

**MAC 2233 CALCULUS FOR BUSINESS AND SOCIAL SCIENCE  
TEST 3**

Name KEY

Score 58

**Part I - Multiple Choice.** Choose the answer that best answers each question. (3 points each)

1 Evaluate the given expression.  $\left(\frac{25}{36}\right)^{3/2}$

- A)  $\sqrt{\frac{125}{216}}$
- B)  $\frac{125}{216}$
- C)  $\frac{25}{36}$
- D)  $\sqrt{\frac{25}{36}}$

2 Solve for  $x$ :  $\log_3 x = 4$

- A)  $x = 81$
- B)  $x = 64$
- C)  $x = 1.262$
- D)  $x = 0.792$

3 Solve the given equation for  $x$ .  $8 = 7 + 3e^{9x}$

- A)  $9e^3$
  - B)  $\frac{e^3}{9}$
  - C)  $\frac{\ln 3}{9}$
  - D)  $\frac{\ln 3}{-9}$
- $e^{9x} = \frac{1}{3}$
- $9x = \ln\left(\frac{1}{3}\right) = \ln(1) - \ln(3) = -\ln(3)$
- $x = \frac{-1}{9} \ln(3)$

4 Solve for  $x$ :  $4 \ln x - \frac{1}{6} \ln x^4 = 20$

- A)  $x = e^6$
- B)  $x = e$
- C)  $x = e^{20}$
- D)  $x = e^4$

$$\ln x^4 - \ln x^{\frac{2}{3}} = 20$$

$$\ln\left(\frac{x^4}{x^{\frac{2}{3}}}\right) = 20$$

$$1 \ln(x) = \frac{20 \cdot 3}{10}$$

$$x = e^6$$

5 Find  $\frac{dy}{dx}$ , where  $y = 20 - 5e^{-0.03x}$ .

- A)  $-5e^{-0.03x}$
- B)  $0.15e^{-0.03x}$
- C)  $-0.15e^{-0.03x}$
- D)  $5e^{-0.03x}$

$$\frac{dy}{dx} = 0.15e^{-0.03x}$$

$$0 - 5e^{-0.03x}(-0.03)$$

6 The equation of the tangent line to  $f(x) = \ln x + 2$  at  $x = 1$  is

- A)  $y = x + 1$
- B)  $y = x$
- C)  $x = 1$
- D)  $y = 1$

$$y' = \frac{1}{x} \quad m = 1 \quad 2 = 1(1) + b$$

$$x = 1 \quad b = 1$$

$$y = x + 1$$

7 Evaluate  $\int (5x^3 - 9x + 2) dx$

- A)  $\frac{5x^4}{4} - \frac{9x^2}{2} + 2x + C$
- B)  $15x^2 - 9 + C$
- C)  $5x^4 - 9x^2 + 2x + C$
- D)  $\frac{5x^4}{4} - \frac{9x^2}{2} + C$

8 If  $\int_a^b f(x) dx = -7$  and  $\int_a^b g(x) dx = 3$ , find  $\int_a^b [f(x) - g(x)] dx$ .

- A) 10
- B) -21
- C) -10
- D) -4

$$\int_a^b [g(x) - f(x)] dx$$

$$3 - (-7) = 10$$

9 Specify the substitution you would choose to evaluate the integrals.

$$\int (t+4)e^{t^2+8t+1} dt$$

- A)  $u = t + 4$
- B)  $u = e^{t^2+8t+1}$
- C)  $u = t^2 + 8t + 1$
- D)  $u = (t+4)e$

10 How quickly will money triple if it is invested at 7% interest compounded continuously?

- A) 15.69 years
- B) 15.71 years
- C) 15.73 years
- D) 15.75 years

$$3 = e^{0.07t}$$

$$A = Pe^{rt}$$

$$0.07t = \ln(3)$$

11 The graph of  $x^3e^3$  has

- A) a relative maximum at  $x = 0$
- B) a relative minimum at  $x = 0$
- C) a point of inflection at  $x = 0$
- D) nothing significant at  $x = 0$

12 Evaluate  $\int_{-1}^1 x^{13} dx$

- A) 0
- B)  $\frac{1}{13}$
- C)  $\frac{1}{26}$
- D)  $-\frac{1}{26}$

$$\frac{x^{14}}{14} \Big|_{-1}^1 = \frac{1}{14} -$$

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

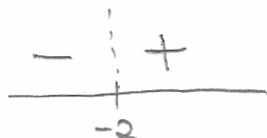
13. Find the intervals where the graph of  $y = 2xe^x$  is concave downwards. (6 points)

$$y' = 2e^x + 2xe^x$$

$$y'' = 2e^x + 2e^x + 2xe^x$$

$$y'' = 4e^x + 2xe^x = 2e^x(2+x) = 0$$

$$x = -2$$



Concave down on  $(-\infty, -2)$

14. A manufacturer estimates that the marginal cost of producing  $q$  units of a certain commodity is  $C'(q) = 3q^2 - 24q + 48$  dollars per unit. If the cost of producing 10 units is \$5000, what is the cost of producing 30 units? (6 points)

$$C(q) = q^3 - 12q^2 + 48q + C$$

$$C(10) = 10^3 - 12 \cdot 10^2 + 48 \cdot 10 + C = 5000$$

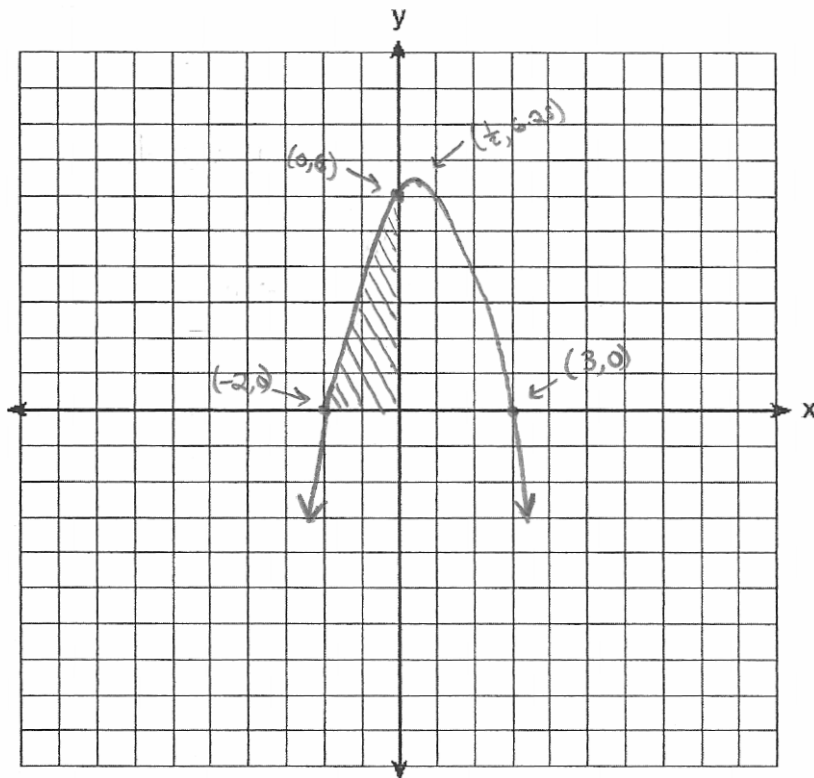
$$C = 4720$$

$$C(q) = q^3 - 12q^2 + 48q + 4720$$

$$C(30) = \$22360$$

15. On the axis below, sketch and shade the region represented by the definite integral. Be accurate with your graph by labeling the vertex and ALL intercepts on your graph. (3 points)

$$\int_{-2}^0 (-x^2 + x + 6) dx$$



Part b) Use the Fundamental Theorem of Calculus to compute the definite integral given above. You may only use your calculator to check your work. (3 points)

$$\left[ -\frac{1}{3}x^3 + \frac{1}{2}x^2 + 6x \right]_{-2}^0 = 0 - \left( -\frac{22}{3} \right) = \frac{22}{3} = 7.\bar{3}$$

16. Compute the following indefinite integral using a substitution:

$$\int \frac{x^2}{x^3+5} dx \quad (4 \text{ points})$$

$$\textcircled{1} \quad u = x^3 + 5$$

$$\textcircled{2} \quad \frac{du}{dx} = 3x^2$$

$$\textcircled{3} \quad dx = \frac{du}{3x^2}$$

$$\textcircled{4} \quad \int \frac{x^2}{x^3+5} dx = \int \frac{x^2}{u} \cdot \frac{du}{3x^2}$$

$$= \frac{1}{3} \int \frac{1}{u} du$$

$$\textcircled{5} \quad = \frac{1}{3} \ln|u| + c$$

$$\textcircled{6} \quad = \boxed{\frac{1}{3} \ln|x^3+5| + c}$$