

# Vertex View

Graph absolute value functions and spot their features.

HIGH SCHOOL • MA.912.AR.4.3

**MA.912.AR.4.3** "Given a table, equation or written description of an absolute value function, graph that function and determine its key features."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## START AT THE VERTEX

For  $y=a|x-h|+k$ , the vertex is  $(h,k)$  and the axis of symmetry is  $x=h$ . A positive  $a$  opens the graph up, and a negative  $a$  opens it down.

## WORKED EXAMPLE

Graph  $y=2|x-3|+1$ . State the vertex, axis, and opening.

1. Vertex:  $(3,1)$ .
2. Axis of symmetry:  $x=3$ .
3. Since 2 is positive, the graph opens up.
4. Points  $(2,3)$  and  $(4,3)$  are symmetric.

**Answer: Vertex  $(3,1)$ ; axis  $x=3$ ; opens up.**

## PRACTICE 5 problems

- 1** Graph  $y=-5|x+8|+9$ . State the vertex, axis, and opening.

**ANSWER** \_\_\_\_\_

- 2** Table:  $x: -12, -10, -8, -6$ ;  $y: 10, 8, 6, 8$ . Write an equation, then state its vertex.

**ANSWER** \_\_\_\_\_

- 3** A V-shaped graph has vertex  $(7,-5)$  and passes through  $(5,7)$  and  $(9,7)$ . Write its equation and state its opening.

**ANSWER** \_\_\_\_\_

- 4** Graph  $y=|x-9|-8$ . State the vertex, axis, and opening.

**ANSWER** \_\_\_\_\_

- 5** Table:  $x: -12, -10, -8, -6$ ;  $y: -5, 5, 15, 5$ . Write an equation and state its opening.

**ANSWER** \_\_\_\_\_

## APPLY IT Show your work

- 1** For an esports challenge, bonus points are modeled by  $y = -6|x - 8| + 9$ , where  $x$  is a player's timing score. Graph the model. What timing score gives the greatest bonus?

WORK SPACE

ANSWER \_\_\_\_\_

- 2** A custom sneaker design has material cost  $y = 5|x - 6| + 7$ , where  $x$  is the design setting. Graph the model. What is the least material cost?

WORK SPACE

ANSWER \_\_\_\_\_

## CHALLENGE One step up

### CHALLENGE

A graph has vertex  $(10, -8)$  and passes through  $(6, 12)$ . Write the equation, then find both  $x$ -intercepts.

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## PART 1 · PRACTICE

| # | PROBLEM                                                                                                                 | ANSWER                                                                                               |
|---|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 1 | Graph $y = -5 x+8 +9$ . State the vertex, axis, and opening.                                                            | <b>Vertex <math>(-8,9)</math>; axis <math>x=-8</math>; opens down.</b>                               |
| 2 | Table: $x$ : -12, -10, -8, -6; $y$ : 10, 8, 6, 8. Write an equation, then state its vertex.                             | <b><math>y =  x+8 +6</math>; vertex <math>(-8,6)</math>; axis <math>x=-8</math>; opens up.</b>       |
| 3 | A V-shaped graph has vertex $(7,-5)$ and passes through $(5,7)$ and $(9,7)$ . Write its equation and state its opening. | <b><math>y = 6 x-7 -5</math>; axis <math>x=7</math>; opens up.</b>                                   |
| 4 | Graph $y =  x-9 -8$ . State the vertex, axis, and opening.                                                              | <b>Vertex <math>(9,-8)</math>; axis <math>x=9</math>; opens up.</b>                                  |
| 5 | Table: $x$ : -12, -10, -8, -6; $y$ : -5, 5, 15, 5. Write an equation and state its opening.                             | <b><math>y = -5 x+8 +15</math>; vertex <math>(-8,15)</math>; axis <math>x=-8</math>; opens down.</b> |

## PART 2 · APPLY IT

- The greatest bonus is 9 points at  $x=8$ . The vertex is  $(8,9)$ , the axis is  $x=8$ , and the graph opens down.** A negative coefficient means the vertex is a maximum. The vertex occurs when  $x=8$ .
- The least material cost is 7 at  $x=6$ . The vertex is  $(6,7)$ , the axis is  $x=6$ , and the graph opens up.** A positive coefficient means the vertex is a minimum. The minimum occurs when  $x=6$ .

## CHALLENGE

**$y = 5|x-10|-8$ ; vertex  $(10,-8)$ ; axis  $x=10$ ; opens up; x-intercepts  $(42/5,0)$  and  $(58/5,0)$ .**

Accept equivalent equation forms and accurate graphs with the stated vertex, axis, and opening. For the challenge, accept  $x=10-8/5$  and  $x=10+8/5$  for the intercept values.