

I. Multiple Choice

- _____ 1. Determine $f'(x)$ if $f(x) = \sin(x) \cot(x)$
 (A) $\cos x$ (B) $-\sin x$ (C) $\sin x$ (D) $-\cos x$ (E) 0
- _____ 2. Given $y = f(x) = 2x^3$, determine the average rate of change of y with respect to x over the interval $[1, 3]$.
 (A) 52 (B) -52 (C) 26 (D) -26 (E) 0
- _____ 3. An object moves in a straight line so that after t seconds its distance in feet from its original position is given by $s = t^4$. Its instantaneous velocity at $t = 4$ seconds is
 (A) 192 feet (B) 256 feet (C) 12 feet (D) 16 feet (E) 32 feet
- _____ 4. If $y = x^6$, $\frac{dy}{dx} =$
 (A) $6x^6$ (B) $6x^5$ (C) $5x^5$ (D) $5x^6$ (E) x^5
- _____ 5. If $u = 3x^2 - 93$, then $\frac{du}{dx} =$
 (A) $6u$ (B) $6x$ (C) $6x - 93$ (D) 6 (E) 0
- _____ 6. If $f(x) = \pi^2$, then $f'(x) =$
 (A) 0 (B) 2π (C) π (D) 1 (E) π^2
- _____ 7. Given $y = \sqrt{x}$ Determine $\frac{dy}{dx}$
 (A) $\frac{1}{2\sqrt{x}}$ (B) $\frac{1}{2}\sqrt{x}$ (C) $\frac{1}{2x}$ (D) $\frac{1}{2}x^{-1}$ (E) $\frac{1}{2}x$
- _____ 8. The area of a circle is given by $A = \pi r^2$.
 Assuming that the radius is changing, the formula for the instantaneous rate of Change of A with respect to r is:
 (A) πr (B) 0 (C) 2π (D) $2\pi r$ (E) $2\pi r^3$

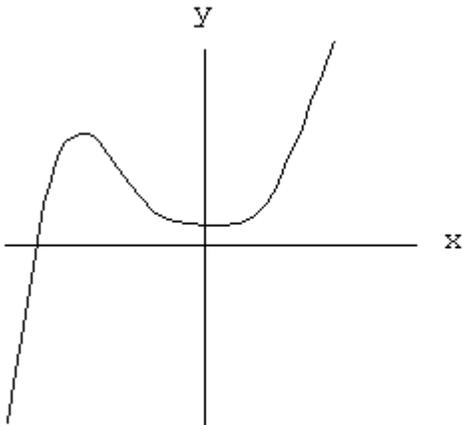
_____ 9. If $y = \frac{2x}{x-2}$, $\frac{dy}{dx}\bigg|_{x=1} =$
(A) 3 (B) -3 (C) 4 (D) -4 (E) 0

_____ 10. Determine the value of k so that the line $y = 2x$ is tangent to the curve $y = x^2 + k$.
(A) -1 (B) 0 (C) 1 (D) 2 (E) None of these answers

II. Free Response

Do ALL work on your own paper.

11. Sketch the graph of the derivative of the function whose graph is shown below:



12. Given $g(x) = \sqrt{x} f(x)$. Determine $g'(1)$ given that $f(1) = 8$ and $f'(1) = 5$.

13. Determine $\frac{d^2 y}{dx^2}$ if $y = x \cos x$.

14. If $y = \sin(x)$, Determine $\frac{d^{105} y}{dx^{105}}$.

15. Determine the equation of the line tangent to the graph of $y = f(x)$ at the point where $x = -3$ if $f(-3) = 2$ and $f'(-3) = 5$.

16 - 17. Given the function $g(x) = \frac{x-1}{2x+4}$.

16. Determine $\frac{d}{dx}(g(x))$

17. Write the equation of the line tangent to $g(x)$ at the point where $x = -1$.

18. Given $y = x^6$, Determine $y'''(1)$.

19. Write out a complete definition of the derivative.

20. Given $y = x^2 + 5x$, use the definition of the derivative to determine $\frac{dy}{dx}$.

21. Extra Credit:

A small water balloon was projected vertically upward by a disgruntled calculus student with an initial velocity of 160 ft/sec. It reaches an elevation of $s = 160t - 16t^2$ feet at the end of t seconds. How high does the balloon rise? When would it hit the calculus teacher who just happens to be walking by a few seconds later and who is 6 feet tall?