

Puzzles on Limits and Differentiation with Business Applications

1. Identify constants and variables in the function $C(x) = 500 + 20x + 3x^2$. Explain their business meaning.
2. If $f(x) = (x^2 - 4)/(x - 2)$, evaluate the limit as x approaches 2.
3. Evaluate: $\lim_{x \rightarrow 3} (x^3 - 27)/(x - 3)$.
4. If cost function $C(x) = 100 + 5x + 2x^2$, find the marginal cost function.
5. Given revenue function $R(x) = 50x - 2x^2$, find first and second derivatives.
6. If profit function $P(x) = 120x - 3x^2 - 200$, determine the output level for maximum profit.
7. Find maxima or minima of the function $f(x) = x^3 - 6x^2 + 9x + 1$.
8. A demand function is $p = 80 - 4x$. Find total revenue and determine the output for maximum revenue.
9. If total cost $C(x) = 200 + 10x + x^2$, find average cost and marginal cost.
10. Evaluate $\lim_{x \rightarrow 0} (\sin x)/x$ (conceptual understanding).
11. If $C(x) = 300 + 12x - x^2$, find marginal cost and determine whether cost is increasing or decreasing at $x = 5$.
12. Given $R(x) = 100x - 5x^2$, find the level of output where marginal revenue becomes zero.
13. For the function $P(x) = -2x^3 + 15x^2 - 24x + 10$, find critical points using first derivative.
14. If demand function is $p = 60 - x^2$, find revenue and determine whether revenue has maximum value.
15. The average cost function is $AC = 50/x + 4 + x$. Find total cost function.
16. If $f(x) = 3x^4 - 8x^3 + 6x^2$, find first and second derivatives.
17. A company's profit is $P(x) = 200x - 4x^2 - 500$. Find maximum profit.
18. Evaluate limit: $\lim_{x \rightarrow 1} (x^2 - 1)/(x - 1)$.
19. If total revenue $R(x) = px$ where $p = 100 - 2x$, find $R(x)$ and determine maximum revenue.
20. Using second derivative test, verify whether $x = 2$ is maxima or minima for $f(x) = x^3 - 3x^2 + 2$.