Name:__________
Date:__________

/55

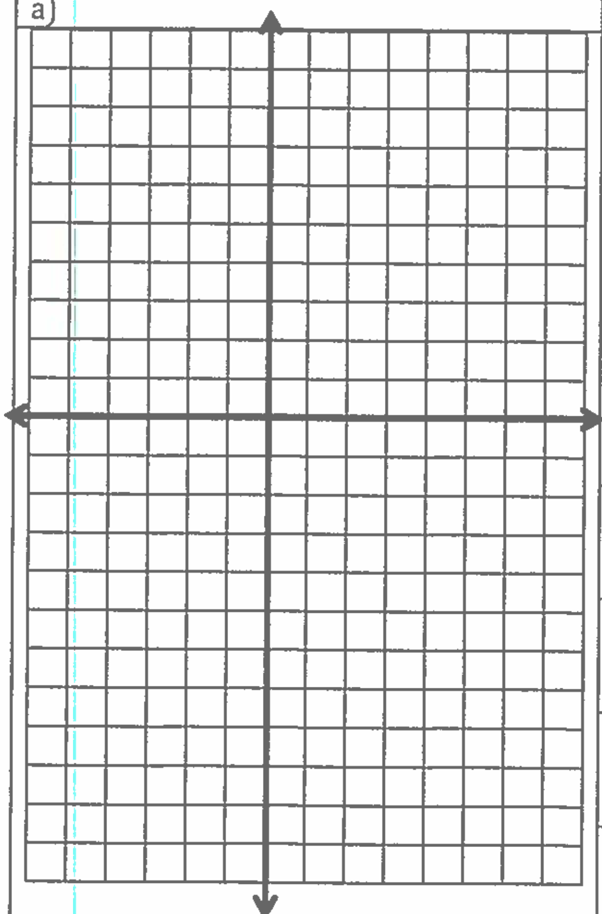
VERTICAL STRETCH AND COMBINED TRANSFORMATIONS OF A QUADRATIC FUNCTION

[5] **1.** Given an equation, describe all transformations of the original graph $f(x) = x^2$. Read the transformations left-to-right and list them in order.

Equation	Transformations
$f(x) = 7(x - 10)^2$	• VSE by a factor of 7 • HT right by 10 units
$f(x) = -5(x - 1)^2 + 4$	• R in the x-axis • VSE by a factor of 5 • HT right by 1 unit • VT up by 4 units
$y = 0.5x^2 + 4$	• VSC by a factor of ½ • VT up by 4 units
$f(x) = -3x^2$	• R in the x-axis • VSE by a factor of 3
! $y - 1 = (x + 2)^2$ $y = (x+2)^2+1$	• HT left by 2 units • VT up by 1 unit

[50] **2.** Graph the given function and describe its properties.(10 marks each)

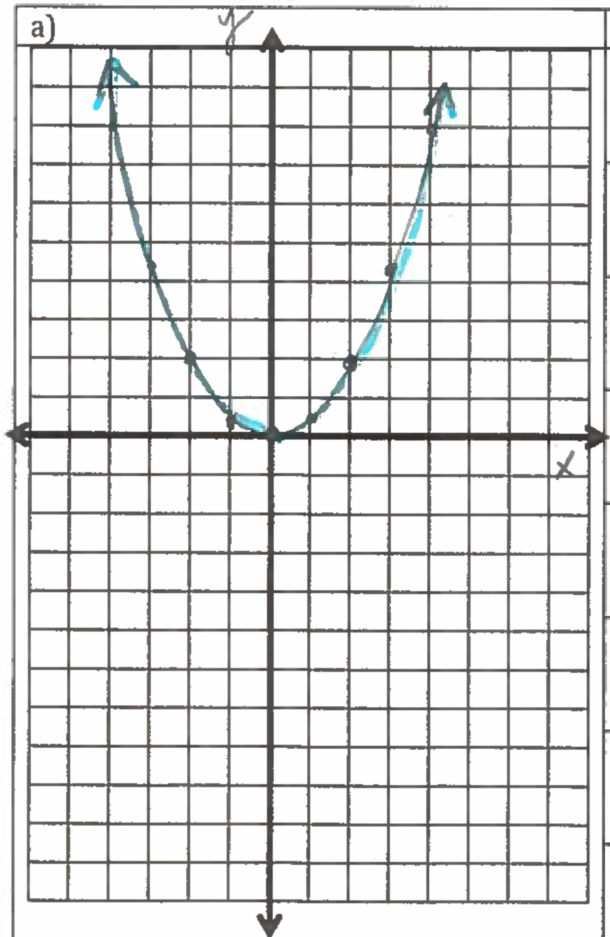
a)



$f(x) = 0.5x^2$	
Coordinates of the vertex	
Opening	
Exact x-intercepts	
Exact y-intercept	
Domain	
Range	
Transformations	
Value of the maximum or minimum	

[50] **2.** Graph the given function and describe its properties.(10 marks each)

a)



$f(x) = 0.5x^2$	
Coordinates of the vertex	(0,0)
Opening	up
Exact x-intercepts	(0,0)
Exact y-intercept	(0,0)
Domain	$D: \{x \mid x \in \mathbb{R}\}$
Range	$R: \{y \mid y \geq 0, y \in \mathbb{R}\}$
Transformations	• VSC by a factor of $\frac{1}{2}$
Value of the maximum or minimum	• min. at $y = 0$

Name:________
Date:________

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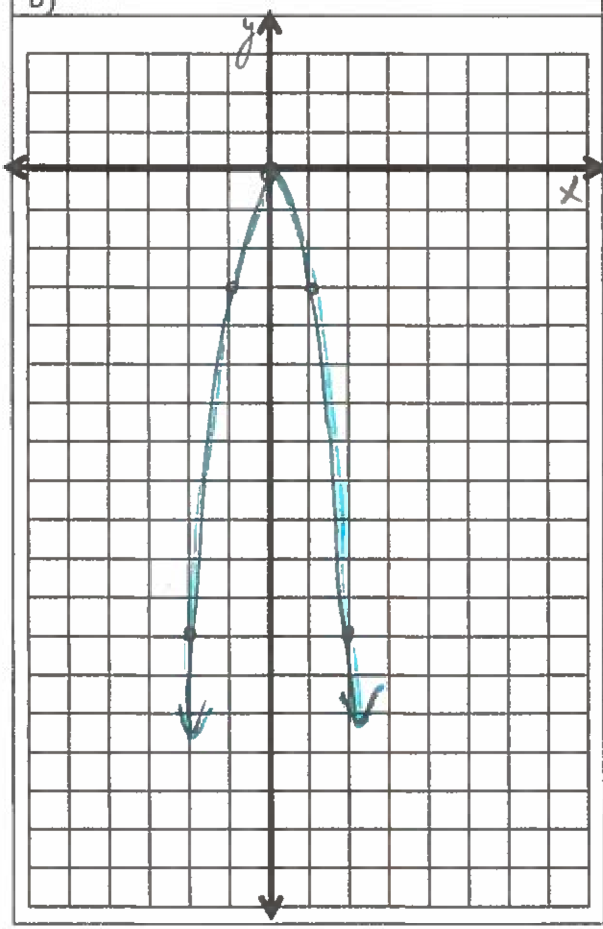
VERTICAL STRETCH AND COMBINED TRANSFORMATIONS OF A QUADRATIC FUNCTION

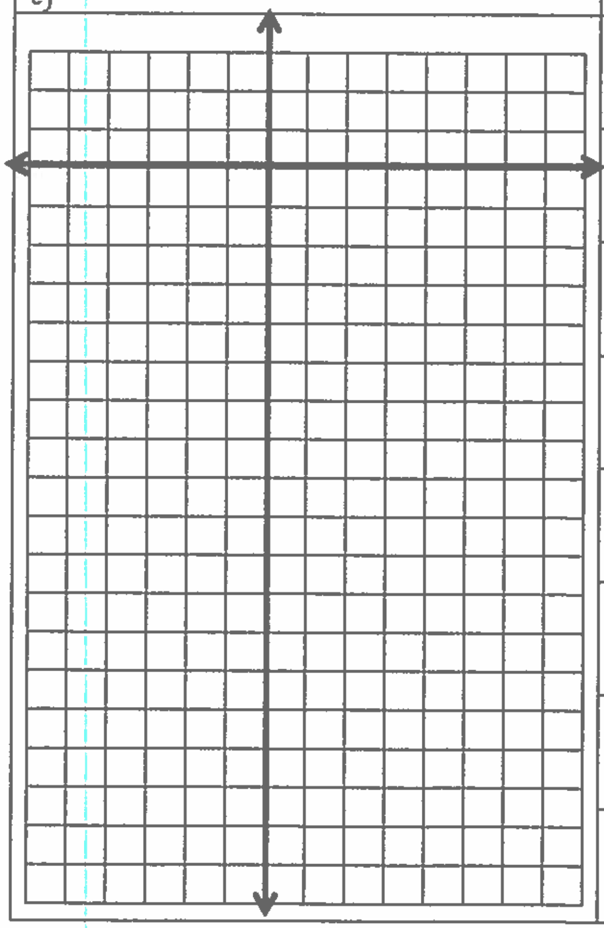
[5] **1.** Given an equation, describe all transformations of the original graph $f(x) = x^2$. Read the transformations left-to-right and list them in order.

Equation	Transformations
$f(x) = 7(x - 10)^2$	
$f(x) = -5(x - 1)^2 + 4$	
$y = 0.5x^2 + 4$	
$f(x) = -3x^2$	
$y - 1 = (x + 2)^2$	

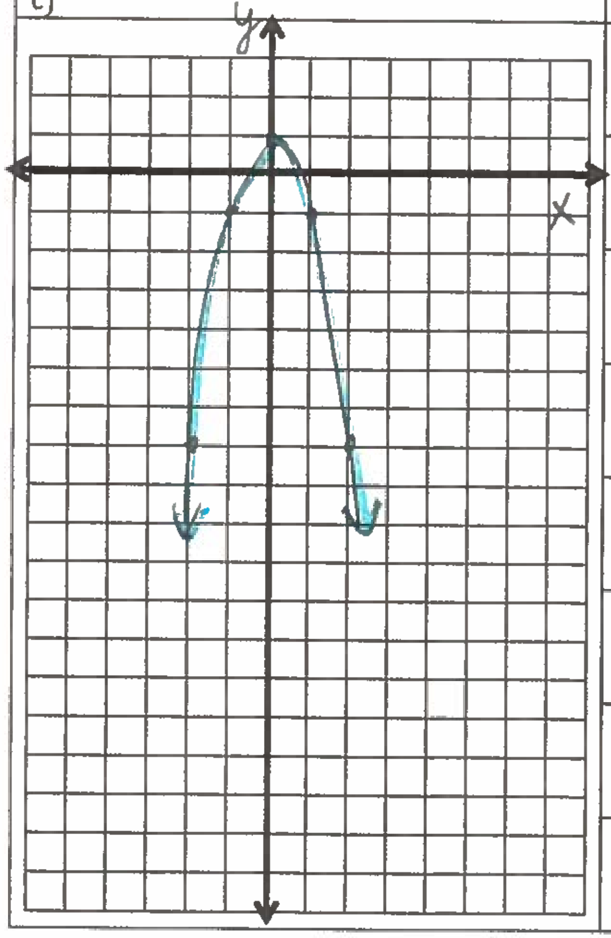
b)



$f(x) = -3x^2$	
Coordinates of the vertex	(0,0)
Exact x-intercepts	(0,0)
Opening	down
Exact y-intercept	(0,0)
Domain	$D: \{x \mid x \in \mathbb{R}\}$
Range	$R: \{y \mid y \leq 0, y \in \mathbb{R}\}$
Transformations	• R in the x-axis • VSE by a factor of 3
Value of the maximum or minimum	max. at $y = 0$

c)	$f(x) = -2x^2 + 1$	
	Coordinates of the vertex	
	Exact x-intercepts	
	Opening	
	Exact y-intercept	
	Domain	
	Range	
	Transformations	
	Value of the maximum or minimum	

c)



$f(x) = -2x^2 + 1$	
Coordinates of the vertex	$(0,1)$
Exact x-intercepts *	$\left(\frac{\sqrt{2}}{2}, 0\right)$ and $\left(-\frac{\sqrt{2}}{2}, 0\right)$
Opening	down
Exact y-intercept	$(0,1)$
Domain	D: $\{x \mid x \in \mathbb{R}\}$
Range	R: $\{y \mid y \le 1, y \in \mathbb{R}\}$
Transformations	• R in the x-axis • VSE by a factor of 2
Value of the maximum or minimum	• max. at $y = 1$

* x-ints: $y = 0$, solve for x

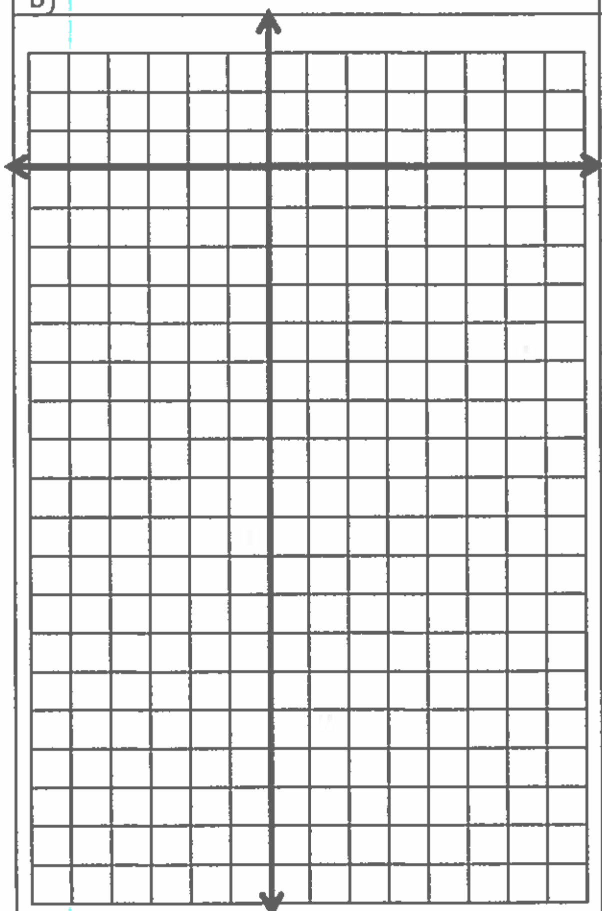
$$0 = -2x^2 + 1$$

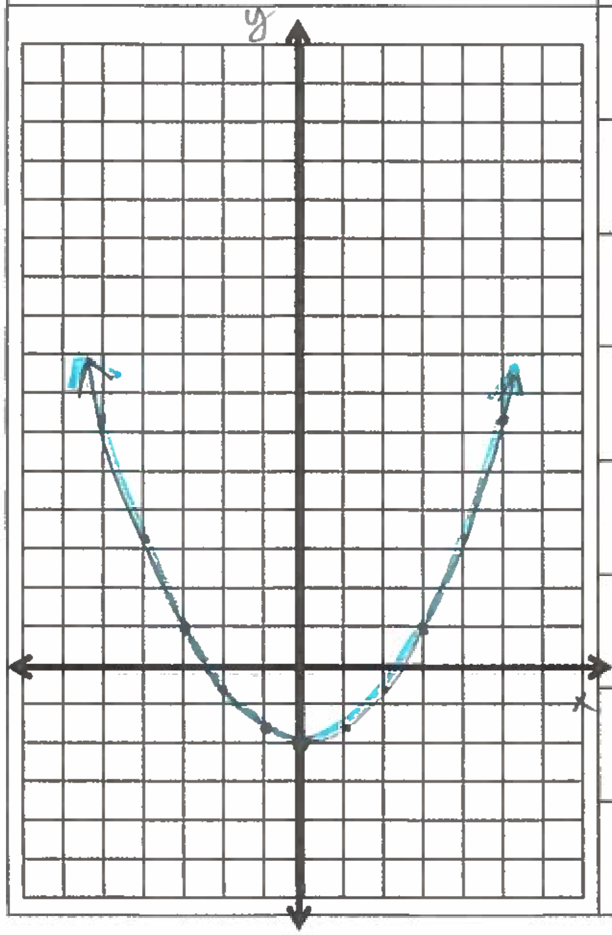
$$\frac{-1}{-2} = \frac{-2x^2}{-2}$$

$$\sqrt{\frac{1}{2}} = \sqrt{x^2}$$

$$x = \pm\sqrt{\frac{1}{2}} = \pm\frac{1}{\sqrt{2}} = \pm\frac{\sqrt{2}}{2}$$

& rationalized the denominator

b)	$f(x) = -3x^2$	
	Coordinates of the vertex	
	Exact x-intercepts	
	Opening	
	Exact y-intercept	
	Domain	
	Range	
	Transformations	
	Value of the maximum or minimum	

d)	$f(x) = \frac{1}{3}x^2 - 2$	
	Coordinates of the vertex	$(0, -2)$
	Exact x-intercepts *	$(-\sqrt{6}, 0)$ and $(\sqrt{6}, 0)$
	Opening	up
	Exact y-intercept	$(0, -2)$
	Domain	D: $\{x \mid x \in \mathbb{R}\}$
	Range	R: $\{y \mid y \geq -2, y \in \mathbb{R}\}$
	Transformations	• VSC by a factor of $\frac{1}{3}$ • VT down by 2 units
	Value of the maximum or minimum	• min. at $y = -2$

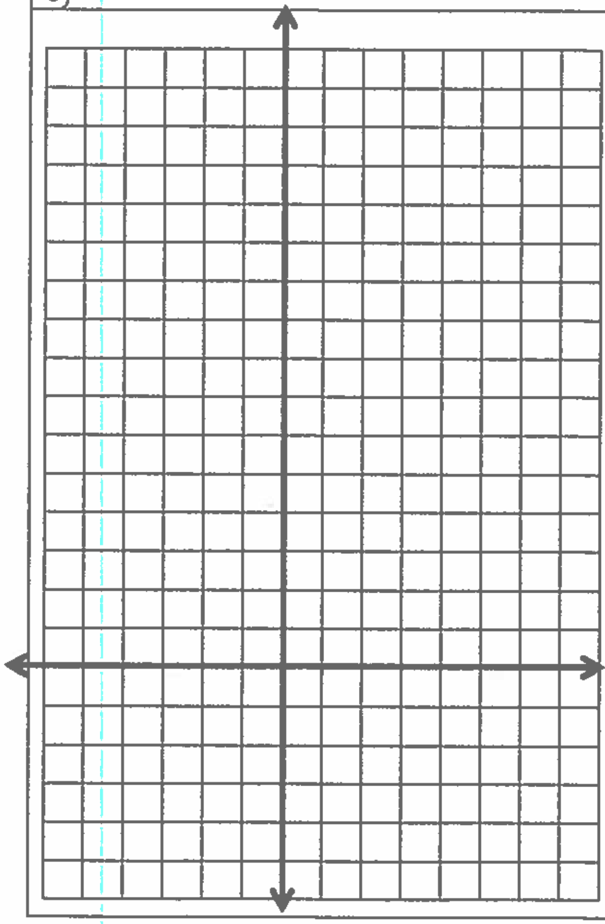
* $0 = \frac{1}{3}x^2 - 2$

$$\frac{2}{\frac{1}{3}} = \frac{\frac{1}{3}x^2}{\frac{1}{3}}$$

$$\sqrt{6} = \sqrt{x^2}$$

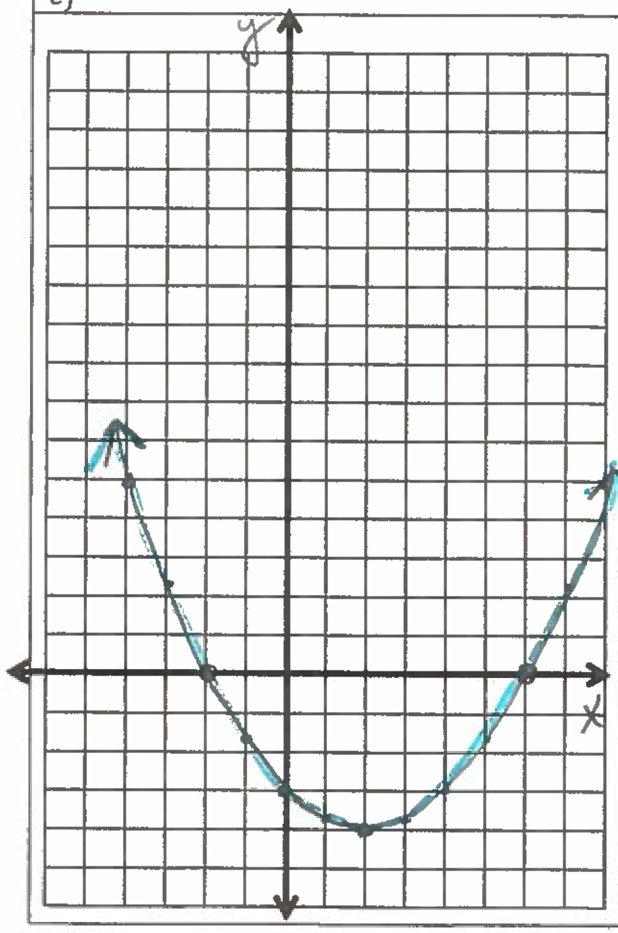
$$x = \pm\sqrt{6}$$

e)



$y = 0.25(x-2)^2 - 4$	
Coordinates of the vertex	
Exact x-intercepts	
Opening	
Exact y-intercept	
Domain	
Range	
Transformations	
Value of the maximum or minimum	

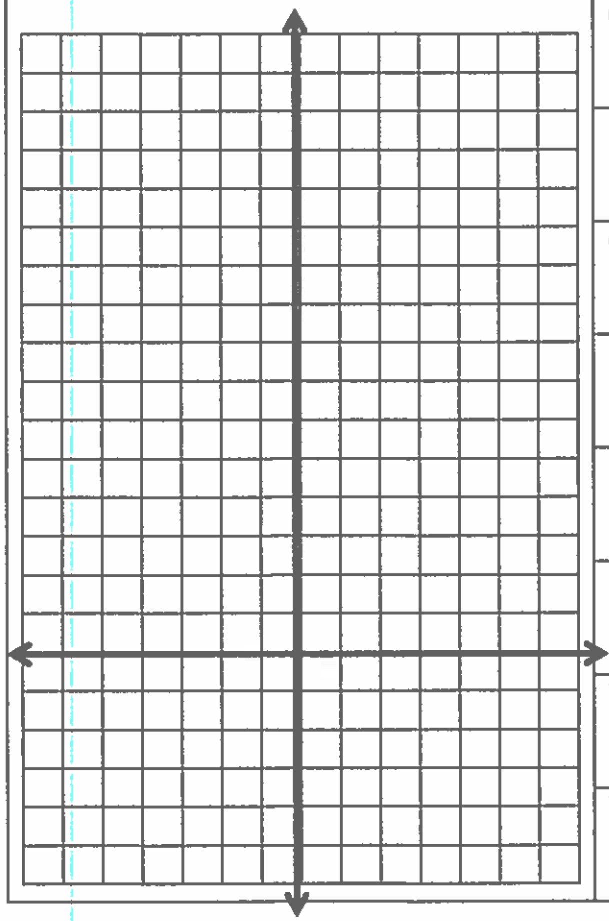
e)



$y = 0.25(x-2)^2 - 4$	
Coordinates of the vertex	$(2, -4)$
Exact x-intercepts	$(-2, 0)$ and $(6, 0)$
Opening	up
Exact y-intercept	$(0, -3)$
Domain	D: $\{x \mid x \in \mathbb{R}\}$
Range	R: $\{y \mid y \geq -4, y \in \mathbb{R}\}$
Transformations	• VSC by a factor of 1/4 • HT right by 2 units
Value of the maximum or minimum	• VT down by 4 unit

min. at $y = -4$

d)



$f(x) = \frac{1}{3}x^2 - 2$	
Coordinates of the vertex	
Exact x-intercepts	
Opening	
Exact y-intercept	
Domain	
Range	
Transformations	
Value of the maximum or minimum	

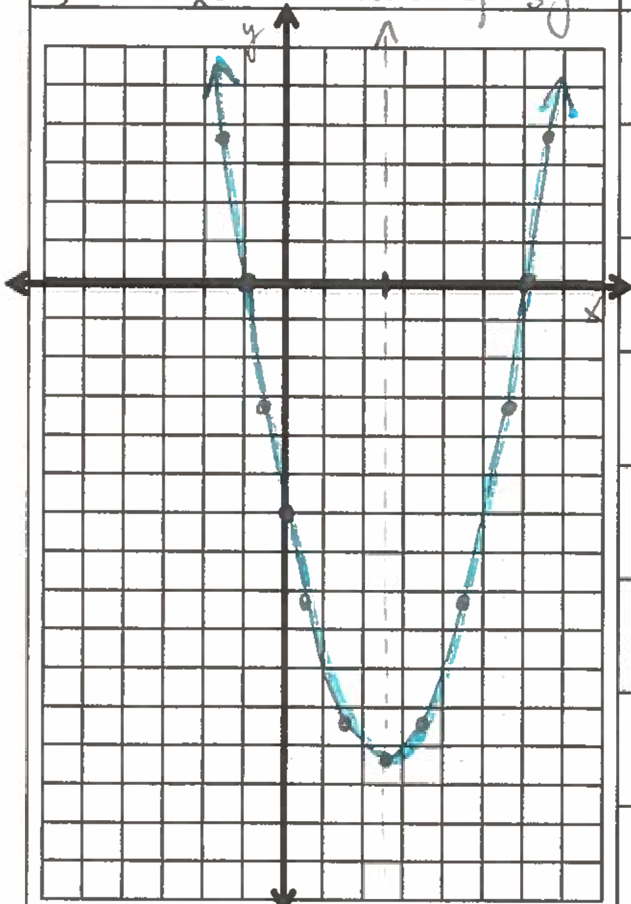
(x) $y=(0+1)(0-6)$
$=(1)(-6) \rightarrow -6$

3.5×3.5: 175, 1050, 12.25

Accept the challenge:

Without using technology and showing all your work, graph and answer the following: → factored form!

e) $x = 2.5$ axis of symmetry



$y=(x+1)(x-6)$	
Coordinates of the vertex **	(2.5, −12.5)
Exact x-intercepts *	(−1,0) and (6,0)
Opening	up
Exact y-intercept x=0 solve for y (x)	(0,−6
Domain	D: {x | x ∈ ℝ}
Range	R: {y | y ≥ −12.25, y ∈ ℝ}
Transformations	• HT right by 2.5 units • VT down by 12.25 units
Value of the maximum or minimum	• min. at y = −12.25

* $y=0$, solve for x.
$0=(x+1)(x-6)$
$x+1=0$, $x=-1$
$x-6=0$, $x=6$

** by symmetry the x-coordinate of the vertex is the midpoint of the x-intercept: −1 —— 6 ⇒ 7 units; half 3.5
→ x-coordinate is 2.5
• y-coordinate: $y=(2.5+1)(2.5-6)=(3.5)(-3.5)$