



Name: _____

Mark:
25

MATH 100
Assignment 3

1. (2 marks) Find $\frac{dy}{dx}$ by implicit differentiation.

$$2x \sin(xy^3) = x^4 + 2y - 7$$

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2. (4 marks) A woman walks along a straight path at a speed of 5 ft/s. A searchlight is located on the ground 24 ft from the path and is kept focused on her. At what rate is the searchlight rotating when the woman is 16 ft from the point on the path closest to the searchlight?

3. Find the absolute extrema of f on the indicated interval.

(a) (3 marks) $f(x) = -3x^{1/3}(x - 32)$ on $[-1, 27]$

(b) (3 marks) $f(x) = \cos 2x - 2 \cos x$ on $[0, 2\pi]$

4. Determine whether the Mean Value Theorem can be applied to f on the indicated interval. If the Mean Value Theorem can be applied, then find all values of c that are guaranteed to exist. If it cannot be applied, then explain why not.

(a) (1 mark) $f(x) = x^{1/3} - 2x$ on $[-1, 8]$

(b) (3 marks) $f(x) = 2\sqrt{5-x} + 3$ on $[1, 5]$

5. (3 marks) Let

$$f(x) = \frac{1}{2}x + \cos x$$

for x in the interval $(0, 2\pi)$. Find the open intervals on which f is increasing or decreasing and find the coordinates of all critical points. Using the First Derivative Test, classify each critical point as a relative maximum, relative minimum or neither.

6. (3 marks) Using the Second Derivative Test, where applicable, find all the relative extrema of

$$f(x) = 12x^5 - 45x^4 + 80x^3 - 360x^2 + 100.$$

7. (3 marks) Find the open intervals on which the graph of

$$f(x) = \frac{4x}{x^2 + 12}$$

is concave upward or concave downward and find the coordinates of all points of inflection.