LESSON MAKER PRO

Slope Snapshots

Estimate how fast a value is changing.

HIGH SCHOOL · C.N.2

C.N.2 "Estimate numerical derivatives from graphs or tables of data."

NAME _____ DATE _____

ESTIMATE THE SLOPE

To estimate a derivative at an interior input, use the closest data points on either side. Divide the change in output by the change in input. At an endpoint, use the closest point on the available side.

WORKED EXAMPLE

Use the table to estimate f'(22).

x	f(x)
20	31
22	39
24	51

1. Use the points on either side of 22: (20, 31) and (24, 51).
2. Output change: 51 - 31 = 20.
3. Input change: 24 - 20 = 4.
4. Divide: 20/4 = 5.

Answer: f'(22) ≈ 5

PRACTICE 4 problems

1 Data points: (0, 2), (1, 7), (2, 14). Estimate f'(1).

ANSWER _____

2 Data points: (1, 18), (3, 12), (5, 2). Estimate f'(3). Is f increasing or decreasing there?

ANSWER _____

3 Data points: (2, 3), (5, 9), (7, 17). Estimate f'(5).

ANSWER _____

4 Data points: (0, 4), (2, 10), (4, 20). Estimate f'(0).

ANSWER _____

APPLY IT Show your work

1 A game downloads to a phone. Use the table to estimate its download rate at 2 minutes, in MB per minute.

GAME DOWNLOAD

Time (min)	Downloaded (MB)
1	12
2	30
3	54

ANSWER _____

2 A phone battery drains during a trip. Use the table to estimate its rate of change at 2 hours, in percentage points per hour.

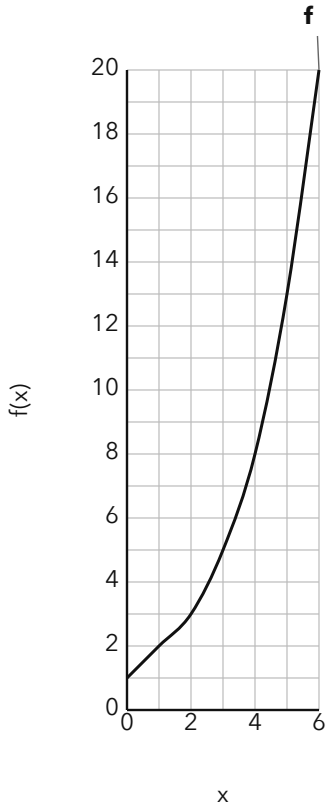
PHONE BATTERY

Time (hours)	Battery (%)
0	96
2	82
4	60

ANSWER _____

CHALLENGE One step up

Use the graph to estimate f'(4) twice: first with x = 3 and x = 5, then with x = 2 and x = 6. Which estimate is likely better? Explain.



WORK SPACE AND ANSWER

Slope Snapshots

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Data points: (0, 2), (1, 7), (2, 14). Estimate f'(1).	**f'(1) ≈ 6**
2	Data points: (1, 18), (3, 12), (5, 2). Estimate f'(3). Is f increasing or decreasing there?	**f'(3) ≈ -4; decreasing**
3	Data points: (2, 3), (5, 9), (7, 17). Estimate f'(5).	**f'(5) ≈ 14/5**
4	Data points: (0, 4), (2, 10), (4, 20). Estimate f'(0).	**f'(0) ≈ 3**

PART 2 · APPLY IT

1. **About 21 MB per minute** Use the values on either side of 2 minutes: (54 - 12)/(3 - 1) = 21.
2. **About -9 percentage points per hour** Use the values on either side of 2 hours: (60 - 96)/(4 - 0) = -9.

CHALLENGE

Using x = 3 and x = 5 gives (13 - 5)/(5 - 3) = 4. Using x = 2 and x = 6 gives (20 - 3)/(6 - 2) = 17/4. The first estimate is likely better because it uses points closer to x = 4.

Accept equivalent fractions or decimals. In the challenge, accept any explanation that favors the closer points because they give a more local estimate.