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

$$p = d(x) = -x^2 - 10x + 110, \quad p = s(x) = 5x + 10.$$  

Find is the equilibrium production level $\bar{x}$ and the equilibrion 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 $A = \lim_{x \to 1} \frac{x + 2}{x(x - 3)}$ and $B = \lim_{x \to 1} \frac{x^2 - 3x + 2}{x^2 + x - 2}$.

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

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) \( \frac{3}{5}x^5 - 3x^{\frac{2}{3}} \) 

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 \( \frac{d}{dt} \left[ (t^2 + 1)\sqrt{t+5} \right]. \)

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) \( \frac{8}{3} \left( \frac{x-1}{x+1} \right)^{-\frac{1}{3}} \cdot \frac{1}{(x+1)^2} \)
b) \( \frac{4}{3} \left( \frac{x-1}{x+1} \right)^{\frac{1}{3}} \)
c) \( \frac{4}{3} \left( \frac{x-1}{x+1} \right)^{-\frac{4}{3}} \cdot \frac{2x-1}{(x+1)^2} \)
d) \( \frac{4}{3} \left( \frac{x-1}{x+1} \right)^{\frac{1}{3}} \cdot \frac{2x+3}{(x+1)^2} \)
17. Find the second derivative $y''$ if $y = x^\frac{2}{3}$.

a) $\frac{2}{9} x^{\frac{1}{3}}$

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

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/min\(^2\)
b) -10 in/min\(^2\)
c) -36 in/min\(^2\)
d) 12 in/min\(^2\)

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.