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1. An equation of the line tangent to the graph of $y = \frac{2x+3}{3x-2}$ at the point (1, 5) is

(A) 13*x*-*y*=8
(B) 13*x*+*y*=18
(C) *x*-13*y*=64
(D) *x*+13*y*=66
(E) -2*x*+3*y*=13

2. If $f(x) = \frac{3x-2}{2x+3}$, then f′(x)=

(A) $-\frac{13}{(2x+3)^2}$
(B) $\frac{3}{(2x+3)^2}$
(C) $\frac{5}{(2x+3)^2}$
(D) $\frac{13}{(2x+3)^2}$
(E) $\frac{12x+5}{(2x+3)^2}$

3. If $y = \frac{2x+3}{3x+2}$, then $\frac{dy}{dx} =$

(A) $\frac{12x+13}{(3x+2)^2}$
(B) $\frac{12x-13}{(3x+2)^2}$
(C) $\frac{5}{(3x+2)^2}$
(D) $\frac{-5}{(3x+2)^2}$
(E) $\frac{2}{3}$

4. If $y = \frac{\ln x}{x}$, then $\frac{dy}{dx} =$

(A) $\frac{1}{x}$
(B) $\frac{1}{x^2}$
(C) $\frac{\ln x-1}{x^2}$
(D) $\frac{1-\ln x}{x^2}$
(E) $\frac{1+\ln x}{x^2}$

5. What is the instantaneous rate of change at *x*=2 of the function *f* given by $f(x) = \frac{x^2-2}{x-1}$?

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(A) -2
(B) $\frac{1}{6}$
(C) $\frac{1}{2}$
(D) 2
(E) 6

6. If $f(x) = \frac{5-x}{x^3+2}$, then $f'(x) =$

(A) $\frac{-4x^3+15x^2-2}{(x^3+2)^2}$
(B) $\frac{-2x^3+15x^2+2}{(x^3+2)^2}$
(C) $\frac{2x^3-15x^2-2}{(x^3+2)^2}$
(D) $\frac{4x^3-15x^2+2}{(x^3+2)^2}$

7. If y=tanx−cotx, then dy/dx =

(A) sec x csc x
(B) sec x- csc x
(C) sec x + csc x
(D) $\sec^2 x$ - $\csc^2 x$
(E) $\sec^2 x$ + $\csc^2 x$

8. $\frac{d}{dx}\left(\frac{x+1}{x^2+1}\right) =$

(A) $\frac{x^2+2x-1}{(x^2+1)^2}$
(B) $\frac{-x^2-2x+1}{x^2+1}$
(C) $\frac{-x^2-2x+1}{(x^2+1)^2}$
(D) $\frac{3x^2+2x+1}{(x^2+1)^2}$
(E) $\frac{1}{2x}$

9. If $f(x) = \frac{x^2+3x+2}{x+3}$, then $f'(x) =$

(A) $2x + 3$
(B) $\frac{-x^2-6x-7}{(x+3)^2}$
(C) $\frac{x^2+6x+7}{(x+3)^2}$
(D) $\frac{x^2+12x+11}{(x+3)^2}$
(E) $\frac{3x^2+12x+11}{(x+3)^2}$

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10. 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 slope $\frac{1}{2}$?

(A) $(0, 0)$ only

(B) $\left(\frac{1}{2}, \frac{1}{5}\right)$ only

(C) $(0, 0)$ and $(-4, 2)$

(D) $(0, 0)$ and $\left(4, \frac{2}{3}\right)$

(E) There are no such points.

11. If $f(x) = \frac{5-x}{x^3+2}$, then $f'(x) =$

(A) $\frac{-4x^3+15x^2-2}{(x^3+2)^2}$

(B) $\frac{-2x^3+15x^2+2}{(x^3+2)^2}$

(C) $\frac{2x^3-15x^2-2}{(x^3+2)^2}$

(D) $\frac{4x^3-15x^2+2}{(x^3+2)^2}$

12. What is the slope of the line tangent to the graph of $y = \frac{x^2-2}{x^2+1}$ when $x = 1$?

(A) $-\frac{3}{2}$

(B) $-\frac{1}{2}$

(C) $\frac{1}{2}$

(D) 1

(E) $\frac{3}{2}$

13.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
0	3	4	2	π

The table above gives values of the differentiable functions f and g and their derivatives at $x = 0$. If $h(x) = \frac{f(x)}{g(x)}$, what is the value of $h'(0)$?

(A) $\frac{8-3\pi}{4}$

(B) $\frac{3\pi-8}{4}$

(C) $\frac{4}{\pi}$

(D) $\frac{2-3\pi}{2}$

(E) $\frac{8+3\pi}{4}$

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14.

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

The table above 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 $k'(3)$?

(A) $-\frac{5}{2}$

(B) -2

(C) 2

(D) 3

(E) 8

15. Given that 3x − tan y = 4, what is $\frac{dy}{dx}$ in terms of y?

(A) $\frac{dy}{dx} = 3\sin^2 y$

(B) $\frac{dy}{dx} = 3\cos^2 y$

(C) $\frac{dy}{dx} = 3\cos y \cot y$

(D) $\frac{dy}{dx} = \frac{3}{1+9y^2}$

16. Which of the following correctly shows the derivation of $\frac{d}{dx}(\sec x)$?

(A) $\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{1}{\frac{d}{dx}(\cos x)} = \frac{1}{\sin x}$

(B) $\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{1}{\frac{d}{dx}(\cos x)} = \frac{1}{-\sin x}$

(C) $\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{\frac{d}{dx}(1)\cdot\cos x - 1\cdot\frac{d}{dx}(\cos x)}{(\cos x)^2} = \frac{0\cdot\cos x - 1\cdot(-\sin x)}{(\cos x)^2}$

(D) $\frac{d}{dx}(\sec x) = \frac{d}{dx}\left(\frac{1}{\cos x}\right) = \frac{\frac{d}{dx}(1)\cdot\cos x + 1\cdot\frac{d}{dx}(\cos x)}{(\cos x)^2} = \frac{0\cdot\cos x + 1\cdot(-\sin x)}{(\cos x)^2}$

17. $\frac{d}{dx}(\cot x) =$

(A) $-\tan x$

(B) $-\csc^2 x$

(C) $\csc x$

(D) $\sec^2 x$

18. If $f(x) = \tan x$, then $\lim_{x\to\frac{\pi}{4}} \frac{f(x)-f\left(\frac{\pi}{4}\right)}{x-\frac{\pi}{4}}$ is

5

(A) 0

(B) $\tan\left(\frac{\pi}{4}\right)$

(C) $\sec^2\left(\frac{\pi}{4}\right)$

(D) nonexistent

19. Which of the following correctly shows the derivation of $\frac{d}{dx}(\cot x)$?

(A) $\frac{d}{dx}(\cot x)=\frac{d}{dx}\left(\frac{1}{\tan x}\right)=\frac{1}{\frac{d}{dx}(\tan x)}=\frac{-1}{\sec^2 x}$

(B) $\frac{d}{dx}(\cot x)=\frac{d}{dx}\left(\frac{1}{\tan x}\right)=\frac{1}{\frac{d}{dx}(\tan x)}=\frac{1}{\sec^2 x}$

(C) $\frac{d}{dx}(\cot x)=\frac{d}{dx}\left(\frac{1}{\tan x}\right)=\frac{\tan x\frac{d}{dx}(1)-1\cdot\frac{d}{dx}(\tan x)}{\tan^2 x}=\frac{(\tan x)\cdot 0-\sec^2 x}{\tan^2 x}=-\frac{\sec^2 x}{\tan^2 x}$

(D) $\frac{d}{dx}(\cot x)=\frac{d}{dx}\left(\frac{1}{\tan x}\right)=\frac{\tan x\frac{d}{dx}(1)+1\cdot\frac{d}{dx}(\tan x)}{\tan^2 x}=\frac{\tan x\cdot 0+\sec^2 x}{\tan^2 x}=\frac{\sec^2 x}{\tan^2 x}$

20. $\frac{d}{dx}(\cos x\tan x)=$

(A) $\sec x+\sin x\tan x$

(B) $\cos x$

(C) $-\sin x\sec^2 x$

(D) $\sin x$

21. If $f(x)=\sec x$, then $\lim\limits_{x\to\frac{\pi}{3}}\frac{f(x)-f\left(\frac{\pi}{3}\right)}{x-\frac{\pi}{3}}$ is

(A) 0

(B) $\sec\left(\frac{\pi}{3}\right)$

(C) $\sec\left(\frac{\pi}{3}\right)\tan\left(\frac{\pi}{3}\right)$

(D) nonexistent

22. $\lim\limits_{x\to 0}\dfrac{\sin x}{e^x-1}$ is

(A) 1

(B) $\dfrac{1}{e}$

(C) 0

(D) nonexistent

5

23.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
2	-3	$\frac{1}{2}$	-3	2

The table above gives values of the differentiable functions f and g and their derivatives at $x = 2$. If $h(x) = \frac{4f(x)}{g(x)+1}$, then $h'(2) =$

(A) -10

(B) -7

(C) 1

(D) 5

24.

x	$f(x)$	$f'(x)$	$f''(x)$	$g(x)$	$g'(x)$	$g''(x)$
2	4	-3	3	-2	5	1

The table above gives values of the twice-differentiable functions f and g and their derivatives at $x = 2$. If h is the function defined by $h(x) = \frac{f'(x)}{g(x)}$, what is the value of $h'(2)$?

(A) $\frac{9}{4}$

(B) $\frac{3}{5}$

(C) $-\frac{3}{2}$

(D) $-\frac{21}{4}$

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

(A) $-\frac{2}{3}$

(B) $\frac{2}{3}$

(C) $\frac{4}{3}$

(D) $\frac{3}{2}$

26.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
2	5	3	2	4

The table shown gives values of the differentiable functions f and g and their derivatives at $x = 2$. If $h(x) = \frac{f(x)}{g(x)}$, what is the value of $h'(2)$?

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(A) $-\frac{7}{2}$

(B) $-\frac{7}{8}$

(C) $\frac{3}{4}$

(D) $\frac{13}{2}$

27. If $y = \frac{x^3}{x+2}$, then $\frac{dy}{dx} =$

(A) $3x^2$

(B) $\frac{-2x^3-6x^2}{(x+2)^2}$

(C) $\frac{2x^3+6x^2}{(x+2)^2}$

(D) $\frac{4x^3+6x^2}{(x+2)^2}$

28.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
2	-1	-4	5	3

The table shown gives values of functions f, g, f', and g' at $x = 2$. If $h(x) = \frac{f(x)}{g(x)}$, then $h'(2) =$

(A) $-\frac{23}{16}$

(B) $-\frac{17}{16}$

(C) $-\frac{11}{16}$

(D) $\frac{5}{3}$

29. If $f(x) = \frac{\sin x}{e^x}$, then $f'(x) =$

(A) $\frac{-\cos x - \sin x}{e^x}$

(B) $\frac{\cos x - \sin x}{e^x}$

(C) $\frac{\sin x - \cos x}{e^x}$

(D) $\frac{\cos x + \sin x}{e^x}$

30. Let f be a differentiable function such that $f(9) = 18$ and $f'(9) = 7$. If g is the function defined by $g(x) = \frac{f(x)}{\sqrt{x}}$, what is the value of $g'(9)$?

(A) 2

(B) $\frac{7}{3}$

(C) $\frac{8}{3}$

(D) 42

31. If $f(x) = \frac{\cos x}{\ln x}$, then $f'(x) =$

5

(A) $\frac{x \sin x \ln x - \cos x}{x(\ln x)^2}$

(B) $\frac{-x \sin x \ln x - \cos x}{x(\ln x)^2}$

(C) $-x \sin x$

(D) $\frac{-x \sin x \ln x + \cos x}{x(\ln x)^2}$

32. Let f be a differentiable function such that $f(8) = 2$ and $f'(8) = 5$. If g is the function defined by $g(x) = \frac{f(x)}{\sqrt[3]{x}}$, what is the value of $g'(8)$?

(A) $\frac{59}{24}$

(B) $\frac{5}{2}$

(C) $\frac{61}{24}$

(D) 60

33.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
0	4	$\frac{1}{2}$	-2	$\frac{3}{2}$

The table above gives values of the differentiable functions f and g and their derivatives at $x = 0$. If $h(x) = \frac{6f(x)}{g(x) - 1}$, then $h'(0) =$

(A) 15

(B) 3

(C) 2

(D) -5