

Name _____
 AP Calculus BC Unit 2 Rules Check

1. Find $\frac{dy}{dx}$. $y = \sqrt{5}$

A. 0

B. $\frac{\sqrt{5}}{5}$

C. $\frac{1}{10}$

D. $\frac{1}{2\sqrt{5}}$

The derivative of a constant is ZERO

$$y = 15x^2 - 2x - 8$$

2. Find $\frac{dy}{dx}$. $y = (3x + 2)(5x - 4)$

A. $15x - 2$

B. $30x - 2$

C. $15x^2 - 2x - 8$

D. $30x$

$$3. y = \frac{4}{x^3} \text{ Find } \frac{dy}{dx} \Big|_{x=2}$$

A. $\frac{3}{2}$

B. $\frac{3}{4}$

C. $\frac{-3}{2}$

D. $\frac{-3}{4}$

$y = 4x^{-3}$ Power Rule

$$4. g(x) = \frac{f(x)}{x^3} \text{ Quotient Rule}$$

Find $g'(-1)$, given that $f(-1) = 6$ and $f'(-1) = 3$.

A. 15

B. 21

C. -15

D. -21

$$g'(x) = \frac{x^3 \cdot f'(x) - f(x) \cdot 3x^2}{(x^3)^2}$$

plug in $x = 1$

$$5. y = \frac{-x}{5} \text{ Find } \frac{dy}{dx}.$$

$$y = -\frac{1}{5}x$$

No Quotient Rule

A. $\frac{5}{x}$

B. $\frac{-1}{5x}$

C. $\frac{-1}{5}$

D. $\frac{-1}{5x^2}$

6. $y = \frac{10x^4 - 8x^2 + 6}{2x}$ Find $\frac{dy}{dx}$.

$$y = \frac{10x^4}{2x} - \frac{8x^2}{2x} + \frac{6}{2x}$$

$$y = 5x^3 - 4x + \frac{3}{x}$$

A. $\frac{40x^3 - 16x}{2}$

B. $15x^2 - 4 - \frac{3}{x^2}$

C. $15x^2 - 4 + \frac{3}{x^2}$

D. $x(15x - 4 - \frac{3}{x})$

$$7. y = -\tan x \text{ Find } \frac{dy}{dx}$$

EMORIZE

A. $-\csc^2 x$

B. $\csc^2 x$

C. $\sec^2 x$

D. $-\sec^2 x$

multiply = \downarrow

$$8. \text{ Find } \frac{dy}{dx} \quad y = x \cdot \csc x \quad \text{product rule}$$

A. $-\csc x \cdot \cot x$

B. $x \csc x - x \csc x \cdot \cot x$

C. $\csc x(1 + x \cot x)$

D. $\csc x(1 - x \cot x)$

9. The equation of the line tangent to $y = x + \sin x$ at the point $x = 0$ is

A. $y = 2x$

B. $y = x$

C. $y = 2x + 1$

D. $y = 0$

- $f(x) = \sin x$
10. Find $f'(x)$ if $f(x) = \cos x \cdot \tan x$ Always simplify 1st / Avoid product rule
- A. $-\sin x$ B. $\cos x$ C. $-\cos x$ D. $\sin x$

11. If $\lim_{x \rightarrow 1} \frac{f(x)-f(1)}{x-1} = 3$, then $\lim_{h \rightarrow 0} \frac{f(1+h)-f(1)}{h} = ?$

- A. $m_{sec} = 3$ B. $m_{sec} = \frac{1}{3}$ C. $m_{tan} = 3$ D. $m_{tan} = \frac{1}{3}$

$$y' = 3x^2 - 3 = 0$$

12. At what points, if any, does the graph of $y = x^3 - 3x + 4$ have a horizontal tangent line? $m_{tan} = 0$

- A. None B. $x = 1$ only C. $x = -1$ only D. $x = 1$ and $x = -1$

13. At $x = 3$, the function given by $f(x) = \begin{cases} x^2 & , x < 3 \\ 6x - 9, & x \geq 3 \end{cases}$ is $(3, 9)$ hole $(3, 9)$ fills in hole

$f'(x) = 2x$	$f'(3) = 6$
$f'(x) = 6$	on both

- A. Continuous but not differentiable B. Differentiable but not continuous
 C. Neither continuous or differentiable D. Both continuous and differentiable

14. If a function is differentiable over an interval (a, b) , then it must be continuous over the entire interval.

- A. True B. False

Differentiability implies continuity

15. Quotient Rule

The function f is defined by $f(x) = \frac{x}{x+2}$. What points (x, y) on the graph of f have the property that the line tangent to f at (x, y) has a slope $\frac{1}{2}$?

$$f'(x) = \frac{(x+2)(1) - x(1)}{(x+2)^2} = \frac{1}{2}$$

- A. $\left(\frac{1}{2}, \frac{1}{5}\right)$ only B. $(0,0)$ and $(-4,2)$ C. $(0,0)$ and $\left(4, \frac{2}{3}\right)$ D. There are no such points

16. $y = x^3 \cdot \tan(x)$. Find $\frac{dy}{dx}$.

Product Rule

- A. $3x^2 \tan x + x^3 \sec^2 x$ B. $3x^2 \tan x + x^3 \csc^2 x$ C. $3x^2 \tan x - x^3 \sec^2 x$ D. $3x^2 \tan x - x^3 \csc^2 x$

17. If $f(x) = 3x^2 + 2x$, then $f'(x) =$

A. $\lim_{h \rightarrow 0} \frac{(3(x+h)^2 + 2(x+h)) - (3x^2 + 2x)}{h}$

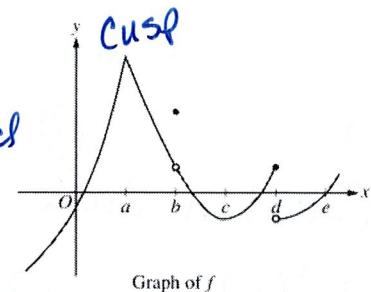
B. $\lim_{x \rightarrow 0} \frac{(3x^2 + 2x + h) - (3x^2 + 2x)}{h}$

C. $\lim_{h \rightarrow 0} \frac{(3x^2 + 2x + h) - (3x^2 + 2x)}{h}$

D. $\lim_{x \rightarrow 0} \frac{(3(x+h)^2 + 2(x+h)) - (3x^2 + 2x)}{h}$

18. The graph of a function f is shown to the right. At which value of x is f continuous, but not differentiable?

Cusps, Corners, pts of Vertical tangency.



- A. a B. b C. c D. d

19. If $y = \tan x - \cot x$, then $\frac{dy}{dx} =$

Trig Derivatives Memorize

- A. $\sec x - \csc x$ B. $\sec x + \csc x$ C. $\sec^2 x - \csc^2 x$ D. $\sec^2 x + \csc^2 x$

20. Let f be the function given by $f(x) = x^3 - 6x^2 + 8x - 2$. What is the instantaneous rate of change of f at $x = 3$?
means derivative

A. -1

B. $-\frac{15}{4}$

C. 6

D. 17

21. If $f(x) = 4x^{-2} + \frac{1}{4}x^2 + 4$, then $f'(2) =$

A. -62

B. -58

C. -3

D. 0

$f(x) = \sqrt{x} + 3 \cdot x^{-\frac{1}{2}}$

22. If $f(x) = \sqrt{x} + \frac{3}{\sqrt{x}}$, then $f'(4) =$

A. $\frac{1}{16}$

B. $\frac{5}{16}$

C. $\frac{7}{2}$

D. $\frac{49}{4}$

Square Root Rule + Power Rule
 Could use Reciprocal Rule

Product Rule

23. If $y = \sin x \cos x$, then at $x = \frac{\pi}{3}$, $\frac{dy}{dx} =$

A. $-\frac{1}{2}$

B. $-\frac{1}{4}$

C. $\frac{1}{4}$

D. $\frac{1}{2}$

$\sin x \cdot \cos x$ is a product

$$y' = \sin x \cdot -\cos x + \cos x \cdot \sin x$$

$$y' \Big|_{x=\pi/3}$$

must know unit circle

24. The table to the right gives values for the functions f and g and their derivatives at $x = 3$. Let k be the function given by

$k(x) = \frac{f(x)}{g(x)}$, where $g(x) \neq 0$. What is the value of $k'(3)$?

$f(3)$	$g(3)$	$f'(3)$	$g'(3)$
-1	2	5	-2

A. -2

B. 2

C. 3

D. 8

Quotient Rule

$$k'(x) = \frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{[g(x)]^2}$$

25. What is the average rate of change of $y = \cos(2x)$ on the interval $[0, \frac{\pi}{2}]$?

A. -1

B. $-\frac{4}{\pi}$

C. 0

D. $\frac{\sqrt{2}}{2}$

x	y
0	$\cos(2 \cdot 0) = 1$
$\frac{\pi}{2}$	$\cos(2 \cdot \frac{\pi}{2}) = -1$

$$\text{AROC} = \frac{1 + (-1)}{0 - \frac{\pi}{2}} = \frac{2}{-\pi/2}$$