

Calculus: Limits, Continuity & Derivative Rules



Name: _____ Date: _____

Part A: Calculus Computation. Evaluate each limit and derivative problem. Choose the correct mathematical result.

1. Evaluate the limit analytically: $\lim_{x \rightarrow 3} [(x^2 - 9) / (x - 3)]$

- A. 0
- B. Undefined (Division by zero)
- C. 6
- D. 3

2. Find the derivative $f'(x)$ of the cubic polynomial function: $f(x) = 4x^3 - 5x^2 + 7x - 12$

- A. $f'(x) = 12x^2 - 10x + 7$
- B. $f'(x) = 12x^3 - 10x^2 + 7x$
- C. $f'(x) = 4x^2 - 5x + 7$
- D. $f'(x) = x^4 - x^3 + 7$

3. What is the slope of the tangent line to the curve $y = x^2$ at the specific point where $x = 4$?

- A. $m = 16$
- B. $m = 8$
- C. $m = 4$
- D. $m = 2$

4. A particle moves along a horizontal line with position $s(t) = 2t^3 - 6t^2 + 10t$ meters. What is its instantaneous velocity $v(t) = s'(t)$ at $t = 2$ seconds?

- A. $v(2) = 10$ m/s
- B. $v(2) = 14$ m/s
- C. $v(2) = 6$ m/s
- D. $v(2) = 0$ m/s (at rest)

Part B: Power Rule Differentiation Fluency. Complete each derivative calculation with the correct leading coefficient or power.

Word bank: 20, 0, 1, 12, 6

1. For $f(x) = 5x^4$, the power rule gives $f'(x) = 5 \cdot 4x^3 = \underline{\hspace{2cm}}x^3$.
2. The derivative of any constant value c (e.g., $d/dx [42]$) is identically equal to $\underline{\hspace{2cm}}$ because a horizontal line has zero rate of change.
3. For the linear function $f(x) = x$, the derivative is $d/dx [x^1] = 1 \cdot x^0 = \underline{\hspace{2cm}}$.
4. If $f(x) = 3x^2$, then $f'(2) = 6(2) = \underline{\hspace{2cm}}$ represents the instantaneous slope at $x = 2$.