

Name: _____
School: _____
Compliments of Mr. Vu

Calculus BC Individual 2019

Brother Martin Tournament

1. Find the y -value of the absolute maximum for the function $y = -(x + 6)^{\frac{2}{3}}$ on the interval $[-4, 1]$

2. Find the equation of the line tangent to the graph of $y = \frac{1}{5x^4 + 5}$ at the point $(1, \frac{1}{10})$.

3. Use implicit differentiation to find $\frac{dy}{dx}$ at $(2, -1)$.

$$5 = 5x^2 + 3x^2y + 3y$$

4. Find $\int_0^2 \frac{24x}{(4x^2 + 4)^2} dx$

5. Find the area of the region enclosed by the curves:

$$y = 3\sqrt{x}, \quad y = -3\sqrt{x}$$

$$x = 0, \quad x = 4$$

6. A spherical snowball melts at a rate of $\frac{32\pi}{3}$ in³/sec. At what rate is the radius of the snowball changing when the radius is 4 inches? Include units.

7. Approximate the area under the curve over the interval $[-2, 2]$ using 2 midpoint rectangles.

$$y = x^2 + x + 1$$

8. Find $\lim_{x \rightarrow 0} \frac{2x}{\ln(x + 1)}$

9. If $F(x) = \int_x^{2x} (t^3 - 2t^2 + 1) dt$, then find and simplify $F'(x)$

10. For the function $y = 2x^2 - 12x + 17$, where does the instantaneous rate of change equal the average rate of change on the interval $[2, 5]$?

11. Find the volume of the solid that results when the region enclosed by the curves is revolved about the x -axis.

$$y = \sqrt[3]{x}, \quad y = 0, \quad x = 1$$

12. Find $\int \frac{\ln x}{\sqrt{x}} dx$

13. Consider the curve defined on the interval $[0, 2\pi)$ by the parametric equations:

$$x(t) = \cos 3t$$

$$y(t) = 3 \sin 2t$$

Find the slope of the line tangent to the curve $t = \frac{\pi}{4}$

14. Find the average value of the function over the interval $[2, 5]$:

$$f(x) = \frac{4}{x}$$

15. If a particle's position is defined by the vector valued function $\langle \cos 3t, 6t^4 - e^{2t} \rangle$, then find the particle's acceleration vector when $t = 0$

Answers

1. $-\sqrt[3]{4}$
2. $y = -\frac{1}{5}x + \frac{3}{10}$
3. $-\frac{8}{15}$
4. $\frac{3}{5}$
5. 32
6. $-\frac{1}{6}$ inches per second
7. 8
8. 2
9. $15x^3 - 14x^2 + 1$
10. $\frac{7}{2}$
11. $\frac{3\pi}{5}$
12. $2 \ln x \cdot \sqrt{x} - 4\sqrt{x} + C$
13. 0
14. $\frac{4}{3} \ln(\frac{5}{2})$
15. $\langle -9, -4 \rangle$