LESSON MAKER PRO

Find the Turn

Read how a parabola changes.

HIGH SCHOOL · C.A.4

C.A.4 "Predict and explain the characteristics and behavior of functions and their graphs (domain, range, increasing/decreasing intervals, intercepts, symmetry, and end behavior)."

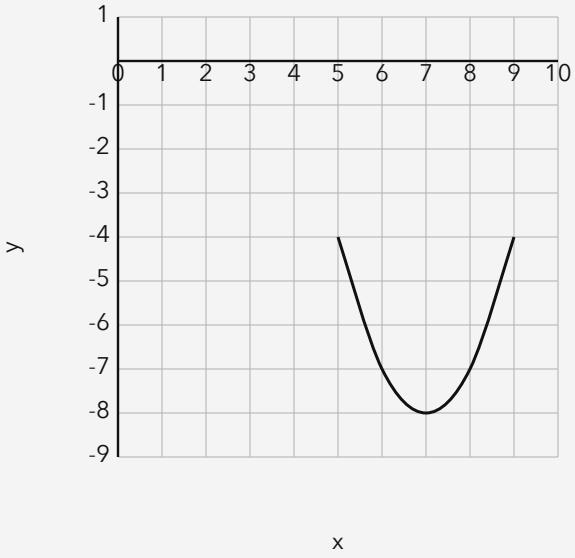
NAME _____ DATE _____

THE TURNING POINT

The vertex is the lowest or highest point of a parabola. A full upward-opening parabola decreases before the vertex and increases after it. A downward-opening parabola does the opposite.

WORKED EXAMPLE

For the full parabola shown, find its minimum y-value and state where it is increasing.

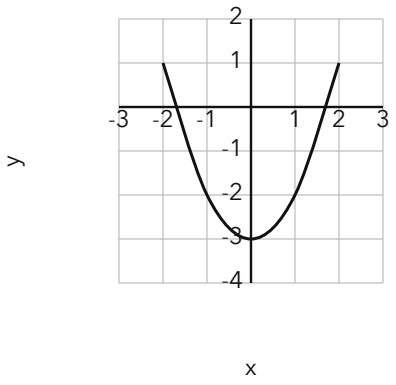


1. Locate the lowest point: (7, -8).
2. Its y-value, -8, is the minimum.
3. The graph rises to the right of x = 7.

Answer: Minimum y-value: -8; increasing for x > 7.

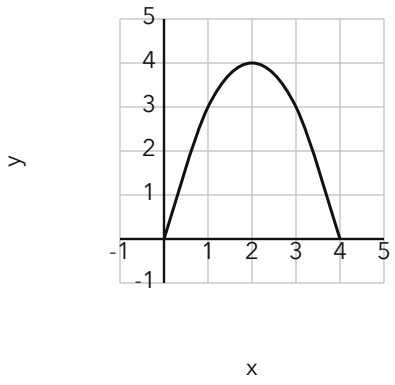
PRACTICE 6 problems

1 For the full parabola shown, find its minimum y-value and state where it is decreasing.



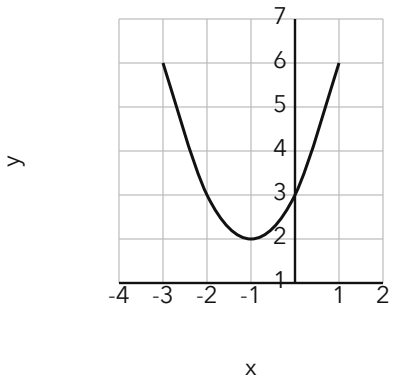
ANSWER _____

2 For the full parabola shown, find its maximum y-value and state where it is increasing.



ANSWER _____

3 For the full parabola shown, state its range and where it is decreasing.



ANSWER _____

4 For the full parabola $y = (x - 3)^2 + 2$, find the vertex and range.

ANSWER _____

5 For the full parabola $y = -(x + 2)^2 + 5$, find the maximum y-value and state where it is decreasing.

ANSWER _____

6 For the full parabola $y = 2(x - 4)^2 - 1$, find the minimum y-value and state where it is increasing.

ANSWER _____

APPLY IT Show your work

1 A drone's altitude during a six-second flight is modeled by $h(t) = -(t - 3)^2 + 12$, where t is seconds and $0 <= t <= 6$. What is its greatest altitude, and when does it reach that altitude?

WORK SPACE

ANSWER _____

2 A skateboarder's height above the ground while riding across a ramp is modeled by $h(t) = 1/2(t - 2)^2 + 1$, where t is seconds and $0 <= t <= 4$. What is the lowest height, and what is the range of heights during the ride?

WORK SPACE

ANSWER _____

CHALLENGE One step up

The full parabolas $f(x) = -(x - 1)^2 + 4$ and $g(x) = (x + 2)^2 - 5$ are both increasing for some of the same x-values. Find those x-values and explain how the vertices show this.

WORK SPACE AND ANSWER

Find the Turn

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For the full parabola shown, find its minimum y-value and state where it is decreasing.	**Minimum y-value: -3; decreasing for x < 0.**
2	For the full parabola shown, find its maximum y-value and state where it is increasing.	**Maximum y-value: 4; increasing for x < 2.**
3	For the full parabola shown, state its range and where it is decreasing.	**Range: y >= 2; decreasing for x < -1.**
4	For the full parabola $y = (x - 3)^2 + 2$, find the vertex and range.	**Vertex: (3, 2); range: y >= 2.**
5	For the full parabola $y = -(x + 2)^2 + 5$, find the maximum y-value and state where it is decreasing.	**Maximum y-value: 5; decreasing for x > -2.**
6	For the full parabola $y = 2(x - 4)^2 - 1$, find the minimum y-value and state where it is increasing.	**Minimum y-value: -1; increasing for x > 4.**

PART 2 · APPLY IT

1. **12 meters at 3 seconds.** The parabola opens downward, so its vertex at t = 3 gives the greatest altitude. Substituting t = 3 gives h(3) = 12.
2. **Lowest height: 1 meter; range: 1 <= h <= 3 meters.** The parabola opens upward, so h(2) = 1 is the lowest height. At both endpoints, h(0) = h(4) = 3, giving a range from 1 to 3 meters.

CHALLENGE

-2 < x < 1. The downward-opening graph of f increases to the left of its vertex at x = 1. The upward-opening graph of g increases to the right of its vertex at x = -2, so both increase between -2 and 1.

Accept equivalent interval notation. For increasing and decreasing intervals, do not include the turning point as a value where the function is strictly changing.