LESSON MAKER PRO

Curve Clues

Find where a curve rises and how it bends.

HIGH SCHOOL · C.G.26

C.G.26 "Analyze curves with attention to non-decreasing functions (monotonicity) and concavity."

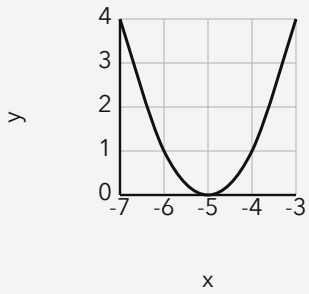
NAME _____ DATE _____

READ THE CURVE

A function is non-decreasing where its output never falls as x increases. A curve is concave up when it bends like a bowl and concave down when it bends like an upside-down bowl.

WORKED EXAMPLE

For the graphed curve, find the non-decreasing interval and its concavity.



1. Find the lowest point: (-5, 0).
2. From x = -5 to x = -3, y never falls.
3. The curve bends upward.

Answer: Non-decreasing for -5 ≤ x ≤ -3; concave up.

PRACTICE 4 problems

1 Find the non-decreasing interval and concavity of $y = (x - 3)^2$.

ANSWER _____

2 Find the non-decreasing interval and concavity of $y = -(x + 2)^2$.

ANSWER _____

3 Find the non-decreasing interval and concavity of $y = x^2 - 8x + 12$.

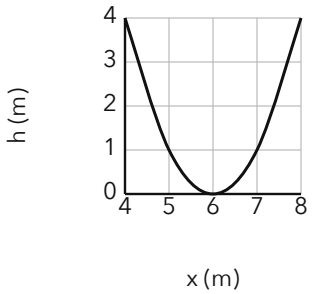
ANSWER _____

4 Find the non-decreasing interval and concavity of $y = -x^2 - 6x + 2$.

ANSWER _____

APPLY IT Show your work

1 A skater crosses a bowl. The graph shows height h at horizontal position x, both in meters. Where is height non-decreasing? Is the bowl concave up or down?



ANSWER _____

2 A quadratic curve models a pop-up shop's daily sales. The table gives sales in hundreds of dollars. For $0 \le t \le 4$, find the non-decreasing interval and concavity.

DAILY SALES

Day t	Sales
0	0
1	3
2	4
3	3
4	0

ANSWER _____

CHALLENGE One step up

Explain why $f(x) = x^2 - 4x + 7$ and $g(x) = -x^2 + 12x - 20$ are both non-decreasing for $2 \le x \le 6$, even though their concavities differ.

WORK SPACE AND ANSWER

ANSWER KEY # Curve Clues

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the non-decreasing interval and concavity of $y = (x - 3)^2$.	**$x \geq 3$; concave up.**
2	Find the non-decreasing interval and concavity of $y = -(x + 2)^2$.	**$x \leq -2$; concave down.**
3	Find the non-decreasing interval and concavity of $y = x^2 - 8x + 12$.	**$x \geq 4$; concave up.**
4	Find the non-decreasing interval and concavity of $y = -x^2 - 6x + 2$.	**$x \leq -3$; concave down.**

PART 2 · APPLY IT

1. **$6 \leq x \leq 8$; concave up.** Height reaches its minimum at $x = 6$ and rises through $x = 8$. The curve bends upward.
2. **$0 \leq t \leq 2$; concave down.** Sales rise through day 2, then fall. The changes between days are 3, 1, -1, and -3, so the quadratic curve is concave down.

CHALLENGE

$f(x) = (x - 2)^2 + 3$ has a minimum at $x = 2$, so it rises to the right and is concave up. $g(x) = 16 - (x - 6)^2$ has a maximum at $x = 6$, so it rises to the left of 6 and is concave down.

Accept interval notation in place of inequalities. The non-decreasing intervals include their endpoints.