LESSON MAKER PRO

Slope in a Snap

Use limits, slopes, and rates of change to find derivatives.

HIGH SCHOOL · MA.912.C.2.1

MA.912.C.2.1 "State, understand and apply the definition of derivative. Apply and interpret derivatives geometrically and numerically."

NAME _____ DATE _____

DERIVATIVE BASICS

The derivative f'(a) is the limit of the average rate of change as the change in x gets closer to zero: f'(a)=lim h->0 [f(a+h)-f(a)]/h. It gives the slope of the tangent line at x=a and the instantaneous rate of change at that input.

WORKED EXAMPLE

Use the definition of derivative to find f'(7) for f(x)=x^2.

1. f'(7)=lim h->0 [f(7+h)-f(7)]/h
2. =lim h->0 [((7+h)^2)-49]/h
3. =lim h->0 [h(14+h)]/h
4. =lim h->0 (14+h)=14

Answer: f'(7)=14

PRACTICE 6 problems

1 Use the limit definition to find f'(1) for f(x)=x^3.

ANSWER _____

2 The tangent line to a curve at x=1 is y=9x-8. What is f'(1)?

ANSWER _____

3 A function has f(1/3)=11 and f(5/3)=3. Use the symmetric difference quotient to estimate f'(1).

ANSWER _____

4 Find g'(8) for g(x)=1/x.

ANSWER _____

5 Find h'(x) for h(x)=5x-11.

ANSWER _____

6 A curve has a tangent slope of 12 at x=-3. State f'(-3).

ANSWER _____

APPLY IT Show your work

1 A streaming creator models the total number of new followers, in hundreds, after t hours by P(t)=t^3+4t. Find the instantaneous rate at t=3. Interpret the result.

WORK SPACE

ANSWER _____

2 In a racing video game, a car's signed position is modeled by s(t)=t^4-8t, where t is in seconds. Find the car's instantaneous velocity at t=1 and interpret the sign.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Use the limit definition to find f'(x) for f(x)=x^4-5x. Then find the equation of the tangent line when x=1.

WORK SPACE AND ANSWER

ANSWER KEY # Slope in a Snap

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use the limit definition to find f'(1) for f(x)=x^3.	**3**
2	The tangent line to a curve at x=1 is y=9x-8. What is f'(1)?	**9**
3	A function has f(1/3)=11 and f(5/3)=3. Use the symmetric difference quotient to estimate f'(1).	**-6**
4	Find g'(8) for g(x)=1/x.	**-1/64**
5	Find h'(x) for h(x)=5x-11.	**5**
6	A curve has a tangent slope of 12 at x=-3. State f'(-3).	**12**

PART 2 · APPLY IT

1. **31 hundreds of followers per hour, or 3,100 followers per hour** Differentiate to get P'(t)=3t^2+4. Then P'(3)=31, and each unit represents one hundred followers per hour.
2. **-4 position units per second; the car is moving in the negative direction** Differentiate to get s'(t)=4t^3-8. Evaluating at t=1 gives -4, so the negative sign shows motion in the negative direction.

CHALLENGE

f'(x)=4x^3-5; tangent line: y=-x-3

Accept equivalent derivative forms and the equivalent tangent-line form y+4=-(x-1). For the numerical estimate, accept -6 when students correctly use the centered secant slope.