

Calculators and mobile phones are not allowed.

Answer all of the following questions.

1. Find the following limit, if it exists

$$\lim_{x \rightarrow 0} \frac{2x + \sin x}{\tan x} \quad (3 \text{ Points})$$

2. Find the vertical and horizontal asymptotes for the graph of f , where

$$f(x) = \frac{2x\sqrt{x^2 + 1}}{x^2 + 3x} \quad (3 \text{ Points})$$

3. Let

$$f(x) = \begin{cases} \frac{\sqrt{5 - 2x} - 1}{x - 2}, & \text{if } x < 2 \\ \frac{Ax - 4}{x^2 - x}, & \text{if } x \geq 2. \end{cases}$$

Find the value of A so that f is continuous at $x = 2$.

(3 Points)

4. Show that the equation $1 - 3x + 2 \cos x = 0$ has at least one real root.

(3 Points)

5. Find $f'(x)$, if

$$f(x) = [x^2 \sin x + \tan(x^3 + 1)]^4 \quad (3 \text{ Points})$$

6. Let

$$f(x) = \frac{1}{3}x^3 - \frac{5}{2}x^2 + 6x + 1.$$

Find the x -coordinates of the points on the graph of f at which the tangent line is horizontal.

(3 Points)

7. If $x^3 + y^3 = 9$, find $\frac{d^2y}{dx^2}$ at $x = 2$.

(3 Points)

8. Let ABC be a right triangle at B with $AC = 10$ cm. Let θ be the angle ACB . If the side BC is increasing at a rate of 2 cm/sec, find the rate of change of the angle θ when $\theta = 30^\circ$.

(4 Points)

Good Luck