Name ______________________ Date ______________

9.2

Quadratic Functions

A **quadratic functions** can be described by $f(x) = ax^2 + bx + c$. The graph of a quadratic function is a **parabola** when the domain is the set of real numbers.

The x–coordinate of the **vertex** (maximum or minimum point) is $-\frac{b}{2a}$.

The **axis of symmetry** is the line $x = -\frac{b}{2a}$.

We can use this information to help graph a quadratic function.

Example Graph $y = 2x^2 + 4x + 1$. $\boxed{a = 2,\ b = 4,\ c = 1}$

The x–coordinate of the vertex is $-\frac{b}{2a} = -\frac{4}{2 \cdot 2} = -\frac{4}{4} = -1$.

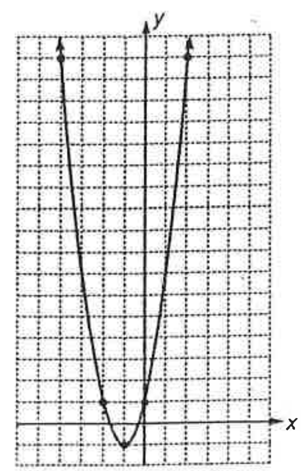
$$\begin{aligned} y &= 2x^2 + 4x + 1 \\ &= 2(-1)^2 + 4(-1) + 1 \\ &= 2 - 4 + 1 \\ &= -1 \end{aligned}$$

Substitute the x–coordinate in the original equation.

The axis of symmetry is the line $x = -1$.

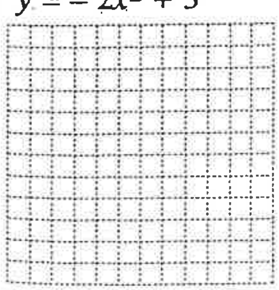
x	y
–2	1
0	1
2	17
–4	17

Choose points on each side of the axis of symmetry.

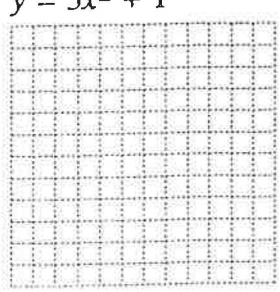


Graph each function.

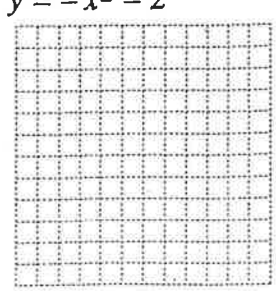
1. $y = -2x^2 + 3$



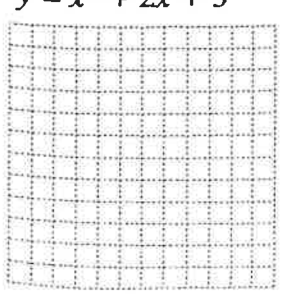
2. $y = 3x^2 + 1$



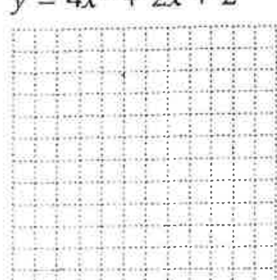
3. $y = -x^2 - 2$



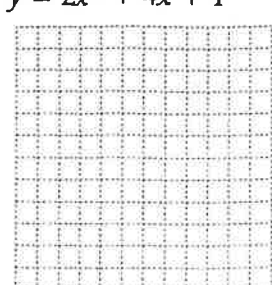
4. $y = x^2 + 2x + 3$

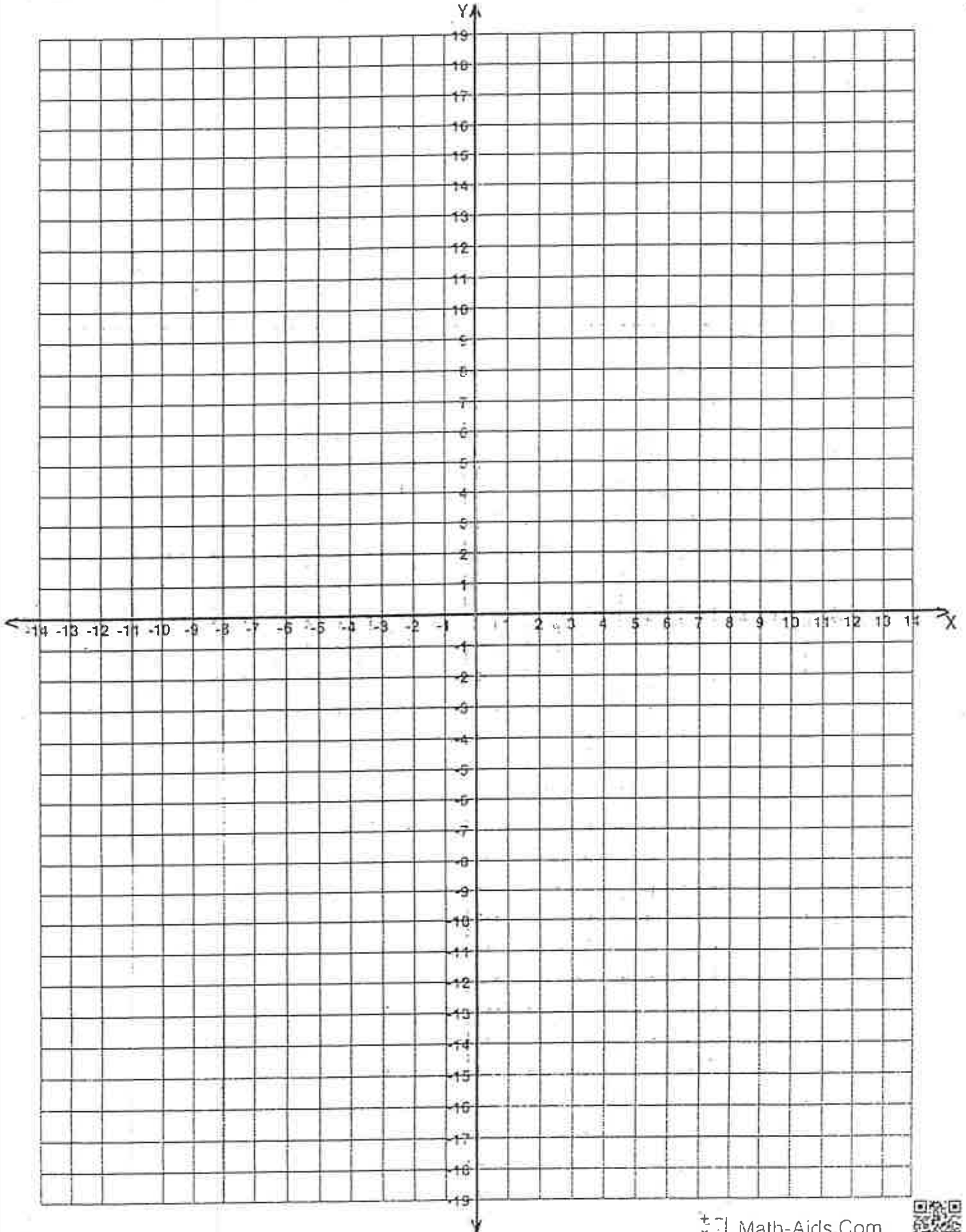


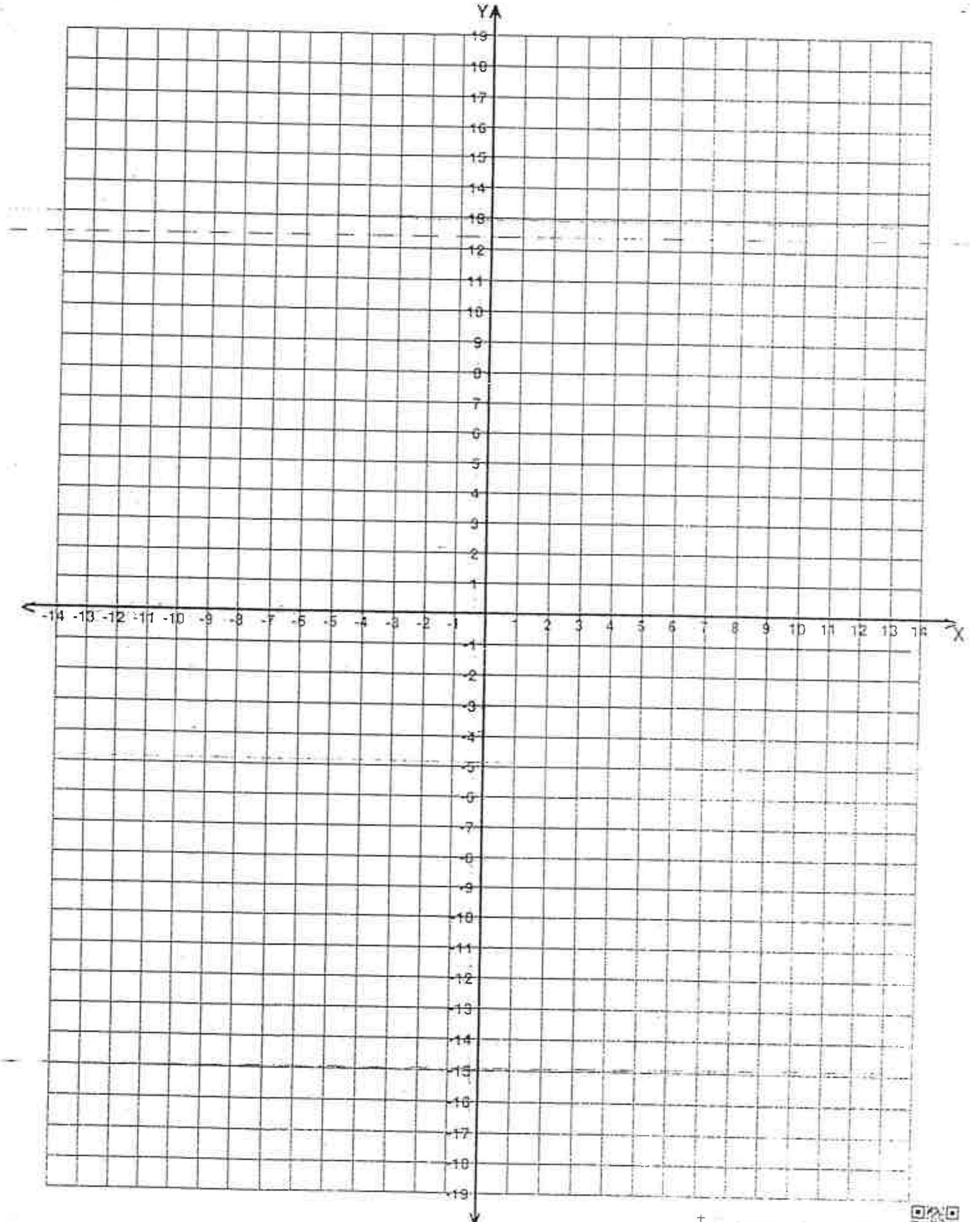
5. $y = 4x^2 + 2x + 2$



6. $y = 2x^2 + 4x + 1$




Y
X


Y
X

9-2 "Another Look Wksht" Answers

① $y=-2x^2+3$

* downward

$\frac{-b}{2a} = \frac{-0}{2(-2)} = 0$

* $x=0$, y-axis
* vertex $(0,3)$ & y-intercept

*

x	y
-2	-5 ✓
-1	1 ✓
0	3 *vertex
1	1 ✓
2	-5 ✓

② $y=3x^2+1$

* upward

$\frac{-b}{2a} = \frac{-0}{2(3)} = 0$

* $x=0$ / y-axis

x	y
-2	13 ✓
-1	4 ✓
0	1 *vertex
1	4
2	13 ✓

③ $y=-x^2-2$

* downward

$\frac{-b}{2a} = \frac{-0}{2(-1)} = 0$

$x=0$, y-axis

x	y
-2	-6 ✓
-1	-3 ✓
0	-2 *vertex
1	-3 ✓
2	-6 ✓

④ $y=x^2+2x+3$

* upward

$\frac{-b}{2a} = \frac{-2}{2(1)} = \frac{-2}{2} = -1$

$x=-1$

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

x	y
-3	6 ✓
-2	3 ✓
-1	2 *vertex
0	3 ✓ *y-intercept
1	6 ✓

upwards

(5) $y = 4x^2 + 2x + 2$

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

$$y = 4\left(\frac{-1}{4}\right)^2 + 2\left(\frac{-1}{4}\right) + 2$$

$$y = \cancel{4}^{1}\left(\frac{1}{\cancel{16}_{4}}\right) + \cancel{2}^{1}\left(\frac{-1}{\cancel{4}_{2}}\right) + 2$$

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

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

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

$$y = \frac{-1}{4} + \frac{8}{4}$$

$$y = +\frac{7}{4}$$

vertex $= \left(-\frac{1}{4}, \frac{7}{4}\right)$

$\left(-\frac{1}{4}, 1\frac{3}{4}\right)$

x	y	
-2	14	
-1	4	
$-\frac{1}{4}$	$7/4$	*vertex
0	2	*y-intercept
1	8	

⑥ $y=2x^2+4x+1$

upwards

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

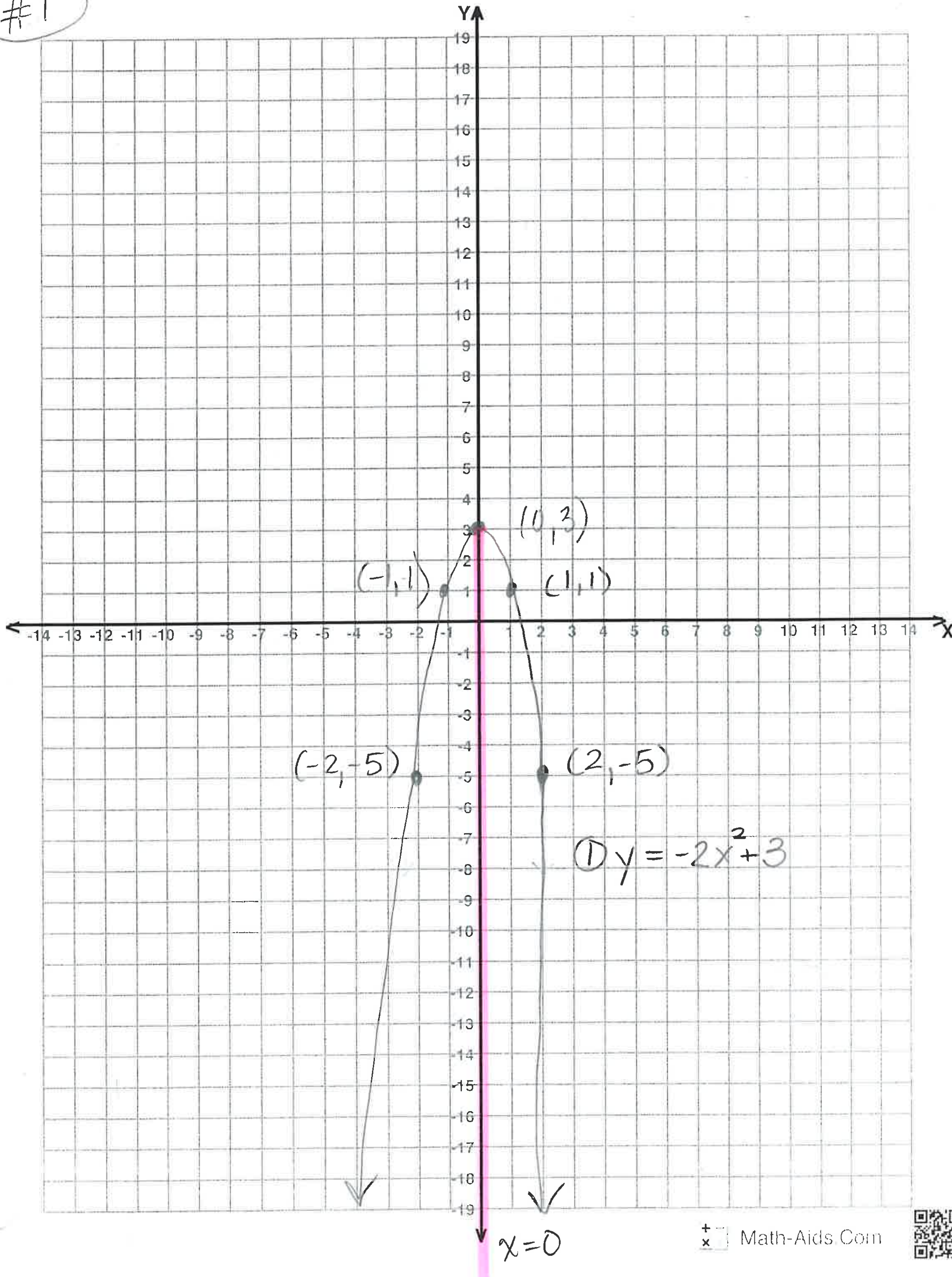
$y=2(1)^2+4(-1)+1$

$y= 2 + -4 + 1$

$y=-1$

x	y
-3	7
-2	1
-1	-1 * vertex
0	1 * y-intercept
1	7

#1



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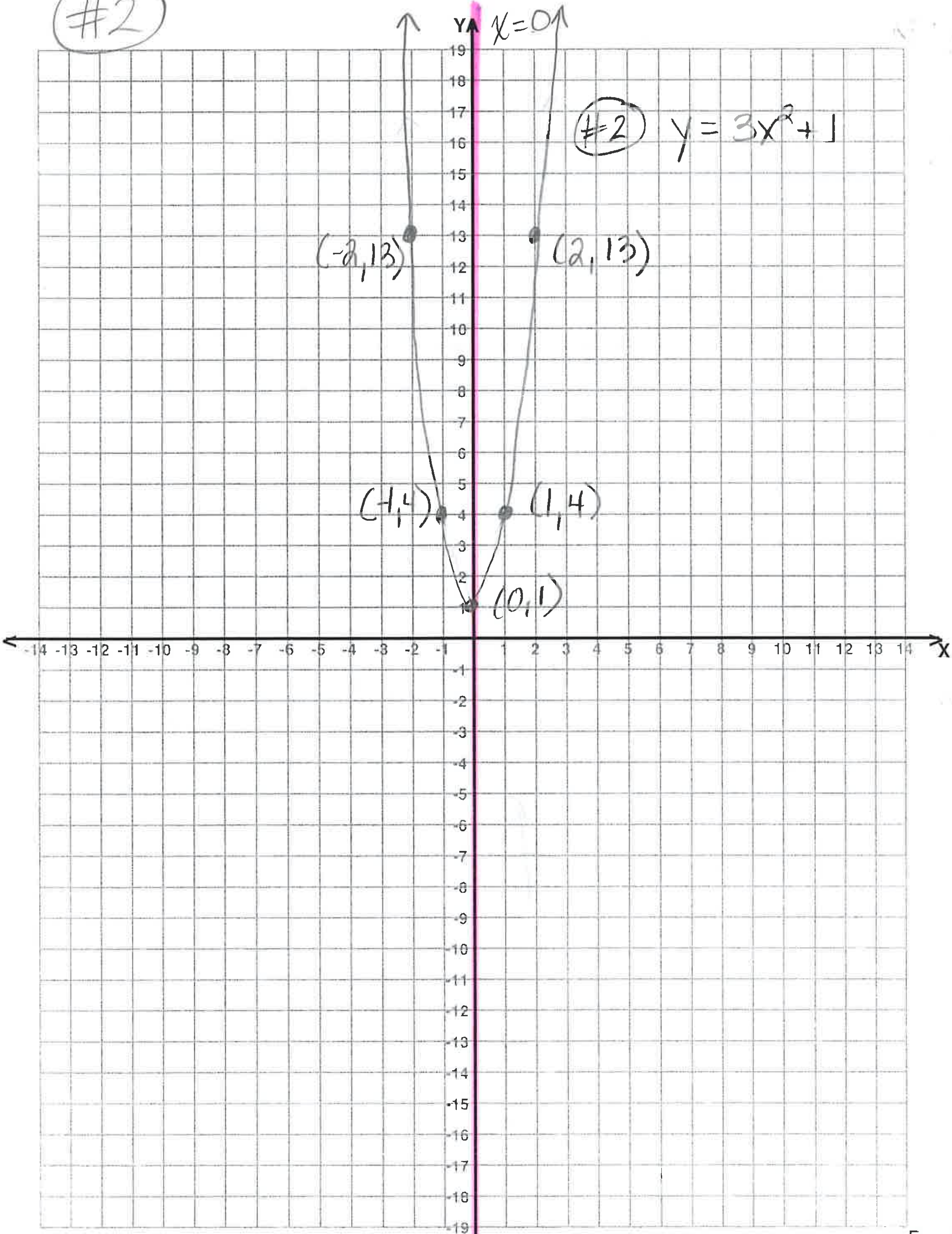

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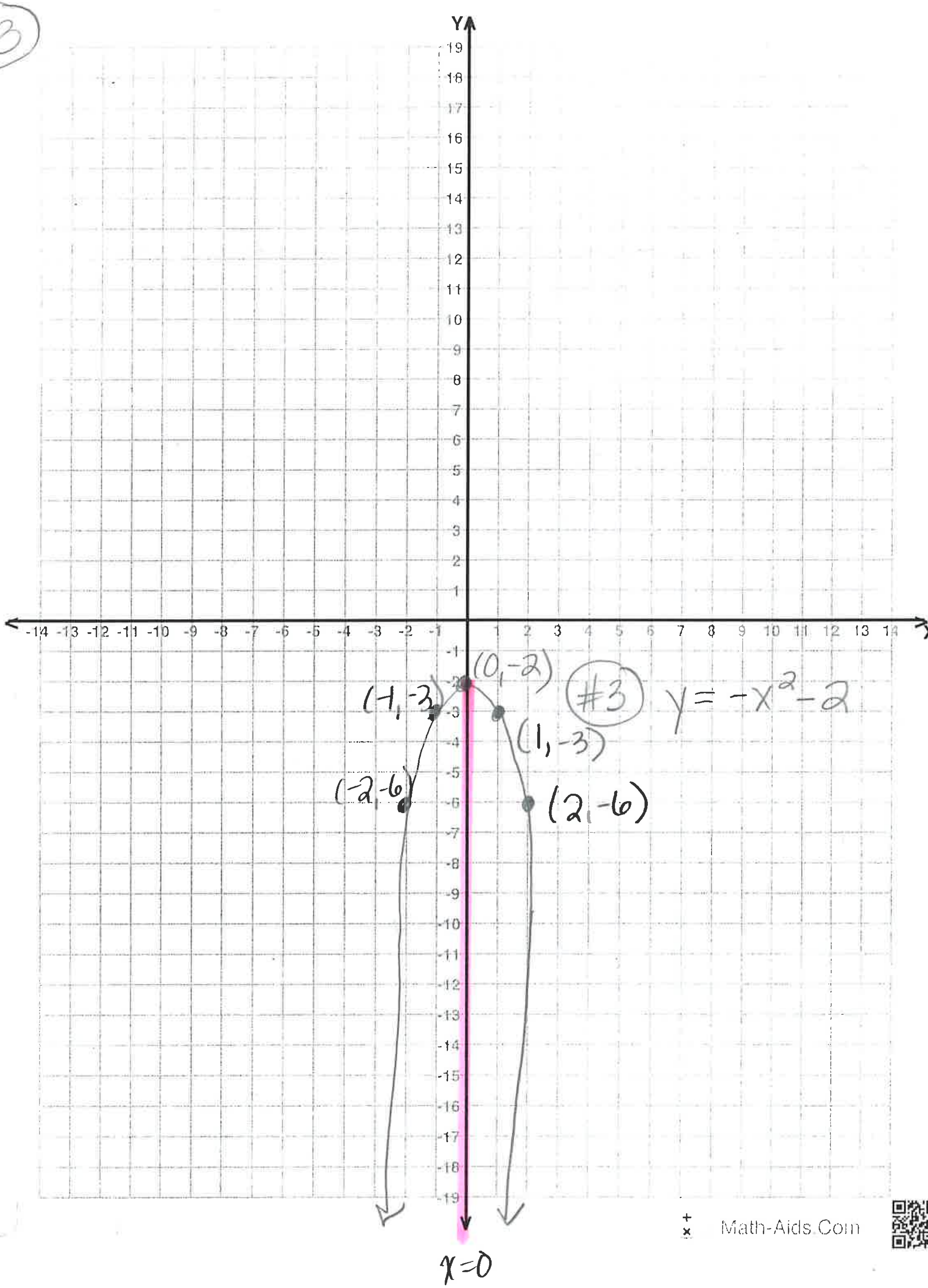

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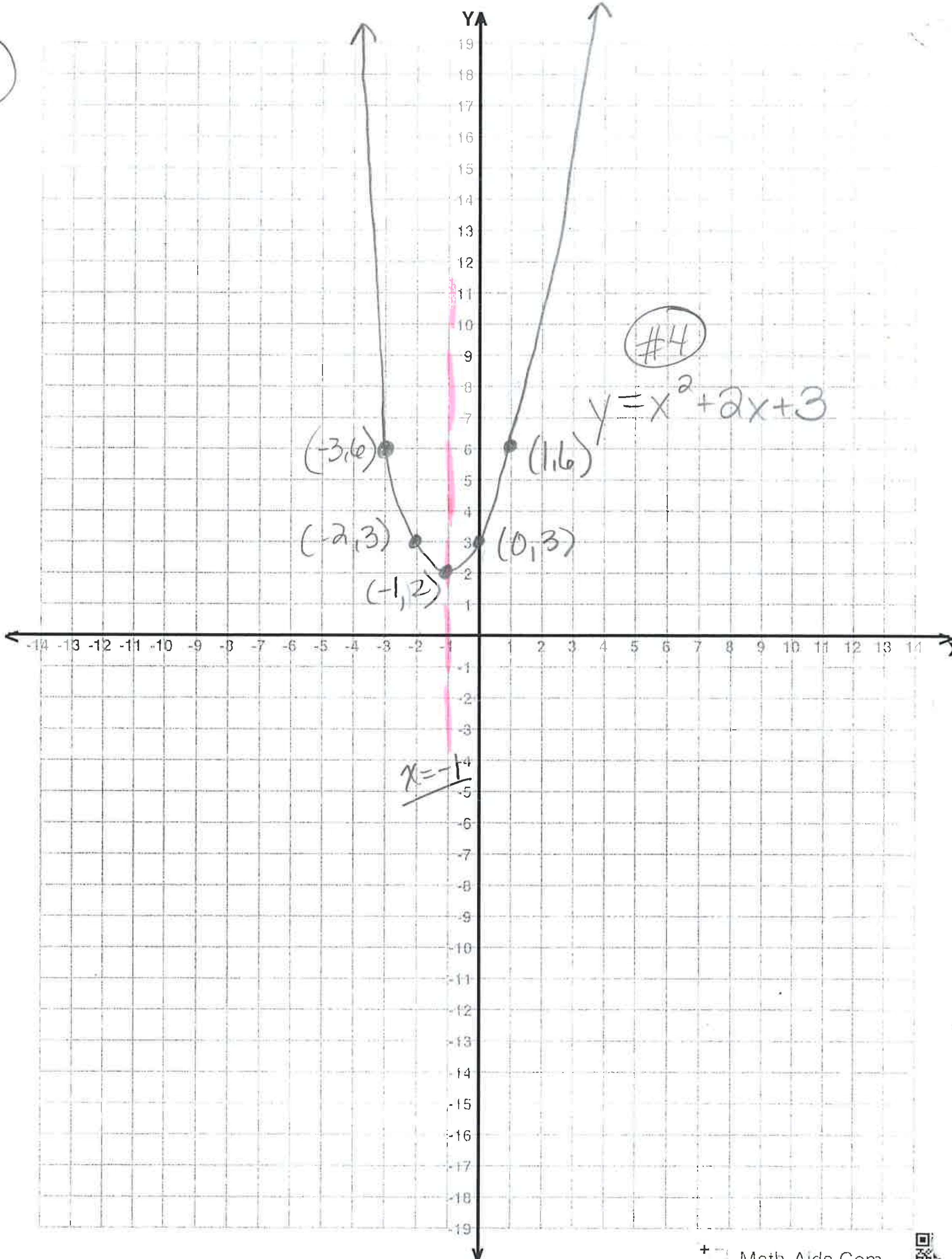

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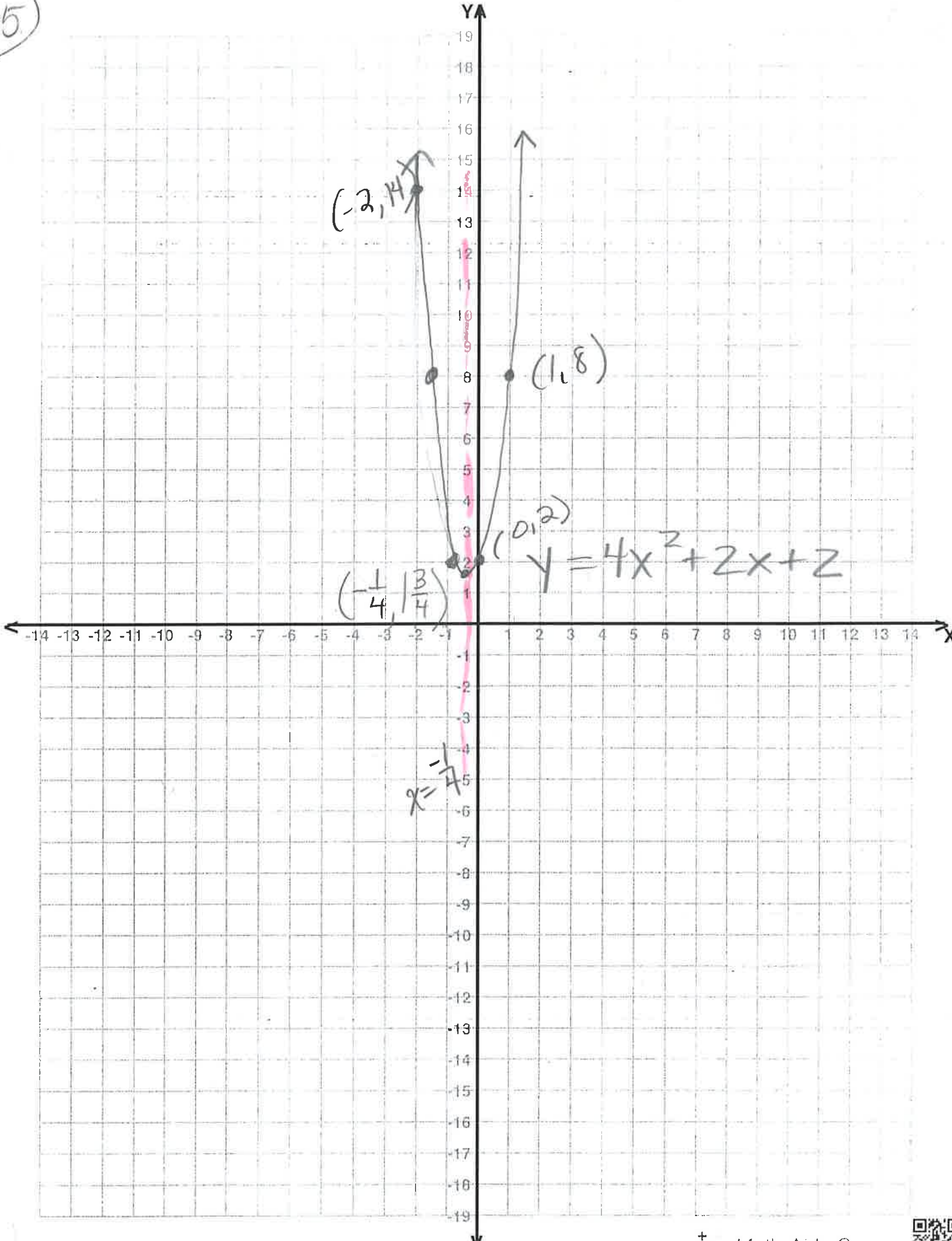

#6