Graphing Parabolas from Vertex Form

$y = a(x-p)^2 + q$

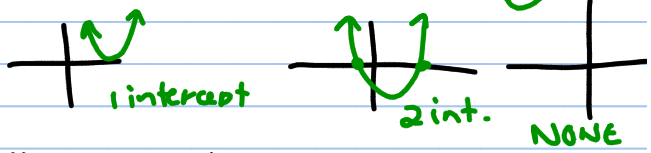
- a: stretch/squish (vertical compression or expansion) AND if a is negative, it is a reflection (flip)
- p: moves it left/right (horizontal translation of p units)
- q: moves it up and down (vertical translation of q units)

If $a > 1$ or $a < -1$ the graph is tall & skinny (stretch or expansion)

$-1 < a < 1$ it is a compression (shorter & flatter)

⇒ From the equation and/or the graph:

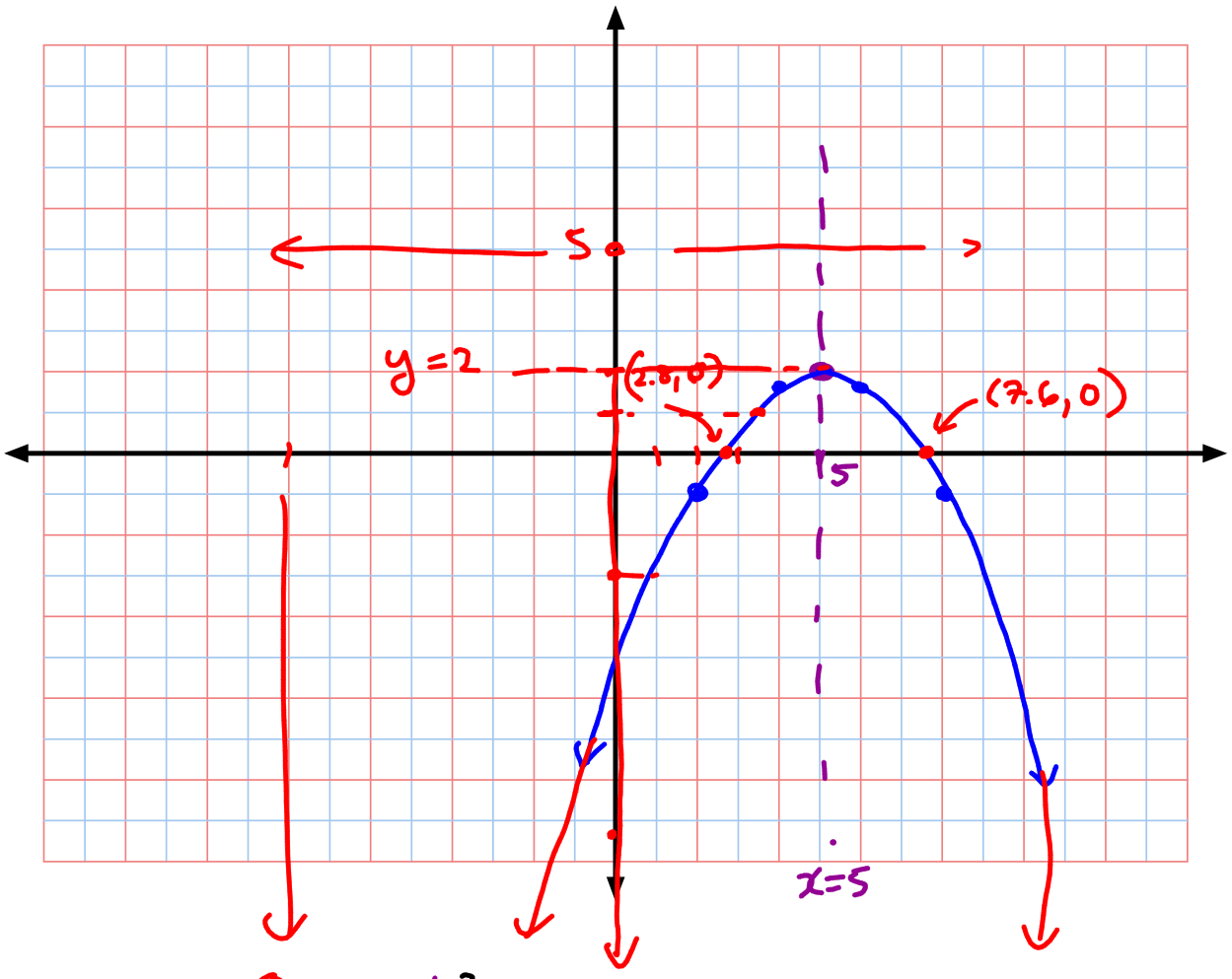
(1) Vertex
(2) Direction of opening
(3) max or min
(4) y intercept
(5) x-intercepts
(6) axis of symmetry $x = p$



* (7) Domain ~ all possible x-values
Range ~ all possible y-values

Domain Range

(x, y)



$y = -\frac{1}{3}(x-5)^2 + 2$

Vertex: (5, 2)

Direction of opening: Down

D: all $\mathbb{R}$ $\{x \mid x \in \mathbb{R}\}$

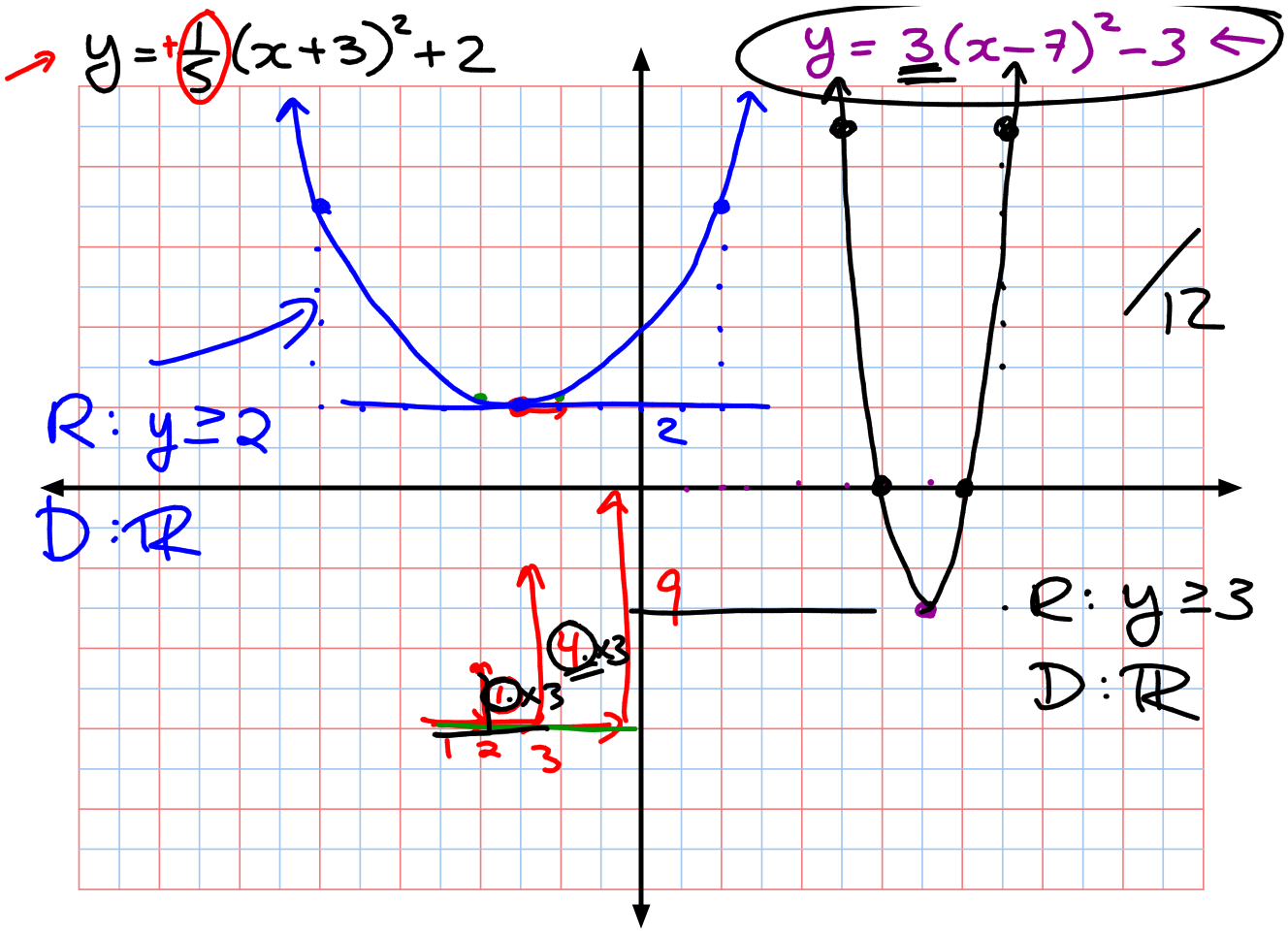
R: $y \leq 2$

max/min max of 2 (at $x = 5$)

x-intercepts 2.8 and 7.6

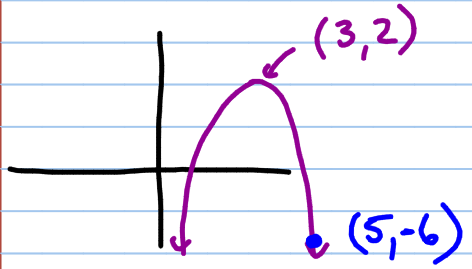
y-intercept $y = -\frac{1}{3}(0-5)^2 + 2 \Rightarrow -\frac{25}{3} + \frac{6}{3} = -\frac{19}{3}$

axis of symmetry. $x = 5$


y = +1/5 (x+3)² + 2
y = 3(x−7)² − 3
12
R: y ≥ 2
D: R
2
9
4 × 3
1 × 3
1 2 3
R: y ≥ 3
D: R

Finding the Equation from the graph or from the vertex and a point

(1) To find the equation of a parabola you need the vertex (p,q) and one other point.



(2) Go back to vertex form and plug in what you know!

- Vertex $(3,2)$ $p=3$ $q=2$

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

- take your other point and use it for x and y

$(5,-6)$ $x=5$ and $y=-6$

$$y = a(x-p)^2+q$$
$$-6 = a(5-3)^2+2$$

(3) Solve for 'a'

$$-6 = a(5-3)^2+2$$
$$-6 = 4a+2$$
$$-2 \quad\quad -2$$
$$\frac{-8}{4} = \frac{4a}{4}$$
$$a = -2$$

$$y = a(x-p)^2+q$$
$$y = -2(x-3)^2+2$$

FINAL ANSWER