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. What is the domain of the function \( f(x) = \frac{\sqrt{x-1}}{x-2} \)?

   a) \( x \neq 1 \), and \( x \neq 2 \)
   b) \( 1 < x < 2 \)
   c) \( 1 \leq x \), and \( x \neq 2 \)
   d) \( 2 \leq x \)

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

\[
\begin{align*}
p &= s(x) = x^2 + 4x + 10, \\
p &= d(x) = 60 - x.
\end{align*}
\]

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

   a) \( \bar{x} = 5 \) and \( \bar{p} = 55 \)
   b) \( \bar{x} = 10 \) and \( \bar{p} = 50 \)
   c) \( \bar{x} = 5 \) and \( \bar{p} = 50 \)
   d) \( \bar{x} = 8 \) and \( \bar{p} = 52 \)
3. A rectangular garden is to have area 1,000 sq.ft. For the front side, fence costing $3 per foot will be used. For the other three sides, fence costing $2 per foot will be used. Let \( x \) denote the length of the front side, and express the total cost \( C(x) \) as a function of \( x \).

a) \( C(x) = 6x + \frac{2000}{x} \)

b) \( C(x) = 5x + \frac{4000}{x} \)

c) \( C(x) = 5x^2 - 4000x \)

d) \( C(x) = \frac{5x + 2000}{x} \)

4. If \( f(x) = \frac{1}{x - 1} \) and \( g(x) = \sqrt{x^2 + 9} \), determine the value of \( f \circ g(4) \).

a) \( f \circ g(4) = \frac{1}{2} \)

b) \( f \circ g(4) = \frac{1}{4} \)

c) \( f \circ g(4) = 4 \)

d) \( f \circ g(4) = \frac{\sqrt{82}}{3} \)
5. Find $A = \lim_{x \to 2} \frac{x - 2}{x^2 + 1}$ and $B = \lim_{x \to 2} \frac{x - 2}{x^2 + x - 6}$.

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

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

c) $A = 0$ and $B = \frac{1}{5}$

d) Neither $A$ nor $B$ exists.

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

a) $A = 0$ and $B = 2$

b) $A = 0$ and $B = \frac{1}{2}$

c) $A$ does not exist, and $B = \frac{1}{2}$

d) Neither $A$ nor $B$ exists.
7. Find all discontinuities of the function

\[ f(x) = \begin{cases} 
  x^2 - 1 & \text{if } x \leq 0 \\
  \frac{1}{x - 1} & \text{if } x > 0 \text{ and } x \neq 1 \\
  1 & \text{if } x = 1 
\end{cases} \]

\( a) \) \text{ } f \text{ } \text{has no discontinuities.} \\
\( b) \) \text{ } f \text{ } \text{is discontinuous at } x = 0 \text{ and at } x = 1. \\
\( c) \) \text{ } f \text{ } \text{is discontinuous only at } x = 0. \\
\( d) \) \text{ } f \text{ } \text{is discontinuous only at } x = 1.

8. Find \( \frac{d}{dx}(2x^3 - 5\sqrt{x}) \).

\( a) \) \text{ } 6x^2 - \frac{5}{2\sqrt{x}} \\
\( b) \) \text{ } 3x^2 - \frac{5}{2\sqrt{x}} \\
\( c) \) \text{ } 6x^2 - \frac{10}{\sqrt{x}} \\
\( d) \) \text{ } 5x^2 - \frac{1}{2\sqrt{x}}
9. Find $\frac{d}{dx}(x^3 + 8)^{\frac{1}{3}}$.

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

b) $\frac{x^2}{(x^3 + 8)^{\frac{2}{3}}}$

c) $-\frac{2}{3(x^3 + 8)^{\frac{1}{3}}}$

d) $\frac{1}{3}(3x^2)^{\frac{1}{3}}$

10. If $g(t) = \frac{t}{t+1}$, find $g'(2)$.

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

b) $\frac{2}{3}$

c) $\frac{1}{9}$

d) $-\frac{2}{9}$
11. Find and simplify \( \frac{d}{dt} \left[ t^2(t^3 + 5)^{10} \right] \).

a) \(2t(3t^2)^{10}\)

b) \(20t(t^3 + 5)^9\)

c) \((t^3 + 5)^9(4t^4 + 6t)\)

d) \((t^3 + 5)^9(32t^4 + 10t)\)

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

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

b) \(\frac{3x^2}{(x+1)^4}\)

c) \(\frac{3x^2}{x+1}\)

d) \(\frac{3}{(x+1)^2}\)
13. The revenue and cost for producing and selling $x$ items are
\[
\begin{align*}
R(x) &= -0.04x^2 + 800x, \\
C(x) &= 200x + 300,000.
\end{align*}
\]
Find the marginal profit function.

a) $P'(x) = 600 - 0.08x$

b) $P'(x) = 300,000 - 0.16x$

c) $P'(x) = 0.04x - 400$

d) $P'(x) = -0.04x^2 + 600x + 300,000$

14. If $f(x) = \sqrt{x + 1}$, what is the value of
\[
\lim_{h \to 0} \frac{f(3 + h) - f(3)}{h}?
\]

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

b) $\frac{1}{2}$

c) $2$

d) The limit does not exist.
15. Find the equation of the line tangent to the graph of

\[ f(x) = 1 + \sqrt{x} \]

at the point (4, 3).

a) \( y = 4x - 13 \)

b) \( y = 2x - 5 \)

c) \( y = \frac{1}{2}x - 1 \)

d) \( y = \frac{1}{4}x + 2 \)

16. If \( y = \frac{16}{t^3} \), find the instantaneous rate of change of \( y \) per unit change of \( t \) when \( t = 2 \).

a) 3

b) −4

c) 4

d) −3
17. Find the second derivative $y''$ if $y = x^3 + \sqrt{x}$.

   a) $y'' = 3x^2 + \frac{1}{2\sqrt{x}}$

   b) $y'' = 6x - \frac{1}{4x^{\frac{3}{2}}}$

   c) $y'' = 6x + \frac{4}{\sqrt{x}}$

   d) $y'' = 3x^2 - \frac{1}{4x^{\frac{3}{2}}}$

18. Find $\frac{d^3}{dx^3} \left( x^{\frac{1}{3}} \right)$.

   a) $\frac{10}{27x^{\frac{5}{3}}}$

   b) $\frac{28x^{\frac{10}{3}}}{27}$

   c) $-\frac{2}{px^{\frac{5}{3}}}$

   d) $\frac{2}{27x^{\frac{4}{3}}}$
19. If \( s \) and \( t \) are related by the equation

\[
s^3t^3 - st = 6,
\]

find \( \frac{ds}{dt} \) when \( t = 2 \) and \( s = 1 \).

a) \( \frac{ds}{dt} = -\frac{1}{2} \)

b) \( \frac{ds}{dt} = \frac{11}{2} \)

c) \( \frac{ds}{dt} = -\frac{5}{11} \)

d) \( \frac{ds}{dt} = \frac{1}{4} \)

20. Suppose \( x = f(p) \) gives the number of units of some commodity that can be sold at unit price \( p \). If \( f(100) = 5,000 \) and \( f'(100) = -25 \), what is the elasticity of demand \( E(100) \) at \( p = 100 \)?

a) \( E(100) = 2 \)

b) \( E(100) = \frac{2}{5} \)

c) \( E(100) = \frac{1}{2} \)

d) \( E(100) = \frac{5}{2} \)
21. Key: 1-c, 2-a, 3-b, 4-b, 5-c, 6-c, 7-d, 8-a, 9-b, 10-c, 11-d, 12-b, 13-a, 14-a, 15-d, 16-d, 17-b, 18-a, 19-a, 20-c.