Calculus

Write your questions and thoughts here!

2.2 Definition of the Derivative

Name:_________________________

Notes

<u>Recall:</u> Average rate of change =

Average rate of change on the interval [   ] is _______________

<u>Defintion of the Derivative:</u>

This limit gives an expression that calculates the instantaneous rate of change (slope of the tangent line) of $f(x)$ at any given x-value.

$$f'(x) =$$

<u>Notation for the Derivative:</u>

Lagrange	Leibniz

Find the derivative using the Definition of the Derivative (limits).

1. $f(x) = 2x^2 - 7x + 1$

2. $y = \frac{1}{x}$

3. If f represents how many meters you have run and x represents the minutes, describe in full sentences the following:

$f(8) = 1{,}500$

$f'(3) = 161$

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Alternate Definition – Derivative at a Point:

Finding the derivative at a specific x-value ($x = c$).

$f'(c) =$ or $f'(c) =$

4. Find $f'(-2)$ if $f(x) = 2x^2 + 1$.

5. $f(x) = x^3 - \frac{3}{x}$ and $f'(x) = 3x^2 + \frac{3}{x^2}$
   Find the equation of the tangent line at $x = 2$.

Identify the original function $f(x)$, and what value of c to evaluate $f'(c)$.

6. $\lim_{h \to 0} \frac{3\ln(2+h) - 3\ln 2}{h}$

7. $\lim_{x \to 7} \frac{\frac{1}{\sqrt{x^2-2x}} - \frac{1}{\sqrt{35}}}{x-7}$

Now summarize what you learned!

2.2 Definition of the Derivative

Calculus   Name: ______________________________   **Practice**

Find the derivative using limits. If the equation is given as $y =$, use Leibniz Notation: $\frac{dy}{dx}$. If the equation is given as $f(x) =$, use Lagrange Notation: $f'(x)$. WRITE SMALL!!

1. $f(x) = 7 - 6x$

2. $y = 5x^2 - x$

3. $y = x^2 + 2x - 9$

4. $y = \sqrt{5x + 2}$

5. $f(x) = \frac{1}{x-2}$

For each problem, create an equation of the tangent line of f at the given point. Leave in point-slope.

6. $f(7) = 5$ and $f'(7) = -2$

7. $f(-2) = 3$ and $f'(-2) = 4$

8. $f(x) = 3x^2 + 2x$;
   $f'(x) = 6x + 2$; $x = -2$

9. $f(x) = 10\sqrt{6x+1}$;
$f'(x) = \frac{30}{\sqrt{6x+1}}$; $x = 4$

10. $f(x) = \cos 2x$;
$f'(x) = -2\sin 2x$; $x = \frac{\pi}{4}$

11. $f(x) = \tan x$;
$f'(x) = \sec^2 x$; $x = \frac{\pi}{3}$

Identify the original function $f(x)$, and what value of c to evaluate $f'(c)$.

12. $\lim_{h\to 0} \frac{3(1+h)^2-7(1+h)+1+(3)}{h}$

13. $\lim_{h\to 0} \frac{\log(2-4(h-5))-\log(22)}{h}$

14. $\lim_{x\to -2} \frac{(3x-9x^2)+(42)}{x+2}$

15. $\lim_{x\to 5} \frac{\frac{1}{\sqrt{3x}}-\frac{1}{\sqrt{15}}}{x-5}$

16. $\lim_{h\to 0} \frac{e^{6(3+h)+1}-e^{19}}{h}$

17. $\lim_{x\to \frac{\pi}{2}} \frac{6x^2\sin x-\frac{3}{2}\pi^2}{x-\frac{\pi}{2}}$

For each problem, use the information given to identify the meaning of the two equations in the context of the problem. Write in full sentences!

18. C is the number of championships Sully has won while coaching basketball.
t is the number of years since 2002 for the function $C(t)$.
$C(12) = 3$ and $C'(12) = 0.4$

19. d is the distance (in miles) from home when you walk to school.
h is the number of hours since 7:00 a.m. for the function $d(h)$.
$d(0.2) = 0.5$ and $d'(0.2) = -11$

20. W is the number of cartoon shows Mr. Kelly watches every week.
x is the number of children Mr. Kelly has for the function $W(x)$.
$W(7) = 25$ and $W'(7) = 3$

21. g is the number of gray hairs on Mr. Brust's head.
x is the number of students in his 4th period.
$g(26) = 501$ and $g'(15) = 130$

Test Prep

2.2 Definition of the Derivative

1. Let $f'(x) = \lim_{h \to 0} \frac{(x+h)^2 - x^2}{h}$. For what value of x does $f(x) = 4$?

(A) -4 (B) -1 (C) 1 (D) 2 (E) 4

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2. If $f(x+y) = f(x) \cdot f(y)$ and if $\lim_{h \to 0} \frac{f(h)-1}{h} = 6$, then $f'(x) =$

(A) 6 (B) $6 + f(x)$ (C) $6 \cdot f(x)$

(D) $6 + f(h)$ (E) $6 \cdot f(h)$

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3. Which of the following gives the derivative of the function $f(x) = x^2$ at the point $(2, 4)$?

(A) $\lim_{h \to 0} \frac{(x+2)^2 - x^2}{4}$ (B) $\lim_{h \to \infty} \frac{(2+h)^2 - 2^2}{h}$ (C) $\frac{(2+h)^2 - 2^2}{h}$

(D) $\lim_{h \to 0} \frac{(2+h)^2 - 2^2}{h}$ (E) $\lim_{h \to 0} \frac{(4+h)^2 - 4^2}{h}$