This exam is closed book. No graphing calculators or cell phones are allowed. No bathroom breaks are permitted while taking the exam. Good luck!

1 Multiple Choice **(2 points each)**

(1) Find the limit if it exists: $\lim_{x\to 2} \dfrac{x^2+6x-16}{x^2-2x}$

(A) indeterminate form (B) 0 (C) 10 (D) 5

(2) Fill in the blanks: A derivative represents the _____ of _____ on _____.

(A) marginal effect, dy, dx (C) marginal effect, dx, dy
(B) average effect, dy, dx (D) average effect, dx, dy

(3) Suppose that the value V of a car depreciates with time t (measured in months) at the rate $V(t) = 7.5 + e^{-0.10t}$. Find $\lim_{t\to\infty} V(t)$.

(A) 0 (B) 5 (C) 7.5 (D) 10

For questions (4)–(8), assume a firm faces the total cost function $C(x) = 5\sqrt{x}$ and total profit function $P(x) = -3x^2 + 9x + 9$.

(4) Find the average cost between $x = 5$ and $x = 20$ units of output.

(A) $\frac{1}{4}$ (B) $\frac{\sqrt{5}}{15}$ (C) $\frac{1}{3}$ (D) $\frac{\sqrt{5}}{3}$

(5) Find the marginal cost at $x = 5$ units of output.

(A) $\frac{5}{2\sqrt{5}}$ (B) $\frac{1}{2\sqrt{5}}$ (C)$5\sqrt{5}$ (D) $\frac{5}{\sqrt{5}}$

(6) At what output level is profit maximized?

(A) $x = \frac{3}{2}$ (B) $x = 1, -1$ (C) $x = \sqrt{3}$ (D) $x = 1$

(7) Suppose the firm in question increases production, from $x = 2$ to $x = 3$. What is the marginal profit of producing the 3^{nd} unit?

(A) -\$9 (B) \$0 (C) -\$3 (D) \$3

(8) Given $C(x)$ and $P(x)$ above, choose a feasible total revenue function $R(x)$:

(A) $x^2+5\sqrt{x}$ (B) $p(x)*x$ (C) $-3x^2+9x+5\sqrt{x}$ (D) $-3x^2+9x+5\sqrt{x}+9$

(9) Find the derivative of $g(x) = -8x^4 + \frac{3}{x^3} - \frac{9}{\sqrt{x^5}} + 10x$.

(A) $g'(x) = -32x^3 - 9x^{-4} + \frac{45}{4}x^{\frac{-9}{4}}$ (B) $g'(x) = -32x^3 - 9x^{-4} + \frac{45}{2}x^{\frac{-7}{2}} + 10$

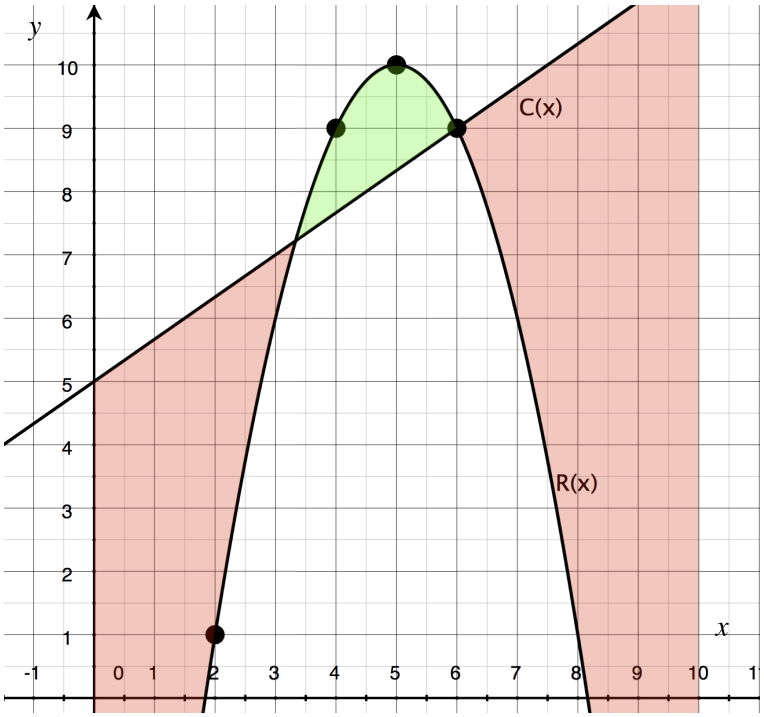
(C) $g'(x) = -32x^3 - 9x^{-4} + \frac{18}{5}x^{\frac{-7}{2}}$ (D) $g'(x) = -32x^3 - 9x^{-2} + \frac{45}{2}x^{-3} + 10$

(10) Find the derivative of $u(x) = \frac{1}{x+1}$.

(A) $u'(x) = \frac{-1}{x+1}$ (B) $u'(x) = \frac{-1}{x^2+1}$ (C) $u'(x) = \frac{-1}{x^2+2x+1}$ (D) $u'(x) = \frac{1}{(x+1)^2}$

2 Short Answer **(3 points each)**

Remember: number problems clearly, show all of your work, and circle your final answer.



(11) Refer to the graph above.

(a) Write an equation describing the *linear* total cost function $C(x)$.

(b) Write a *quadratic* equation describing the total revenue function $R(x)$.

(HINT: $f(x) = mx + b$ and $f(x) = a(x - h)^2 + k$, where (h, k) represents a parabola's vertex.)

(12) Find the firm's *break-even* points, given the cost and revenue curves above.

(HINT: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.)

(13) Solve the following:

(a) Find the firm's marginal revenue function, $R'(x)$.

(b) Show that marginal revenue is zero ($R'(x) = 0$) when revenue is maximized.

(14) Find the firm's profit function, $P(x)$, and then find *what* maximum profit is at the point where $P'(x) = 0$.