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Name_____

10-digit PUID_____

RECITATION Section Number and time_____

Recitation Instructor_____

Lecturer_____

Instructions:

1. Fill in all the information requested above and on the scantron sheet. On the scantron sheet also fill in the little circles for your name, section number and PUID.
2. This booklet contains 12 problems, each worth 8 points (except problems 3,4,7 and 9 are worth 9 points each). The maximum score is 100 points. The test booklet has 7 pages, including this one.
3. For each problem mark your answer on the scantron sheet and also circle it in this booklet.
4. Work only on the pages of this booklet.
5. Books, notes, calculators or any electronic devices are not to be used on this test.
6. At the end turn in your exam and scantron sheet to your recitation instructor.

1) A tank has the shape of an inverted circular cone with radius 2 m and height 8 m. If water is poured into the tank at a rate of 4 m^3 per minute, find the rate at which the water level is rising (in m per minute) when the water is 4 m deep.

A) $\frac{4}{\pi}$

B) $\frac{2}{\pi}$

C) $\frac{8}{3\pi}$

D) $\frac{3}{\pi}$

E) $\frac{4}{3\pi}$

2) Use a linear approximation to compute the approximate value of $\sqrt[3]{8.06}$.

A) 2.04

B) 2.02

C) 2.005

D) 2.01

E) 2.0025

3) If $f(x) = x^3 + x - 1$ on the interval $[0, 2]$, find a number c that satisfies the Mean Value Theorem.

A) $\frac{2}{\sqrt{3}}$

B) $\sqrt{2}$

C) $\sqrt{\frac{5}{3}}$

D) $\frac{\sqrt{3}}{3}$

E) $\frac{4}{\sqrt{3}}$

4) If m_1 is the minimum of $f(x) = x^3 + 3x^2 - 9x$ on $[0, 2]$ and m_2 is the maximum, find $m_1 + m_2$.

A) 7

B) -3

C) 5

D) 2

E) -52

5) if $f(x) = \sinh(\ln x)$, calculate $f'(2)$.

A) $\frac{3}{8}$

B) $\frac{5}{4}$

C) $\frac{3}{4}$

D) $\frac{5}{8}$

E) $\frac{5}{2}$

6) If $f(t) = t^2 + 4\cos t$ on $(0, 2\pi)$ find the interval(s) where the graph of f is concave upward.

A) $\left(0, \frac{\pi}{6}\right) \cup \left(\frac{11\pi}{6}, 2\pi\right)$

B) $\left(\frac{\pi}{3}, \frac{5\pi}{3}\right)$

C) $\left(\frac{2\pi}{3}, \frac{4\pi}{3}\right)$

D) $\left(\frac{\pi}{6}, \frac{11\pi}{6}\right)$

E) $\left(0, \frac{\pi}{3}\right) \cup \left(\frac{5\pi}{3}, 2\pi\right)$

7) Let $f(x) = 2x^3 - 3x^2$. f has

A) 1 local max and 2 points of inflection

B) 1 local max and 1 point of inflection

C) 1 local min and 2 points of inflection

D) 1 local min and 1 point of inflection

E) 1 local min, 1 local max and 1 point of inflection

8) Find the least distance between the hyperbola $x^2 - y^2 = 1$ and the point $(4, 0)$.

A) 2

B) 4

C) $\sqrt{7}$

D) $\sqrt{8}$

E) 4

9) $\lim_{x\to 0} \dfrac{\sin x - x}{\tan x - x} =$

A) $-\dfrac{1}{2}$

B) -1

C) 0

D) $\dfrac{1}{2}$

E) 1

10) $\lim_{x\to 0^+} (1-3x)^{1/5x} =$

A) 1

B) e^{-15}

C) $e^{-3/5}$

D) $e^{-5/3}$

E) $e^{-1/15}$

11) Let $f'(x) = (x+1)(x-1)^2(x-2)$. f has

A) no local maxima and 2 local minima

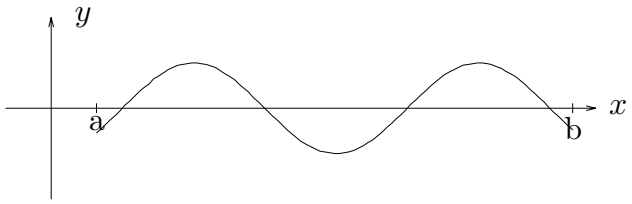
B) 2 local maxima and no local minima

C) 1 local maximum and 2 local minima

D) 2 local maxima and 1 local minimum

E) 1 local maximum and 1 local minimum

12) The graph of f' is given below, $a \leq x \leq b$.



A) f has exactly 2 points of inflection and exactly 4 local extrema.

B) f has exactly 2 points of inflection and exactly 3 local extrema.

C) f has exactly 4 points of inflection and exactly 3 local extrema.

D) f has exactly 3 points of inflection and exactly 4 local extrema.

E) f has exactly 3 points of inflection and exactly 5 local extrema.