

I. Multiple Choice

_____ 1. Determine the instantaneous rate of change of the function $f(x) = x^4 - 4x^2 + 2$ at $x = 2$.

- (A) -16 (B) $x^2(x + 2)$ (C) 0 (D) 16
(E) the limit doesn't exist

_____ 2. If $y = w^3 + \sin w$ and $w = 3x^2 - x$, then $\frac{dy}{dw} =$

- (A) $3w^2 + \cos w$
(B) $3(3x^2 - x)^2 + 6x \cos(3x^2 - x) - 1$
(C) $3(3x^2 - x)^2 + (6x - 1) \cos(3x^2 - x)$
(D) $3(3x^2 - x)^2 (6x - 1) + (6x \cos - 1)(3x^2 - x) 4x - 6$
(E) $w^2 + \cos w$

_____ 3. If the line $3x - 4y = 0$ is tangent in the first quadrant to the curve $y = x^3 + k$, then k is

- (A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) 0 (D) $-\frac{1}{8}$ (E) $-\frac{1}{2}$

_____ 4. Given $y = (x^2 + 5)^6$ Determine $\frac{dy}{dx}$

- (A) $6(2x)^5$ (B) $6(x^2 + 5)^5$
(C) $12x(x^2 + 5)^5$ (D) $12x(x^2 + 5)$

_____ 5. The value of the derivative of $f(x) = 3x^2 + 2x + 5$ at $x = -3$ is:

- (A) -24 (B) -16 (C) $6x + 2$ (D) 14
(E) Nonexistent

_____ 6. Suppose that f , g , and h are differentiable functions of x . Then $\frac{d}{dx}\left(\frac{f+g}{h}\right) =$

- (A) $\frac{f'+g'}{h'}$ (B) $\frac{f'+g'}{h^2}$
(C) $\frac{fh'+gh'-hf'-hg'}{h^2}$ (D) $\frac{hf'+hg'-fh'+gh'}{h^2}$
(E) $\frac{hf'+hg'-fh'-gh'}{h^2}$

_____ 7. If $f(x) = \pi^2$, then $f'(x) =$

- (A) 0 (B) 2π (C) π (D) 1 (E) π^2

_____ 8. If $y = x^6$, $\frac{dy}{dx} =$

- (A) $6x^6$ (B) $5x^5$ (C) $6x^5$ (D) $5x^6$ (E) x^5

_____ 9. If $y = \sin^2 x + \cos^2 x$, $\frac{dy}{dx} =$

- (A) 1 (B) 0 (C) $4 \sin x \cos x$ (D) $2 \sin x + 2 \cos x$
(E) $2 \sin x - 2 \cos x$

_____ 10. If $y = (x^2 + 1)^4$ Then the differential $dy =$

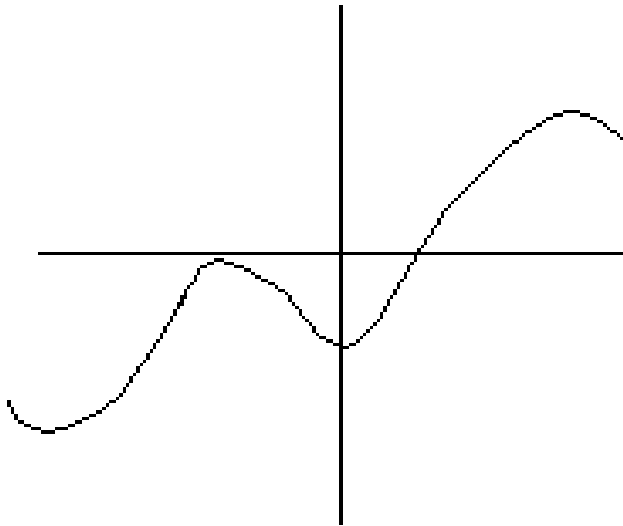
- (A) $4(x^2 + 1)^3$ (B) $4(x^2 + 1)^3 dx$ (C) $4(2x)^3 dx$
(D) $8x(x^2 + 1)^3 dx$ (E) $8x(x^2 + 1)^3$

II. Free Response – DO ON YOUR OWN PAPER!

11. Determine the 77th derivative of $y = 3x^{-1}$.

12. Find $\lim_{h \rightarrow 0} \frac{\sin(x+h) - \sin(x)}{h}$

13. Draw a sketch of the derivative of the function given by the following graph:



14. Suppose that the tangent line to $y = g(x)$ at $(-3, 6)$ passes through the point $(2, -4)$.
Find $g(-3)$, $g'(-3)$, and the equation of the tangent line to $y = g(x)$ at $(-3, 6)$.

15. Determine $\frac{d^2y}{dx^2}$ if $y = \tan(5x)$

16. Given $f(1) = 2$, $f'(1) = 4$, and $g(x) = (f(x))^{-3}$

Determine $\frac{d}{dx}(g(x))\big|_{x=1}$

17. Given $x^3 - y^3 = 6xy$ Determine $\frac{dy}{dx}$.

18. Given $\frac{1}{y} - \frac{1}{x} = 1$ Determine $\frac{dy}{dx}$.

19. Use differentials to determine the value of $\sqrt[3]{26}$.

20. State and prove the rule for finding either
(A) the derivative of a product or
(B) the derivative of the $\cot(x)$