LESSON MAKER PRO

Change Takes Shape

Describe how one quantity changes with another.

HIGH SCHOOL · MM.D3D.B.15.b

MM.D3D.B.15.b "Describe the overall relationship between two quantitative variables (increase, decrease, linearity, concavity, extrema, inflection) or pattern of change."

NAME _____ DATE _____

SPOT THE PATTERN

For equal steps in x, equal changes in y mean a linear pattern. If the changes in y grow, the pattern is concave up. A shift from decreasing to increasing marks a minimum.

WORKED EXAMPLE

A post gains views over time. Describe the pattern shown.

POST VIEWS

Hour	Views
41	110
42	119
43	130
44	143

1. Find the changes in views: 9, 11, 13.
2. Each change is positive, so views increase.
3. The changes grow, so the pattern is concave up.

Answer: Views increase at a growing rate. The pattern is concave up, not linear.

PRACTICE 4 problems

1 For $x \geq 0$, $y = 4x + 5$. Is y increasing or decreasing? Is the pattern linear?

ANSWER _____

2 For $0 \leq x \leq 8$, $y = 18 - 2x$. Is y increasing or decreasing? Is the pattern linear?

ANSWER _____

3 For $x \geq 0$, $y = x^2 + 7$. Is y increasing or decreasing? Is the pattern concave up or down?

ANSWER _____

4 For $0 \leq x \leq 10$, $y = (x - 6)^2 + 1$. Give the minimum point and describe how y changes on either side.

ANSWER _____

APPLY IT Show your work

1 A student tracks shares of a short video. Describe the pattern over the weeks shown.

VIDEO SHARES

Week	Shares
0	2
1	6
2	12

ANSWER _____

2 A phone has 80% battery charge. Each hour of use lowers it by 10 percentage points. Describe the relationship between hours of use and charge. What is the charge after 6 hours?

WORK SPACE

ANSWER _____

CHALLENGE One step up

For $0 \le x \le 6$, $y = (x - 3)^2 + 5$. Describe where y decreases and increases, give its minimum point, and explain its concavity using changes in y for unit steps in x.

WORK SPACE AND ANSWER

Change Takes Shape

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For $x \geq 0$, $y = 4x + 5$. Is y increasing or decreasing? Is the pattern linear?	**Increasing and linear.**
2	For $0 \leq x \leq 8$, $y = 18 - 2x$. Is y increasing or decreasing? Is the pattern linear?	**Decreasing and linear.**
3	For $x \geq 0$, $y = x^2 + 7$. Is y increasing or decreasing? Is the pattern concave up or down?	**Increasing and concave up.**
4	For $0 \leq x \leq 10$, $y = (x - 6)^2 + 1$. Give the minimum point and describe how y changes on either side.	**The minimum is (6, 1). y decreases before x = 6 and increases after x = 6.**

PART 2 · APPLY IT

1. **Shares increase at a growing rate, so the pattern is concave up over these weeks.** The weekly increases are 4 and 6 shares. Both are positive, and the second is larger.
2. **The charge decreases linearly. After 6 hours, it is 20%.** The charge falls by the same amount each hour. Compute $80 - 6 \times 10 = 20$.

CHALLENGE

y decreases to x = 3, then increases. Its minimum point is (3, 5). For unit steps from x = 0 to x = 6, the changes in y are -5, -3, -1, 1, 3, 5. Because these changes grow, the pattern is concave up.

Accept equivalent descriptions such as "rises faster" for increasing at a growing rate. In the challenge, the ordered changes in y support the concavity claim.