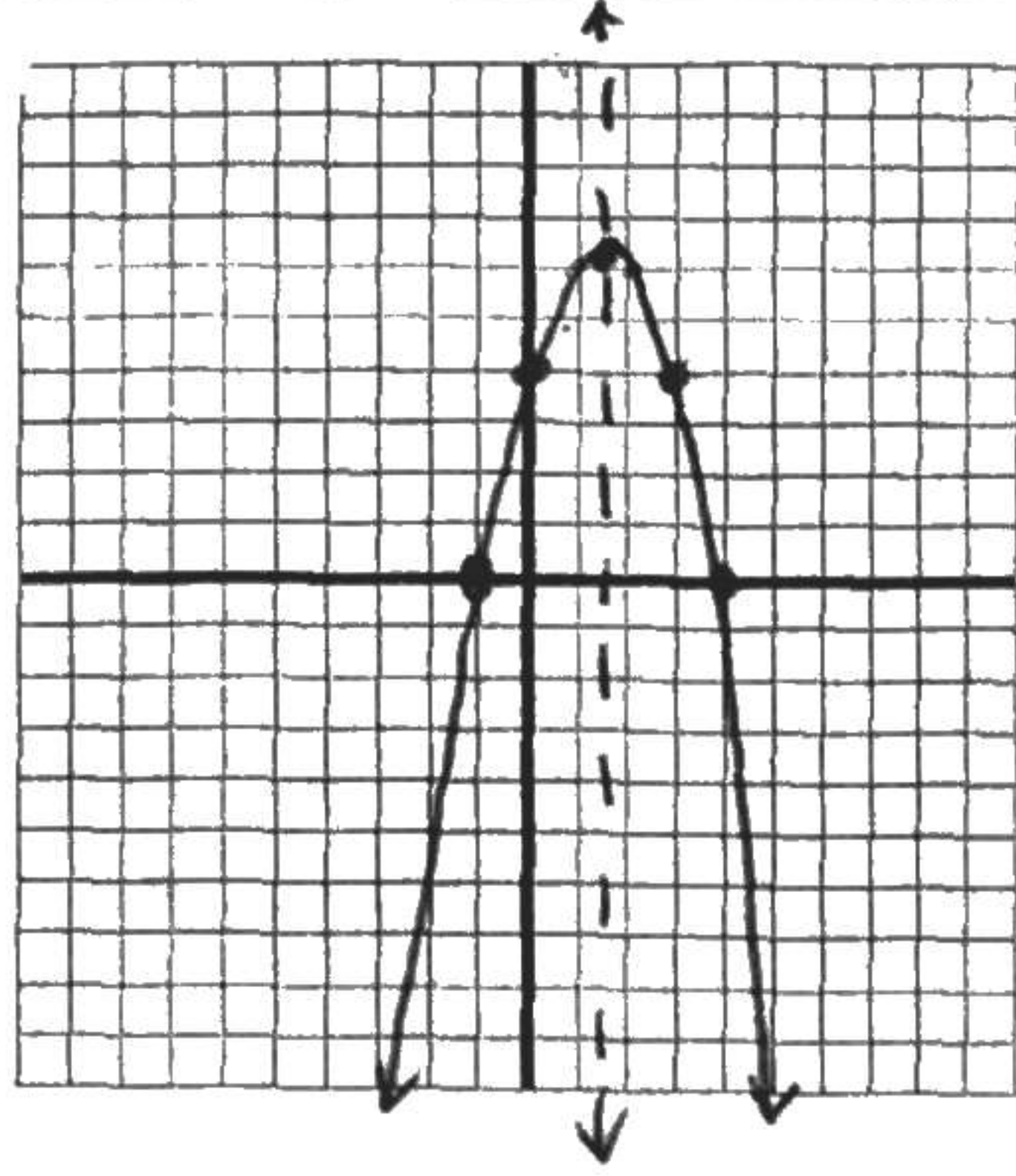
Maximum or Minimum Value: max value of 6.25

Zeros:  $(-1, 0)$  +  $(4, 0)$

y- intercept:

$$(0, 4)$$

Domain  $\mathbb{R}$  Range  $y \leq 6.25$



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

$a = 1$   $b = 1$   $c = -2$

Factors:

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

Axis of symmetry:

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

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

Vertex

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

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

$$y = -2.25$$

$$(-\frac{1}{2}, -2.25)$$

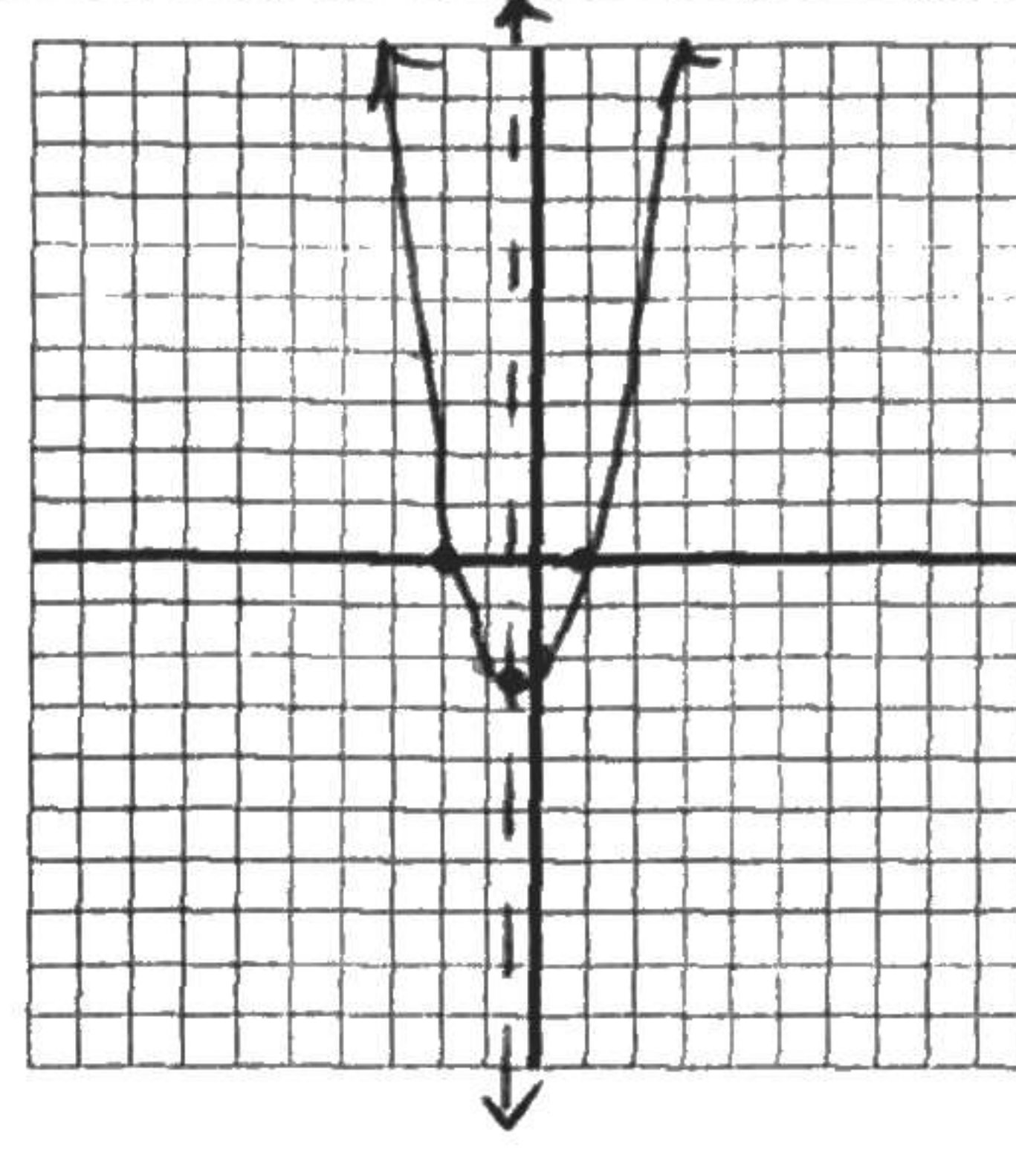
Maximum or Minimum Value: minimum value of -2.25

Zeros:  $x = -2, 1$

y- intercept:

$$(0, -2)$$

Domain  $\mathbb{R}$  Range  $y \geq -2.25$

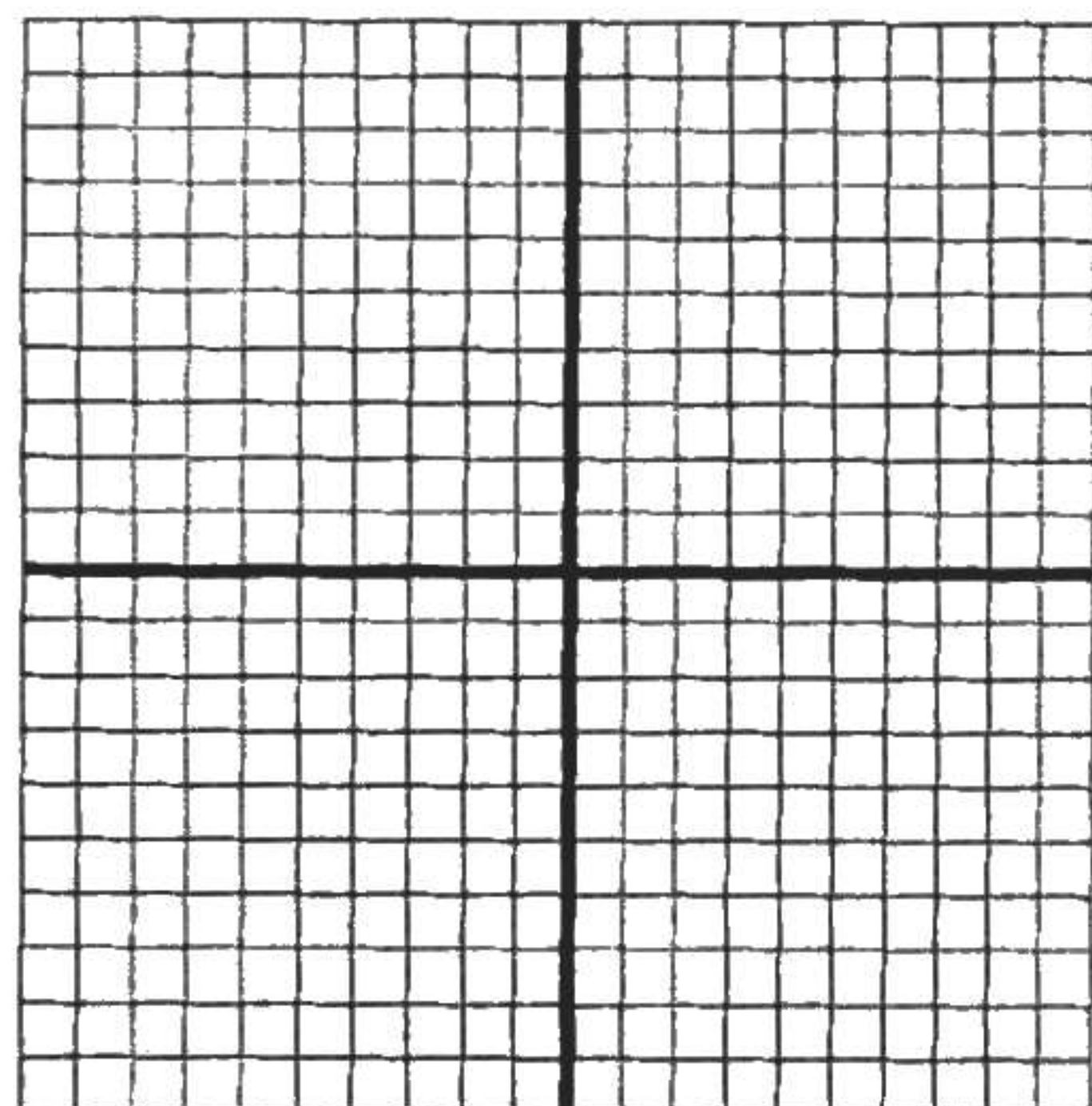


3)  $y = x^2 + 4x + 3$

Factors:

Axis of symmetry:

Vertex



Maximum or Minimum Value:

Zeros:

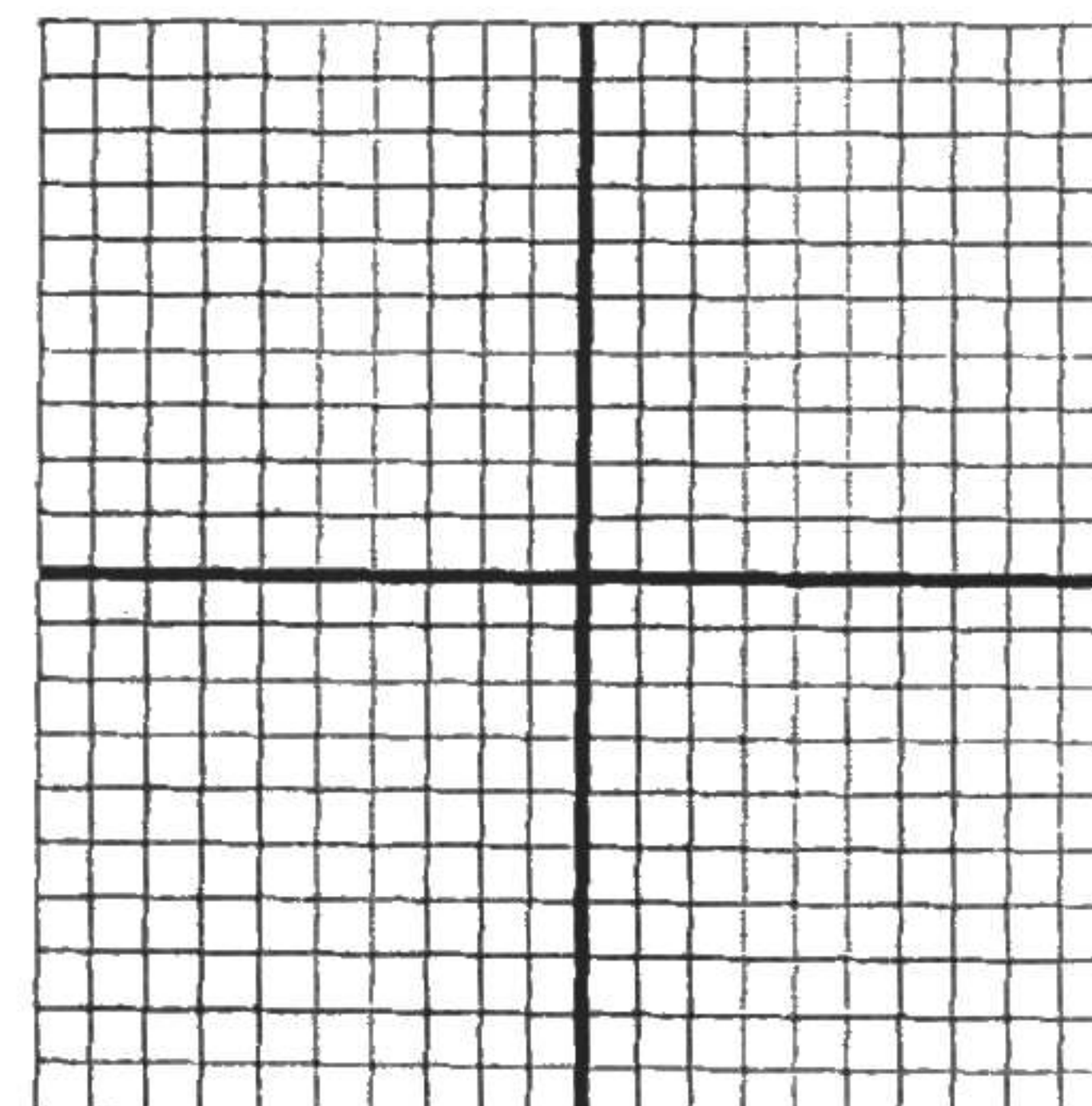
y- intercept:

Domain \_\_\_\_\_ Range \_\_\_\_\_

4)  $y = -x^2 + 6x - 5$

Axis of symmetry:

Vertex



Maximum or Minimum Value:

Zeros:

y- intercept:

Domain \_\_\_\_\_ Range \_\_\_\_\_