

FINDING THE RULE

Goal:

- to find the rule of an absolute value function

What minimum information do you need to find the rule?

- vertex + 1 point

There are three cases for which we are responsible for finding the rule.

Case 1: Given the vertex and a point.

Ex: The vertex is (3,-1) and the function passes through the point (8,-17).

$$f(x) = a|x-h| + k$$

$$f(x) = a|x-3| - 1$$

$$-17 = a|8-3| - 1$$

$$-17 = 5a - 1$$

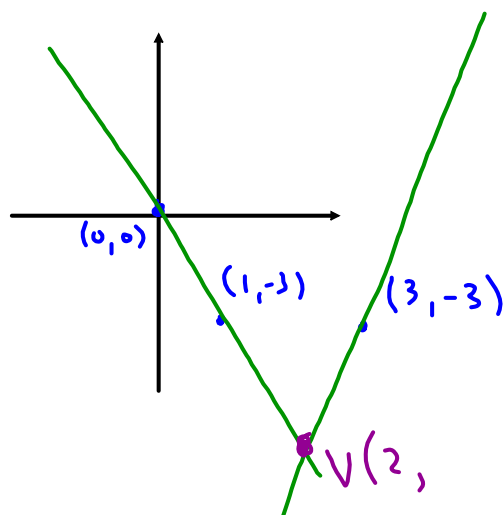
$$-16 = 5a$$

$$\frac{-16}{5} = a$$

$$f(x) = -\frac{16}{5}|x-3| - 1$$

Case 2: Using symmetry and three given points

Ex: An absolute value function passes through the points $(0,0)$, $(1,-3)$ and $(3,-3)$.



find "h" using symmetry

$$h = \frac{x_1 + x_2}{2}$$

if x_1 and x_2 have same y-coord.

$$h = \frac{1+3}{2} = 2$$

slope of left-branch:

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - 0}{1 - 0} = -3$$

since V opens up "a" is positive:

$$a = 3$$

$$f(x) = 3|x - 2| + k$$

$$0 = 3|0 - 2| + k$$

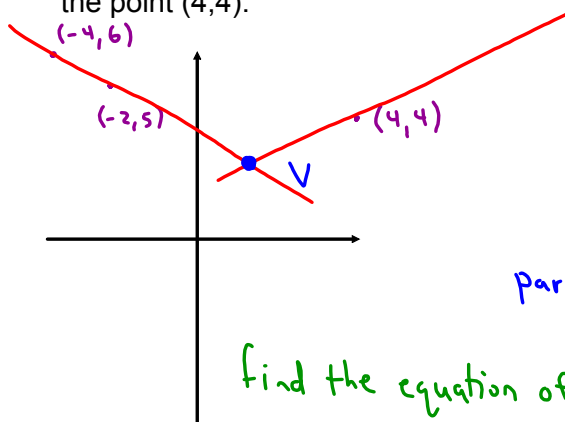
$$0 = 6 + k$$

$$-6 = k$$

substitute any point

Case 3: Three points without any symmetry.

Ex: An absolute value function has one ray pass through the points $(-4,6)$, $(-2,5)$ and the other ray passes through the point $(4,4)$.



find slope of one ray:

$$\frac{5-6}{-2-(-4)} = \frac{-1}{2}$$

parameter $a = \frac{1}{2}$

find the equation of each ray and solve the system:

left-ray: $y = -\frac{1}{2}x + b$

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

$$b = 2 + b$$

$$4 = b$$

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

right-ray: $y = \frac{1}{2}x + b$

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

$$4 = 2 + b$$

$$2 = b$$

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

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

$$2 = x$$

$$y = \frac{1}{2}(2) + 2 \quad V(2, 3)$$

$$= 3$$

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

