

MATH 110
EXAMINATION I
FEBRUARY 25, 2003

NAME _____
STUDENT NUMBER _____
INSTRUCTOR _____
SECTION NUMBER _____

The examination consists of **20** multiple choice questions, each worth 5 points. For each problem, please fill in the bubble on the scantron sheet and circle the correct answer on your examination.

**THE USE OF CALCULATORS IS NOT PERMITTED
IN THIS EXAMINATION.**

CHECK THE EXAMINATION BOOKLET BEFORE
YOU START. THERE SHOULD BE **20** PROBLEMS
ON **11** PAGES (INCLUDING THIS ONE).

1. If $f(x) = \frac{1}{x}$ and $g(x) = \sqrt{x+1}$, determine the values of $f \circ g(3)$ and $g \circ f(3)$.

a) $f \circ g(3) = \frac{2}{\sqrt{3}}$ and $g \circ f(3) = 2$

b) $f \circ g(3) = \frac{1}{2}$ and $g \circ f(3) = \frac{2}{\sqrt{3}}$

c) $f \circ g(3) = 2$ and $g \circ f(3) = \frac{1}{\sqrt{3}}$

d) $f \circ g(3) = \frac{1}{2}$ and $g \circ f(3) = \frac{1}{2}$

2. What is the domain of the function $f(x) = \frac{x}{\sqrt{4-x^2}}$?

a) $x < -2$ or $x > 2$

b) $-2 < x < 2$ and $x \neq 0$

c) $-2 < x < 2$

d) $-2 \leq x \leq 2$

3. If $f(x) = \frac{1}{x+1}$, then the expression $\frac{f(1+h) - f(1)}{h}$ can be simplified to

a) $\frac{-1}{4+2h}$

b) $\frac{h}{h+1}$

c) $\frac{-1}{2h+1}$

d) $\frac{1}{4}$

4. The demand and supply functions for a certain commodity are

$$p = d(x) = -x^2 - 10x + 110,$$

$$p = s(x) = 5x + 10.$$

Find is the equilibrium production level \bar{x} and the equilibrium price \bar{p} .

a) $\bar{x} = 10$ and $\bar{p} = 60$

b) $\bar{x} = 5$ and $\bar{p} = 15$

c) $\bar{x} = 12$ and $\bar{p} = 70$

d) $\bar{x} = 5$ and $\bar{p} = 35$

5. Find $A = \lim_{x \rightarrow 1} \frac{x+2}{x(x-3)}$ and $B = \lim_{x \rightarrow 1} \frac{x^2 - 3x + 2}{x^2 + x - 2}$.

a) $A = \frac{3}{2}$ and B does not exist.

b) $A = -\frac{3}{2}$ and $B = 3$

c) $A = -\frac{3}{2}$ and $B = -\frac{1}{3}$

d) Neither A nor B exists.

6. Find $A = \lim_{x \rightarrow 3^+} \frac{x(x+1)}{3-x}$ and $B = \lim_{x \rightarrow \infty} \frac{(x^2+2)(3x^2-5)}{x^4+6}$.

a) $A = -\infty$ and $B = -\frac{5}{3}$

b) $A = 0$ and $B = 0$

c) $A = \infty$ and $B = \infty$

d) $A = -\infty$ and $B = 3$

7. An airport shuttle service carries 1200 passengers per day. The current fare is \$15. It estimates that increasing the fare by x dollars will result in the loss of $(50x)$ passengers per day. Find the resulting total daily revenue as a function of x .

a) $R = 15(1200 - 50x + x^2)$

b) $R = (15 + x)(1200 - 50x)$

c) $R = (50 + x)(1200 - 15x)$

d) $R = (15 - x)(1200 + 50x)$

8. Find all discontinuities of the function

$$f(x) = \begin{cases} x^2 + 2 & \text{if } -\infty < x < 1 \\ 2x + 1 & \text{if } 1 \leq x \leq 3 \\ \frac{1}{x - 3} & \text{if } 3 < x < \infty \end{cases}$$

a) f has no discontinuities.

b) f is discontinuous at $x = 1$ and at $x = 3$.

c) f is discontinuous only at $x = 1$.

d) f is discontinuous only at $x = 3$.

9. Let

$$f(x) = \frac{2x^3 + x^2 + 2x + 1}{2x - 1}.$$

Compute $f(-1)$, $f(0)$, and $f(1)$. Which one of the following statements is true?

- a) The Intermediate Value Theorem implies that $f(x) = 0$ has a solution in $[-1, 0]$.
- b) The Intermediate Value Theorem implies that $f(x) = 0$ has a solution in $[0, 1]$.
- c) The Intermediate Value Theorem implies that $f(x) = 0$ has two solutions in $[-1, 1]$.
- d) The Intermediate Value Theorem does not apply since f is not continuous at $x = \frac{1}{2}$.

10. If $f(2) = 3$ and $f'(2) = -1$, what is the equation of the line tangent to the graph of $y = f(x)$ at the point where $x = 2$?

- a) $y = 5 - x$
- b) $y = 3 - x$
- c) $y = 3x - 1$
- d) $y = x + 1$

11. Find $\frac{d}{dx}(3x^4 - 5x^{\frac{2}{3}})$.

a) $12x^3 - \frac{10}{3x^{\frac{1}{3}}}$

b) $12x^3 - \frac{10}{3}x^{\frac{1}{3}}$

c) $4x^3 - 10x^{\frac{2}{3}}$

d) $\frac{3}{5}x^5 - 3x^{\frac{5}{3}}$

12. Find $\frac{d}{dx}(\sqrt{x} + 1)^5$.

a) $5\left(\frac{1}{2\sqrt{x}}\right)^4$

b) $5(\sqrt{x} + 1)^4$

c) $\frac{5(\sqrt{x} + 1)^4}{2\sqrt{x}}$

d) $5(\sqrt{x} + 1)^4\sqrt{x}$

13. If $f(x) = (4x + 3)^{\frac{1}{3}}$, find $f'(6)$.

a) $\frac{4}{27}$

b) $\frac{2}{9}$

c) $-\frac{1}{3}$

d) $\frac{5}{81}$

14. Find $f'(x)$ if $f(x) = \frac{3x}{x^2 - 2}$.

a) $\frac{3}{2x}$

b) $\frac{3x^2 + 2}{(x^2 - 2)^2}$

c) $\frac{-3x^2 - 6}{(x^2 - 2)^2}$

d) $\frac{x^2 - 6}{x^2 - 2}$

15. Find $\frac{d}{dt} [(t^2 + 1)\sqrt{t + 5}]$.

a) $2t\sqrt{t + 5} + (t^2 + 1)$

b) $\frac{t}{\sqrt{t + 5}}$

c) $\frac{t^2 + 1}{\sqrt{t + 5}}$

d) $2t\sqrt{t + 5} + \frac{t^2 + 1}{2\sqrt{t + 5}}$

16. Find $\frac{dy}{dx}$ if $y = \left(\frac{x - 1}{x + 1}\right)^{\frac{4}{3}}$.

a) $\frac{8}{3} \left(\frac{x - 1}{x + 1}\right)^{\frac{1}{3}} \frac{1}{(x + 1)^2}$

b) $\frac{4}{3} \left(\frac{x - 1}{x + 1}\right)^{\frac{1}{3}}$

c) $\frac{4}{3} \left(\frac{x - 1}{x + 1}\right)^{-\frac{1}{3}} \frac{2x - 1}{(x + 1)^2}$

d) $\frac{4}{3} \left(\frac{x - 1}{x + 1}\right)^{\frac{1}{3}} \frac{2x + 3}{(x + 1)^2}$

17. Find the second derivative y'' if $y = x^{\frac{2}{3}}$.

a) $\frac{2}{9}x^{\frac{1}{6}}$

b) $-\frac{2}{3x^{\frac{2}{3}}}$

c) $\frac{1}{6x^{\frac{4}{3}}}$

d) $-\frac{2}{9x^{\frac{4}{3}}}$

18. Find $\frac{d^2}{dx^2} \left(\frac{2x-1}{x+1} \right)$.

a) $\frac{2x+1}{(x+1)^4}$

b) $-\frac{6}{(x+1)^3}$

c) $\frac{3x}{(x+1)^3}$

d) $-\frac{2x-1}{(x+1)^4}$

19. A bug, crawling on a wire, is

$$s(t) = 12t^2 - t^3$$

inches along the wire after t minutes ($0 \leq t \leq 8$). What is its acceleration when $t = 2$?

- a) 6 in/min²
- b) -10 in/min²
- c) -36 in/min²
- d) 12 in/min²

20. The demand function for a certain commodity is

$$p = -x^2 - 10x + 110,$$

where x is the number of units sold, and p is the price for each unit. Find the marginal revenue function.

- a) $R'(x) = -2x - 10$
- b) $R'(x) = -3x^2 - 20x + 110$
- c) $R'(x) = -2x^2 - 10x$
- d) $R'(x) = -x - 10 + \frac{110}{x}$

21. KEY: 1-b, 2-c, 3-a, 4-d, 5-c, 6-d, 7-b, 8-d, 9-a, 10-a, 11-a, 12-c, 13-a, 14-c, 15-d, 16-a, 17-d, 18-b, 19-d, 20-b.