LESSON MAKER PRO

Tangent Line Snapshots

Use derivatives to find an exact rate at one moment.

HIGH SCHOOL · MA.912.C.2.2

MA.912.C.2.2 "Interpret the derivative as an instantaneous rate of change or as the slope of the tangent line."

NAME _____ DATE _____

THE BIG IDEA

The derivative f'(a) gives the instantaneous rate of change of f at x = a. It is also the slope of the tangent line at that point. Differentiate first, then substitute the given x-value.

WORKED EXAMPLE

For f(x) = x^2 + 5x, find the instantaneous rate of change at x = 4.

1. Find the derivative: f'(x) = 2x + 5.
2. Substitute x = 4: f'(4) = 2(4) + 5.
3. Simplify: f'(4) = 13.

Answer: The instantaneous rate of change is 13, so the tangent line slope is 13.

PRACTICE 6 problems

1 For f(x) = x^3, find the instantaneous rate of change at x = 1.

ANSWER _____

2 For g(x) = x^6, find the slope of the tangent line at x = 1.

ANSWER _____

3 The tangent line to r at x = 8 is y = 7x - 9. What is r'(8)?

ANSWER _____

4 For q(x) = x^3 + 6x, find the instantaneous rate of change at x = 1.

ANSWER _____

5 A curve has tangent line y = 11x - 7 at x = 6. Find the derivative of the curve at x = 6.

ANSWER _____

6 If p'(x) = x^6 - 8x, find p'(3).

ANSWER _____

APPLY IT Show your work

1 A skateboarder's position along a straight ramp is modeled by s(t) = t^3 + 6t, where s is in feet and t is in seconds. What is the skateboarder's instantaneous velocity at t = 3?

WORK SPACE

ANSWER _____

2 A gaming channel models its total livestream views by V(t) = t^3 + 8t, where V is measured in hundreds of views and t is measured in hours. What is the instantaneous rate of views at t = 1?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

For k(x) = x^3 - 7x, write the equation of the tangent line at x = 3. Explain how the derivative gives the slope of your line.

_____

_____

ANSWER KEY

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	For f(x) = x^3, find the instantaneous rate of change at x = 1.	**3**
2	For g(x) = x^6, find the slope of the tangent line at x = 1.	**6**
3	The tangent line to r at x = 8 is y = 7x - 9. What is r'(8)?	**7**
4	For q(x) = x^3 + 6x, find the instantaneous rate of change at x = 1.	**9**
5	A curve has tangent line y = 11x - 7 at x = 6. Find the derivative of the curve at x = 6.	**11**
6	If p'(x) = x^6 - 8x, find p'(3).	**705**

PART 2 · APPLY IT

1. **33 feet per second** Differentiate to get s'(t) = 3t^2 + 6. Substitute t = 3 to get s'(3) = 33.
2. **11 hundred views per hour, or 1,100 views per hour** Differentiate to get V'(t) = 3t^2 + 8. At t = 1, V'(1) = 11 hundred views per hour.

CHALLENGE

k'(x) = 3x^2 - 7, so k'(3) = 20. Also, k(3) = 6. The tangent line is y - 6 = 20(x - 3), or y = 20x - 54. The derivative value 20 is the slope of the tangent line at x = 3.

Accept equivalent tangent-line forms, including point-slope form. For the gaming context, accept either 11 hundred views per hour or 1,100 views per hour.