

Sample Math 115 Midterm Exam

Spring, 2016

- The midterm examination is on **Wednesday, March 09 at 5:50PM – 7:50PM**.
 - The midterm examination will be in Budig 120. Look for your instructor who will direct you where to sit.
 - Only simple graphing calculators (TI-84 plus and below) are allowed for the common exams.
 - You can do all your work in exam booklets and circle one answer for each problem. Having done with all the problems, you will need to complete the bubble sheet with a #2 pencil. You will need to write your instructor's name on margins of the bubble sheet.
 - You are considered responsible to bring pens/pencils and a calculator to the common exams. Pens or pencils will not be provided for you, and interchanging calculators will be prohibited during the exams.
 - The common midterm will cover Chapters 2 and 3 (excluding Section 3.7).
 - The problems below, all multiple-choice with exactly one correct answer, are intended to be reasonably representative of what might appear on the actual exam, which will have **25** problems.
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1. The domain of function $f(x) = \frac{x+3}{2x^2-x-3}$ is

- (A) $(-\infty, +\infty)$ (B) $(-\infty, \frac{3}{2}) \cup (\frac{3}{2}, +\infty)$ (C) $(-\infty, -1) \cup (-1, \frac{3}{2}) \cup (\frac{3}{2}, +\infty)$
(D) $(-\infty, -1) \cup (-1, +\infty)$ (E) None of the above

2. Let $f(x) = \frac{1}{x^2}$ and $g(x) = 3x + 5$. Then, $(f \circ g)(x)$ is

- (A) $\frac{1}{(3x+5)^2}$ (B) $\frac{3}{x^2} + 5$ (C) $\frac{1}{x^2}$ (D) $3x + 5$ (E) None of the above

3. Let $f(x) = x^2 + 1$ and $g(x) = \frac{1}{\sqrt{x}}$. Then, $f(g(2))$ is

- (A) $\frac{1}{1+\sqrt{2}}$ (B) $\frac{1}{\sqrt{5}}$ (C) $\frac{2}{3}$ (D) $\frac{3}{2}$ (E) None of the above

4. Find $\lim_{x \rightarrow 3} \frac{x^2-9}{x-3}$.

- (A) 1 (B) limit does not exist (C) 6 (D) 3 (E) None of the above

5. Find $\lim_{x \rightarrow 0} \frac{\sqrt{1+x}-1}{x}$.

- (A) $\frac{1}{2}$ (B) limit does not exist (C) 0 (D) -1 (E) None of the above

6. Find $\lim_{x \rightarrow \infty} \frac{3x^2+2x+4}{2x^2-3x+1}$.

- (A) 4 (B) $\frac{3}{2}$ (C) limit does not exist (D) 0 (E) None of the above

7. Find the limit $\lim_{x \rightarrow -\infty} \frac{x^2+3}{x+1}$.

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

8. Let $f(x) = x^2 - 4x$. When simplified, the difference quotient $\frac{f(x+h)-f(x)}{h}$ becomes

- (A) $2x + h - 4$ (B) 2 (C) 0 (D) $2x - 4$ (E) None of the above

9. Let $f(x) = \frac{1}{x}$. When simplified, the difference quotient $\frac{f(x+h)-f(x)}{h}$ becomes

- (A) 1 (B) $\frac{-1}{x(x+h)}$ (C) $\frac{1}{h^2}$ (D) 0 (E) None of the above

10 Let $f(x) = \begin{cases} 2x - 4 & \text{if } x \leq 0 \\ 1 & \text{if } x > 0 \end{cases}$ Which of the following statements is true?

- (A) The limit $\lim_{x \rightarrow 0} f(x)$ exists (B) $f(x)$ is continuous at $x = 0$
(C) $f(x)$ is discontinuous at $x = 0$ (D) $f(x)$ is differentiable at $x = 0$
(E) None of the above

11. What is the profit in terms of the cost $C(x)$ to produce x units and the unit price $p(x)$ at which x units will sell?

- (A) $x(p(x) - C(x))$ (B) $p(x) - xC(x)$ (C) $p(x) + xC(x)$ (D) $xp(x) - C(x)$

- (E) None of the above

12. Given the demand equation $4x + 2p - 36 = 0$ and the supply equation $2x - p + 10 = 0$, where p is the unit price and x represents the quantity, find the equilibrium quantity and the equilibrium price.

(A) $x = 2$ and $p = 14$ (B) $x = 3$ and $p = 16$ (C) $x = 4$ and $p = 18$

(D) $x = 18$ and $p = 4$ (E) None of the above

13. It is known that $\lim_{x \rightarrow 2^+} f(x) = 3$, $\lim_{x \rightarrow 2^-} f(x) = 3$, and $f(2) = 1$. Which of the following statements is False?

(A) $f(x)$ is discontinuous at $x = 2$. (B) The graph of $f(x)$ is broken at $x = 2$.

(C) $\lim_{x \rightarrow 2} f(x)$ exists. (D) $f(x)$ is differentiable at $x = 2$.

(E) $f(x)$ is defined at $x = 2$.

14. The total weekly cost on dollars incurred by Herald Media Corp. in producing x DVDs is given by the total cost function

$$C(x) = 2500 + 2.2x, \quad 0 \leq x \leq 8000.$$

The marginal cost and the average cost function are

(A) $2500x + 2.2, \frac{2500}{x} + 2.2$ (B) $2.2, \frac{2500}{x} + 2.2x$ (C) $2.2, \frac{2500}{x} + 2.2$

(D) $2500, \frac{2500}{x^2}$ (E) None of the above

15. An equation for the line tangent to the curve $y = x^3 - 2x + 5$ at the point $(-2, 1)$ is

(A) $y + 1 = (2x^2 - 2)(x + 2)$ (B) $y - 1 = (2x^2 - 2)(x + 2)$ (C) $y = \frac{-x}{2}$

(D) $y = 5x + 11$ (E) $y = 10x + 21$

16. A ball is thrown straightly up into the air so that its height (in feet) after t seconds is given by $s(t) = -16t^2 + 64t$. The average velocity of the ball over the interval $[1, 1.05]$ is

(A) 49.56 ft/sec (B) 1.56 ft/sec (C) 31.2 ft/sec (D) 48 ft/sec

(E) None of the above

17. Assume that the distance function $s(t)$ is given as in Problem 16. The velocity of the ball at time $t = 1$ is

(A) 50 ft/sec (B) 2 ft/sec (C) 32 ft/sec (D) 48 ft/sec

(E) None of the above

18. Find an equation of the tangent line at the point $(1, 32)$ of the graph of $y = x(x+1)^5$.

(A) $y - 32 = (x + 1)^4(6x + 1)$ (B) $y + 32 = (x + 1)^4(6x + 1)$ (C) $y = 112x - 80$

(D) $y = 112x + 80$ (E) None of the above

19. For $f(x) = \sqrt{2 + \sqrt{x}}$, evaluate $f'(4)$.

(A) $\frac{1}{64}$ (B) $\frac{1}{16}$ (C) $\frac{1}{4}$ (D) $\frac{1}{2}$ (E) None of the above

20. An equation for the line tangent to the curve $y = (x^2 + x + 1)(x^3 - 2x + 2)$ at the point $(1, 3)$ is

(A) $y = 2x + 1$ (B) $y = 3x$ (C) $y = 6x - 3$ (D) $y = 7x - 4$

(E) None of the above

21. Let $y = \sqrt{u}$ and $u = 7x - 2x^2$. Find $\frac{dy}{dx}$.

(A) $\frac{1}{2}(7 - 4x)(7x - 2x^2)^{1/2}$ (B) $\frac{1}{2}(7 - 4x)(7x - 2x^2)^{-1/2}$ (C) $\frac{1}{2}(7 - 4x)$

(D) $\frac{1}{2}(7x - 2x^2)^{-1/2}$ (E) None of the above

22. Suppose that $F(x) = f(x^2 + 1)$ and $f'(2) = 3$. Find $F'(1)$.

(A) 3 (B) 4 (C) 5 (D) 6 (E) None of the above

23. Suppose $h = f \circ g$. Find $h'(0)$ given that $f(0) = 6$, $f'(5) = -2$, $g(0) = 5$, and $g'(0) = 3$.

(A) -6 (B) 18 (C) -10 (D) 6 (E) None of the above

24. What is the marginal profit in terms of the cost $C(x)$ to produce x units and the unit price $p(x)$ at which x units will sell?

- (A) $p'(x) - C'(x)$ (B) $p'(x) + xp(x) - C'(x)$ (C) $x(p(x) - C'(x))$
(D) $p(x) + xp'(x) - C'(x)$ (E) None of the above

25. Find $\frac{dy}{dx}$ in terms of x and y when x and y are related by the equation $x^2y - y^3 = 2$.

- (A) $\frac{xy}{3y^2 + x^2}$ (B) $\frac{x}{x - 3y}$ (C) $\frac{2xy}{3y^2 - x^2}$ (D) $\frac{x^2 + y^2}{2x + y}$
(E) None of the above

26. Find $\frac{dy}{dx}$ at point $(2, \sqrt{5})$ when x and y are related by the equation $2x^2 - y^2 = 3$.

- (A) $\frac{4}{\sqrt{5}}$ (B) $\frac{2\sqrt{5}}{5}$ (C) $\sqrt{5}$ (D) 2 (E) None of the above

27. Find $\frac{dy}{dx}$ in terms of x and y when x and y are related by the equation $x^2 + y^2 + 2x^2y^2 = 10$.

- (A) $-\frac{x(1 + 2y^2)}{y(1 + 2x^2)}$ (B) $-\frac{y(1 + 2x^2)}{x(1 + 2y^2)}$ (C) $-\frac{x(1 + 2x^2)}{y(1 + 2y^2)}$
(D) $-\frac{x}{y}$ (E) None of the above

28. The second derivative of function $f(x) = (x^2 + 1)^5$ is

- (A) $20(x^2 + 1)^3$ (B) $10x(x^2 + 1)^4$ (C) $10(x^2 + 1)^3(9x^2 + 1)$
(D) $10(x^2 + 1)^3(7x^2 + 4)$ (E) None of the above

29. The third derivative of $f(x) = \frac{1}{x}$ is

- (A) $-\frac{1}{x^2}$ (B) $-\frac{2}{x^3}$ (C) $\frac{2}{x^3}$ (D) $-\frac{6}{x^4}$
(E) None of the above

30. The distance s (in feet) covered by a car t seconds after starting from rest is given by $s = -t^3 + 8t^2 + 20t$. Find the car's acceleration at time t .

- (A) $-t^3 + 8t^2 + 20t$ (B) $-3t^2 + 16t + 20$ (C) $-6t + 16$ (D) $-6t + 36$
(E) None of the above