Differentiation Review Worksheet (NO CALCULATOR)

1. If $f(x) = 3\sqrt{x} + \frac{5}{\sqrt{x}}$, then $f'(4) =$

A) $-\frac{1}{16}$ B) $\frac{1}{16}$ C) 1 D) $\frac{5}{16}$ E) $\frac{7}{16}$

2. If $f(x) = x^3+2x-4$ and g is a differentiable function of x, what is the derivative of $f(g(x))$?

A) $3g^2(x)g'(x)$ B) $(3g^2(x)+2)g'(x)$ C) $3g^2(x)+2$ D) $3x^2g'(x)$ E) $3(g'(x))^2$

3. If $f''(x) = (x+1)(x-2)^2$, then the graph of f is concave down for

A) $X < -1$
B) $0 < x < 2$
C) $X > -1$
D) $-1 < x < 2$
E) $x > 2$

4. If $y = \sin x \cos x$, then at $x = \frac{\pi}{6}$, $\frac{dy}{dx} =$

A) 1 B) $-\frac{1}{2}$ C) $\frac{1}{4}$ D) $\frac{1}{2}$ E) $\frac{3}{4}$

5. If $x^2y - 3x = y^3 - 3$, then at the point (-1, 2), $\frac{dy}{dx} =$

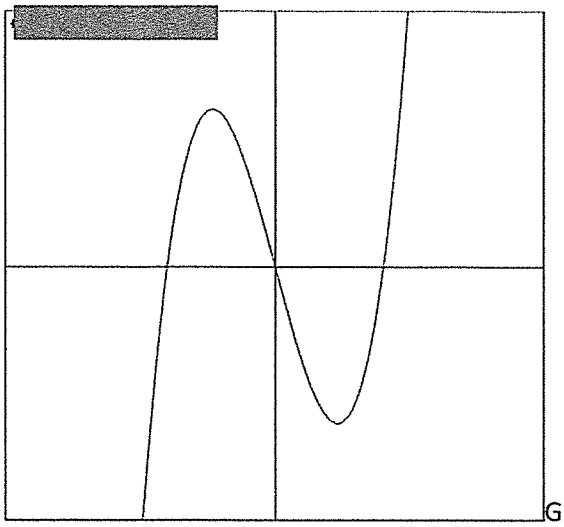
A) $-\frac{7}{11}$ B) $-\frac{7}{13}$ C) $-\frac{1}{2}$ D) $-\frac{3}{14}$ E) 7

6. Let f be the function with derivative defined by $f'(x) = x^3 - 16x$. At which of the following values of x does the graph of f have a point of inflection?

A) 0 B) $\frac{4}{3}$ C) $\frac{2}{3}$ D) $\frac{2}{\sqrt{3}}$ E) $\frac{4}{\sqrt{3}}$

7. If $f(x) = (x-1)(x^2+2)^3$, then $f'(x) =$

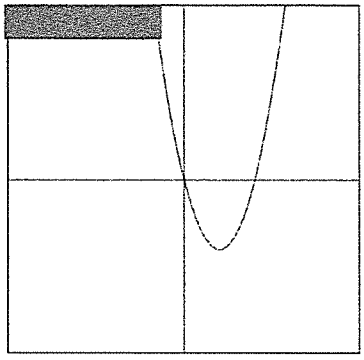
A) $6x(x^2+2)^2$
B) $6x(x-1)(x^2+2)^2$
C) $(x^2+2)^2(x^2+3x-1)$
D) $(x^2+2)^2(7x^2-6x+2)$
E) $-3(x-1)(x^2+2)^2$



Graph of f

12. The graph of a function f is shown above. Which of the following could be the graph of f ', the derivative of f?

A)



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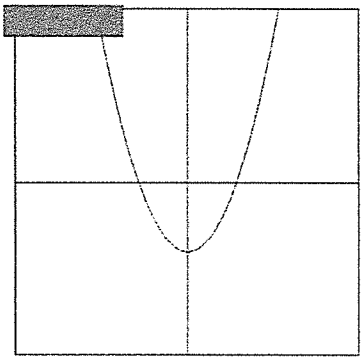

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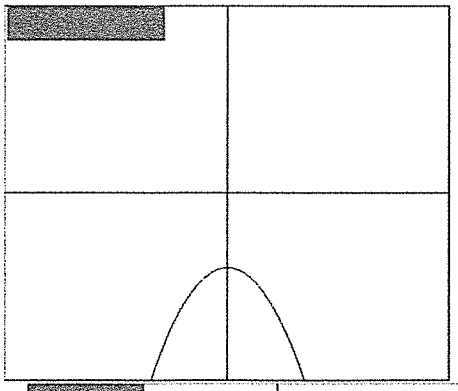

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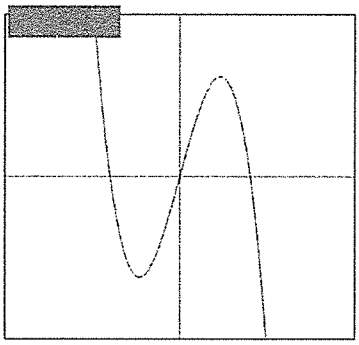
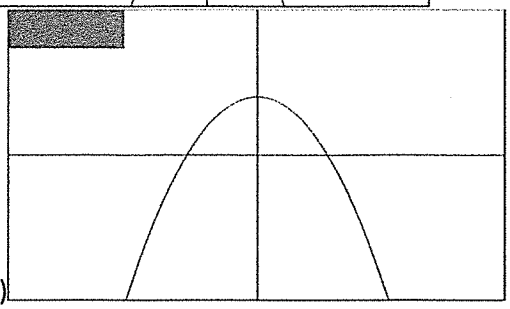


E)



13. If $f(x) = e^{(2/x)}$, then $f'(x) =$

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

14. In the xy-plane, the line $3x + y = k$, where k is a constant, is tangent to the graph of $y = x^2 + 3x + 1$. What is the value of k?

A) -9 B) -8 C) -3 D) 0 E) 1

15. The function f is twice differentiable with $f(2) = 1$, $f'(2) = 4$, and $f''(2) = 3$. What is the value of the approximation of f(1.9) using the line tangent to the graph of f at $x = 2$?

A) 0.4 B) 0.6 C) 0.7 D) 1.3 E) 1.4

16. What is the slope of the line tangent to the curve $y = \arctan(4x)$ at the point at which $x = ¼$?

A) 2 B) ½ C) 0 D) -1/2 E) -2

17. Let f be a differentiable function such that $f(3) = 15$, $f(6) = 3$, $f'(3) = -8$ and $f'(6) = -2$. The function g is differentiable and $g(x) = f^{-1}(x)$ for all x. What is the value of $g'(3)$?

A) -1/2 B) -1/8 C) 1/6 D) 1/3 E) It cannot be determined.

18. The radius of a sphere is decreasing at a rate of 2 centimeters per second. At the instant when the radius of the sphere is 3 centimeters, what is the rate of change, in square centimeters per second, of the surface area of the sphere? (The surface area S of a sphere with radius r is $S = 4\pi r^2$) (calc OK)

A) -108π B) -72π C) -48π D) -24π E) -16π

19. If $y = \frac{x+1}{x^2+1}$, then dy/dx =

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) $\frac{1}{2x}$

x	f(x)	f'(x)	g(x)	g'(x)
-1	6	5	3	-2
1	3	-3	-1	2
3	1	-2	2	3

20. Please answer the following questions:

a) If $h(x) = f(g(x))$, then $h'(1) =$

b) If $p(x) = f^{-1}(x)$, then $p'(6) =$

c) If $j(x) = g(x^3)$, then $g'(-1) =$

d) If $k(x) = \ln(g(x))$, then $k'(3) =$

e) If $n(x) = \frac{f(x)}{x^3}$, then $n'(1) =$

f) If $b(x) = e^{g(x)}$, then $b'(3) =$ (in terms of e)

Practice: Multiple Choice.

Rules: $(\cos x)' = -\sin x$ $(\ln x)' = \frac{1}{x}$ $(kx^n)' = nkx^{n-1}$ $(\sin x)' = \cos x$ $(e^x)' = e^x$ $(\tan x)' = \sec^2 x$

$(e^{kx})' = ke^x$ $\ln(u)' = \frac{u'}{u}$ $(a^u)' = u' \cdot a^u \cdot \ln a$

15.

An equation of the line tangent to the graph of $y = \cos(2x)$ at $x = \frac{\pi}{4}$ is

(A) $y - 1 = -\left(x - \frac{\pi}{4}\right)$

(B) $y - 1 = -2\left(x - \frac{\pi}{4}\right)$

(C) $y = 2\left(x - \frac{\pi}{4}\right)$

(D) $y = -\left(x - \frac{\pi}{4}\right)$

(E) $y = -2\left(x - \frac{\pi}{4}\right)$

16.

$\frac{d}{dx}\cos^2(x^3) =$

(A) $6x^2 \sin(x^3)\cos(x^3)$

(B) $6x^2 \cos(x^3)$

(C) $\sin^2(x^3)$

(D) $-6x^2 \sin(x^3)\cos(x^3)$

(E) $-2\sin(x^3)\cos(x^3)$

17.

If $f(x) = (x^2 - 2x - 1)^{\frac{2}{3}}$, then $f'(0)$ is

(A) $\frac{4}{3}$ (B) 0 (C) $-\frac{2}{3}$ (D) $-\frac{4}{3}$ (E) -2

18. $\frac{d}{dx} \ln\left|\cos\left(\frac{\pi}{x}\right)\right|$

A) $\frac{-\pi}{x^2\cos\left(\frac{\pi}{x}\right)}$ B) $-\tan\left(\frac{\pi}{x}\right)$ C) $\frac{1}{\cos\left(\frac{\pi}{x}\right)}$ D) $\frac{\pi}{x}\tan\left(\frac{\pi}{x}\right)$ E) $\frac{\pi}{x^2}\tan\left(\frac{\pi}{x}\right)$

18.

If $f(x)=x\sqrt{2x-3}$, then $f'(x)=$

(A) $\dfrac{3x-3}{\sqrt{2x-3}}$

(B) $\dfrac{x}{\sqrt{2x-3}}$

(C) $\dfrac{1}{\sqrt{2x-3}}$

(D) $\dfrac{-x+3}{\sqrt{2x-3}}$

(E) $\dfrac{5x-6}{2\sqrt{2x-3}}$

19.

If $f(x)=(x-1)^2\sin x$, then $f'(0)=$

(A) -2 (B) -1 (C) 0 (D) 1 (E) 2

20.

If $y=\tan x-\cot x$, then $\dfrac{dy}{dx}=$

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

21.

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

(A) $13x-y=8$ (B) $13x+y=18$ (C) $x-13y=64$

(D) $x+13y=66$ (E) $-2x+3y=13$

$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ · $f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$

26.

The $\lim_{h \to 0} \frac{\tan 3(x+h) - \tan 3x}{h}$ is

(A) 0 (B) $3\sec^2(3x)$ (C) $\sec^2(3x)$ (D) $3\cot(3x)$ (E) nonexistent

27.

If $y = 2\cos\left(\frac{x}{2}\right)$, then $\frac{d^2y}{dx^2} =$

(A) $-8\cos\left(\frac{x}{2}\right)$ (B) $-2\cos\left(\frac{x}{2}\right)$ (C) $-\sin\left(\frac{x}{2}\right)$ (D) $-\cos\left(\frac{x}{2}\right)$ (E) $-\frac{1}{2}\cos\left(\frac{x}{2}\right)$

28.

If $f(x) = \sin\left(e^{-x}\right)$, then $f'(x) =$

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

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

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

(D) $e^{-x}\cos(e^{-x})$

(E) $-e^{-x}\cos(e^{-x})$

29.

If $f(x) = (x-1)^{\frac{3}{2}} + \frac{e^{x-2}}{2}$, then $f'(2) =$

(A) 1 (B) $\frac{3}{2}$ (C) 2 (D) $\frac{7}{2}$ (E) $\frac{3+e}{2}$

30.

$\frac{d}{dx}\left(xe^{\ln x^2}\right) =$

(A) $1+2x$ (B) $x+x^2$ (C) $3x^2$ (D) x^3 (E) x^2+x^3

31.

$$\lim_{h\to 0}\frac{\ln(e+h)-1}{h} \text{ is}$$

(A) $f'(e)$, where $f(x)=\ln x$

(B) $f'(e)$, where $f(x)=\dfrac{\ln x}{x}$

(C) $f'(1)$, where $f(x)=\ln x$

(D) $f'(1)$, where $f(x)=\ln(x+e)$

(E) $f'(0)$, where $f(x)=\ln x$

32. (Calculator permitted)
Let f be the function given by $f(x)=2e^{4x^2}$. For what value of x is the slope of the line tangent to the graph of f at $(x, f(x))$ equal to 3?

(A) 0.168 (B) 0.276 (C) 0.318 (D) 0.342 (E) 0.551

33.

If $f(x)=\dfrac{e^{2x}}{2x}$, then $f'(x)=$

(A) 1

(B) $\dfrac{e^{2x}(1-2x)}{2x^2}$

(C) e^{2x}

(D) $\dfrac{e^{2x}(2x+1)}{x^2}$

(E) $\dfrac{e^{2x}(2x-1)}{2x^2}$