

Instructions: \implies

If you do not read the instructions, then how will you know what to do? Read them now.

- This test is multiple-choice. You must mark your answer on the provided scantron. Before you begin, fill in all the required information on the scantron.
- Fill in the appropriate bubbles for your information and for your answers on the scantron very carefully.
- You may use one 8.5 × 11 inch note sheet prepared in advance. You may write on both sides of your note sheet.
- Note sheets may not be shared. If you do not bring a note sheet you will have to do without any help notes.
- You may not use any books, notebooks, additional note sheets nor note cards.
- You are expected to have a simple scientific calculator available for use on this test. Calculators and other equipment may not be shared.
- You may use a simple graphics calculator but not a laptop computer nor any device capable of extensive symbolic manipulation (other than your own brain).

Be sure to enter all required information on the scantron.

Section number: 060

There are xxproblems.

Problem 1. Let $f(x) = (1+x)^{1/3}$. Compute the Taylor-Maclaurin polynomial (Taylor polynomial centered at the origin or Maclaurin polynomial) of degree 2 for $f(x)$.

- A.) $1 + x - x^2$ B.) $1 + x/3 + x^2/9$
 C.) $1 + x/3 - x^2/9$ D.) $1 + x/3 - 2x^2/9$ E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 1).

Problem 2. Let $g(x) = (1+x)^{-1/3}$. The Taylor-Maclaurin polynomial (Taylor polynomial centered at the origin or Maclaurin polynomial) of degree 2 for $g(x)$ is

$$1 - \frac{1}{3}x + \frac{2}{9}x^2.$$

Use this Taylor polynomial to approximate $g(0.1)$. Choose the number closest to your result from the list below.

- A.) 0.968022 B.) 0.968729
 C.) 0.968803 D.) 0.968888 E.) 0.968999

←Write letter corresponding to your answer here and mark it on the scantron (Problem 2).

Problem 3. Find the solution y of the ordinary differential equation

$$\frac{dy}{dx} = y^2 (2 + x^{-2})$$

which satisfies $y = 1$ when $x = 1$. Then find the value of y which corresponds to $x = 2$.

- A.) $-\frac{2}{3}$ B.) $-\frac{1}{3}$
 C.) $\frac{1}{3}$ D.) $\frac{2}{3}$ E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 3).

Problem 4. A rectangular box (with open top and square base) is to be made from 48 square inches of material. Find the maximum volume that can be obtained.

- A.) 31 in^3 B.) 32 in^3
C.) 29 in^3 D.) 26 in^3 E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 4).

Problem 5. If $f(x) = \sin(x) \tan(x)$ then the derivative $f'(x)$ is given by

- A.) $\sin(x) \tan^2(x)$ B.) $\sin(x) (1 + \sec^2(x))$
C.) $\cos(x) + \sec^2(x)$ D.) $\sin(x) (1 + \sec(x))$ E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 5).

Problem 6. The tangent line at $(1, 1/2)$ to the graph of

$$y = \frac{x^3}{1+x}$$

is

- A.) $y = (5/4)x - 3/4$ B.) $y = (4/5)x - 3/10$
C.) $y = 3x - 5/2$ D.) $y = (3/2)x - 1$ E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 6).

Problem 7. Find the maximum value of $(x - 1)(y - 3)$ if $xy = 12$ and $0 \leq x \leq 4$.

- A.) 12 B.) 9
C.) 6 D.) 3 E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 7).

Problem 8. Compute the limit

$$\lim_{x \rightarrow 0} \frac{x - \sin(x)}{x^3}.$$

- A.) 0 B.) $1/3$
C.) $1/12$ D.) undefined E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 8).

Problem 9. For a certain function f on the interval $[-3, 3]$ the Taylor-Maclaurin polynomial of degree 3 is given by

$$P_3(x) = 3 - x^2 + \frac{1}{4}x^3$$

and we have $|f^{(4)}(x)| \leq 1.2 \times 10^{-5}$ for each x in the interval $[-3, 3]$. If we use $P_3(2) = 1$ to approximate $f(2)$ then we make an error no larger than (choose the best estimate)

- A.) 5.00×10^{-7} B.) 8.00×10^{-6}
C.) 1.20×10^{-5} D.) 1.92×10^{-4} E.) 1.98×10^{-2}

←Write letter corresponding to your answer here and mark it on the scantron (Problem 9).

Problem 10. If a person 6 feet tall is walking at a rate of 4 ft/sec away from a lamp which is 30 feet off the ground, at what rate does the person's shadow lengthen?

- A.) 1 ft/sec B.) 2 ft/sec
C.) 3 ft/sec D.) 4 ft/sec E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 10).

Problem 11. Let f be a differential function on $[3, 11]$ satisfying $f(3) = 2$ and $f(11) = 6$. Then there *must be* a point c such that $3 \leq c \leq 11$ and

- A.) $f'(c) = 1$ B.) $f'(c) = 1/2$
C.) $f'(c) = 1/4$ D.) $f'(c) = 1/8$ E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 11).

Problem 12. If $|g'(x)| \leq 0.04$ for $0 \leq x \leq 3$ then $|g(2.225) - g(2.100)| \leq a$ where (pick the best value)

- A.) $a = 0.002$ B.) $a = 0.003$
C.) $a = 0.004$ D.) $a = 0.005$ E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 12).

Problem 13. If $f(x) = x^5 - 10x^2 + 4$ then f has a critical point which is a local minimum. Use the second derivative test to locate this critical point.

- A.) 0 B.) $2\sqrt{2}$
C.) 1 D.) The test fails. E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 13).

Problem 14. The equation

$$x^4y^4 + xy^3 = 2$$

determines y as a function of x such that $y = 1$ when $x = 1$. Compute $\frac{dy}{dx}$ when $x = 1$ and $y = 1$.

- A.) $-5/7$ B.) $-3/7$
C.) $-1/7$ D.) $-1/2$ E.) None of the above.

←Write letter corresponding to your answer here and mark it on the scantron (Problem 14).

Use the rest of this page and the backs of all the pages for scratch work.