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Name

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Student ID number

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Lecturer

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Recitation Instructor

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Time of Recitation Class

Instructions:

1. This package contains 14 problems, each worth 7 points, for a total of 100 points (that includes 2 bonus points for coming).
2. Please supply all information requested above and on the mark-sense sheet.
3. Work only in the space provided, or on the backside of the pages. Mark your answers clearly on the mark-sense sheet.
4. No books, notes, or calculator, please.

1.  $\frac{d}{dx} \sin^{-1} \sqrt{x} =$

A.  $\frac{\cos \sqrt{x}}{2\sqrt{x} \sin^2 \sqrt{x}}$

B.  $\frac{\cos^{-1} \sqrt{x}}{2\sqrt{x}}$

C.  $\frac{1}{2\sqrt{x-x^3}}$

D.  $\frac{1}{\sqrt{1-x}}$

E.  $\frac{1}{2\sqrt{x-x^2}}$

2. An equation of the line tangent to the graph of  $x^2 + y^4 = 2xy^2 + 1$  at  $(2,1)$  is

A.  $y = \frac{x}{2}$

B.  $y = 2 - \frac{x}{2}$

C.  $y = 2x - 3$

D.  $y = 2x + 3$

E. None of the above

3. When  $x = \frac{\pi}{3}$ ,  $\frac{d^2}{dx^2} \cos 3x =$

- A. 6
- B. 9
- C. 12
- D. 0
- E. -6

4. If  $y = \frac{e^x \sqrt{x}}{(x-1)^2}$ , then  $y' =$

- A.  $\frac{e^x}{4\sqrt{x}(x-1)}$
- B.  $\frac{\sqrt{x}}{(x-1)^4}$
- C.  $1 + \frac{1}{2x} - \frac{2}{x-1}$
- D.  $e^x \left( \frac{\sqrt{x}}{(x-1)^2} + \frac{1}{2\sqrt{x}} \right)$
- E.  $\left( 1 + \frac{1}{2x} - \frac{2}{x-1} \right) \frac{e^x \sqrt{x}}{(x-1)^2}$

5.  $\lim_{x \rightarrow \infty} \sinh x =$

- A.  $-\infty$
- B.  $-1$
- C.  $0$
- D.  $1$
- E.  $\infty$

6. The half-life of radioactive calcium-161 is 3 years. If a sample has a mass of 6 lb, how much will remain after 8 years?

- A.  $\frac{6}{2^{8/3}}$  lb
- B. 2 lb
- C.  $\frac{3}{2^{4/3}}$  lb
- D.  $\frac{6}{3^{1/4}}$  lb
- E.  $\frac{8}{3^3}$  lb

7. A particle moves along the curve  $y = (5 + x^2)^{3/2}$ . As it reaches the point  $(2, 27)$  the  $x$ -coordinate is increasing at a rate of 2 in/s. How fast (in in/s) is the  $y$ -coordinate of the point increasing at that instant?

- A. 4
- B. 9
- C. 18
- D. 36
- E. 54

8. Use differentials (or equivalently, a linear approximation) to estimate  $\sqrt[4]{80}$ .

- A.  $3 - \frac{1}{4} \cdot \frac{1}{27}$
- B.  $3 + \frac{1}{4} \cdot \frac{1}{27}$
- C.  $3 - \frac{1}{4} \cdot \frac{1}{3}$
- D.  $3 + \frac{1}{4} \cdot \frac{1}{3}$
- E.  $4 - \frac{1}{4} \cdot \frac{1}{3}$

9. A spotlight on the ground shines on a vertical wall 12 m away. If a man 2 m tall walks from the spotlight toward the wall at a rate of 2 m/s, how fast is the length of his shadow on the wall decreasing when he is 5 m from the wall?

- A. 2 m/s
- B.  $\frac{48}{49}$  m/s
- C.  $\frac{24}{5}$  m/s
- D.  $\frac{24}{10}$  m/s
- E.  $\frac{48}{25}$  m/s

10. A circle has a circumference measured to be 30 in with a possible error of  $\frac{1}{4}$  in. Estimate the maximum possible error in the resulting area of the circle (in  $\text{in}^2$ ).

- A. 30
- B.  $30\pi$
- C.  $\frac{30}{\pi}$
- D.  $\frac{15}{4\pi}$
- E.  $\frac{15}{2\pi}$

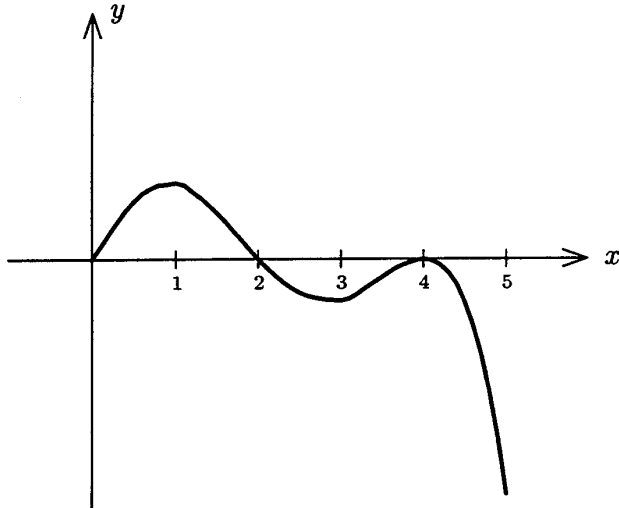
11. The absolute minimum value of the function  $f(x) = x^2 + 2/x$  on the interval  $[\frac{1}{2}, \frac{3}{2}]$  is

- A.  $\frac{9}{4}$
- B.  $\frac{17}{4}$
- C. 3
- D.  $\frac{43}{12}$
- E.  $\frac{35}{12}$

12. The function  $f(x) = x^4 - 8x^2$  satisfies the three hypotheses of Rolle's Theorem on the interval  $[-1, 1]$ . How many numbers  $c$  are there in this interval that satisfy the conclusion of Rolle's Theorem?

- A. 0
- B. 1
- C. 2
- D. 3
- E. None of the above

13. Given the graph of  $y = f'(x)$  below, it follows that



- A.  $f$  is decreasing on  $(1,3)$
- B.  $f$  is concave upward on  $(2,4)$
- C.  $f$  is increasing on  $(1,2)$
- D.  $f$  is concave downward on  $(0,2)$
- E. None of the above

14. The function  $f(x) = x^4(x - 1)^3$  has

- A. two critical numbers
- B. a relative minimum at  $x = 0$
- C. a relative minimum at  $x = 1$
- D. a relative maximum at  $x = 1$
- E. None of the above