

MAC 2233 CALCULUS FOR BUSINESS AND SOCIAL SCIENCE
TEST 1

Name KEY

Score 40

Part I - Multiple Choice. Write your answer choice in the space provided next to each question.

- 1 Find the composite function $f(g(x))$.

$$f(x) = x^3 + 2, g(x) = x + 3$$

- A) $x^3 + 5$
B) $x^3 + 6$
 C) $(x+3)^3 + 2$
D) $x^3 + x + 5$

- 2 Find the points of intersection (if any) of the given pair of curves.

$$y = x + 2 \text{ and } y = 2x + 4$$

- A) $(-2, 0)$
B) $(1, -4)$
C) $(0, 2)$
D) $(1, 6)$

- 3 Determine the domain of the given function.

$$f(x) = \frac{x^2 - 9}{x + 10}$$

- A) all real numbers x
 B) all real numbers except $x = -10$
C) all real numbers x except $x = 3$ and $x = 8$
D) all real numbers x except $x = 3, x = -3,$ and $x = -10$

- 4 Find the slope (if possible) of the line that passes through the two points $(11, 5)$ and $(6, 4)$.

- A) 5
 B) $\frac{1}{5}$
C) 0
D) The slope is undefined.

- 5 The cost of renting a backhoe at one distributor is \$340, plus \$45 per day. Write a linear function $C(x)$ that describes the cost of renting the backhoe for x days, then use your function to find how much it would cost to rent it for 19 days.
- A) $C(x) = 340x + 45$; \$6,505
 B) $C(x) = 19(340 + 45x)$; \$22,705
 C) $C(x) = 340 + 45x$; \$1,195
 D) $C(x) = 45x + 321$; \$1176

- 6 Decide if the given function is continuous at the specified value of x :

$$f(x) = \begin{cases} x+3 & \text{if } x < 1 \\ 3x+1 & \text{if } x \geq 1 \end{cases}; \quad x=1$$

- A) No, the function is not continuous at $x = 1$.
 B) Yes, the function is continuous at $x = 1$.

- 7 Determine all points of discontinuity for $f(x) = \frac{2x+1}{x^2+x}$.

- A) -1
 B) 0 and -1
 C) $-\frac{1}{2}$
 D) None

- 8 Compute the indicated value of the given function.

$$f(t) = \begin{cases} -4t+4 & \text{if } t < -1 \\ t^2+5 & \text{if } t \geq -1 \end{cases}; \quad f(-3)$$

- A) 16
 B) -8
 C) 14
 D) -4

- 9 The equation of the line tangent to the graph of $f(x) = x^2 + 3x$ at $x = 2$ is

- A) $y = 7x - 4$
 B) $y = 7x - 422$
 C) $y = 7x - 2$
 D) $y = 7x - 144$

10 The derivative of $f(t) = \frac{1}{t^7}$ is

- A) $\frac{-7}{t^8}$
- B) $\frac{-7}{t^6}$
- C) $\frac{7}{t^6}$
- D) $\frac{1}{t^8}$

11 Find the limit: $\lim_{x \rightarrow 2^-} f(x)$, where $f(x) = \begin{cases} x+5 & \text{if } x < 2 \\ x^2 & \text{if } x \geq 2 \end{cases}$

- A) 7
- B) 0
- C) 4
- D) There is none

12 Differentiate: $f(x) = (x^2 + 6)(x + 2)$.

- A) $3x^2 + 4x + 6$
- B) $2x + 1$
- C) $24x + 1$
- D) $x^2 + 1$

Part II – Short Answer. Answer each question showing ALL work for full credit.

13. A closed box with a square base is to have a volume of 50 cubic meters. The material for the top and bottom of the box costs \$2 per square meter, and the material for the sides costs \$5 per square meter. Express the construction cost of the box as a function of the length of its base. Draw and label a picture with variables as part of your response. (4 points)

$$V = L^2 H = 50 \rightarrow H = \frac{50}{L^2}$$

$$C = 2(2L^2) + 5(4LH) = 4L^2 + 20LH = 4L^2 + 20L\left(\frac{50}{L^2}\right)$$

$$C = 4L^2 + \frac{1000}{L}$$

14. a) Use $f(x) = \frac{x^3 - 8}{x - 2}$ to complete the following table of values. (3 points)

x	$f(x)$
1.997	11.982
1.998	11.988
1.999	11.994
2	ERROR
2.001	12.006
2.002	12.012
2.003	12.018

b) Based on the evidence in the table, determine the value of $\lim_{x \rightarrow 2} f(x)$. (1 point)

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15. Market research indicates that consumers will buy q units of a certain product when the unit price is $p = 40 - q$. The production costs are \$20 per unit and the fixed overhead costs are \$80. Find each of the following while simplifying your answers.

a) the linear cost function $C(q)$. (1 point)

$$C(q) = 20q + 80$$

b) the revenue function $R(q)$. (1.5 points)

$$R(q) = p \cdot q = (40 - q)q$$

$$R(q) = 40q - q^2$$

c) the profit function $P(q)$. (1.5 points)

$$P(q) = R(q) - C(q)$$

$$= 40q - q^2 - (20q + 80)$$

$$P(q) = -q^2 + 20q - 80$$

16. Use the short cuts for differentiation to compute the derivatives for the following functions. Be sure to simplify your answers.

a) $g(x) = \sqrt{x} - 4x^2 + 12x - 8$ (2 points)

$$g'(x) = \frac{1}{2\sqrt{x}} - 8x + 12$$

b) $k(x) = \frac{2x-3}{5x+4}$ (2 points)

Use quotient rule

$$k'(x) = \frac{(2)(5x+4) - (2x-3)(5)}{(5x+4)^2}$$

$$= \frac{10x+8-10x+15}{(5x+4)^2}$$

$$k'(x) = \frac{23}{(5x+4)^2}$$