
On the front of your Bluebook write: (1) your name, (2) your instructor's name, (3) your lecture section number and (4) a grading table for ***five*** problems.

- Text books, class notes, cell phones and calculators are NOT permitted.
- **Show all work and simplify your answers!** Name any theorem that you use. Limit problems should not be evaluated using L'Hopital's Rule. Answers with no justification will receive no points unless the problem explicitly states otherwise.
- Make sure all of your work is in your bluebook. Nothing on this exam sheet will be graded. Please begin each problem on a new page.

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1. (20 pts) Find the requested derivative for each of the following.

   (a) Find y' for $y = \sqrt[4]{x}\cos(x)$.

   (b) Find $\dfrac{dy}{dx}$ for $(x+y)^3 = x^3 + y^3$.

   (c) Find $\dfrac{d^2y}{dt^2}$ for $y = \sec(t)$.

   (d) Find $f'(1)$ for $f(x) = \dfrac{x^2-4}{x-3}$.

2. (16 pts) The following problems are unrelated

   (a) Use the definition of a derivative to find the derivative of $f(t) = 10 - t^2$.

   (b) Find the linearization of $\tan(x - \pi/4)$ at $a = \pi/2$ and use it to approximate the value of $\tan(\pi/5)$.

3. (24 pts) The position of a particle along a straight line is described by the function

$$s(t) = \frac{t}{4} - \frac{1}{2}\sin(t),$$

on the interval $[0, 2\pi]$.

   (a) What is the velocity of the object at any time t?

   (b) What is the acceleration of the object at any time t?

   (c) Find all critical values of $s(t)$ on the interval $(0, 2\pi)$.

   (d) Use the second derivative test to classify the local extrema of $s(t)$ on the interval $(0, 2\pi)$.

   (e) Find the absolute maximum and minimum values of the **velocity** on the interval $[0, 2\pi]$.

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4. (20 pts) The following problems are unrelated.

(a) (i) State Rolle's theorem.

(ii) Verify that $f(x) = x^2 - 2x - 8$ satisfies the assumptions of Rolle's theorem on the interval $[-1, 3]$. Then find all values of c whose existence is guaranteed by Rolle's theorem on the interval.

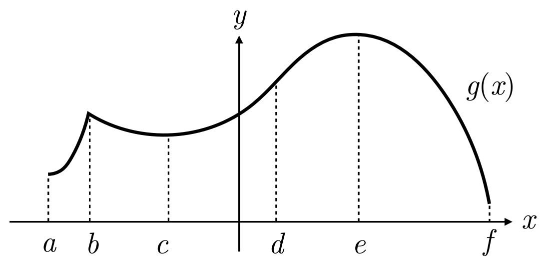
(b) Below is a sketch of a function $g(x)$ on the interval $[a, f]$. Use the values of the x-coordinates specified to identify the following. No justification is necessary.

(i) Critical numbers of $g(x)$.

(ii) Locations of the absolute extrema of $g(x)$.

(iii) Intervals where $g'(x) \geq 0$.

(iv) Intervals where $g''(x) > 0$.



5. (20 pts) A thin sheet of ice is in the form of a circle and maintains this shape as it melts. If the ice is melting in such a way that the area of the sheet is decreasing at a rate of $0.5\ \text{m}^2/\text{sec}$, at what rate is the radius decreasing when the area of the sheet is $12\ \text{m}^2$?