1) The management of Arconic plans to market the Electro Star, an electronic speaker system. The marketing department has determined that the demand function for the speaker is \( p = -0.04x + 800 \) \((0 \leq x \leq 20000)\)
where \( p \) denotes the speaker's unit price (in dollars) and \( x \) denotes the quantity demanded.

a) Find the revenue function \( R \).

b) Find the marginal revenue function \( R' \).

c) What is the marginal revenue for selling the 5000th speaker?

2) The weekly demand for the Pulstar 25 color LED television is \( p = 600 - 0.05x \) \((0 \leq x \leq 12000)\) where \( p \) denotes the wholesale unit price in dollars and \( x \) denotes the quantity demanded. The weekly total cost function associated with manufacturing the Pulstar 25 is given by \( c(x) = 0.000002x^3 - 0.03x^2 + 400x + 80000 \) where \( c(x) \) denotes the total cost in producing \( x \) sets.

a) Find the revenue function \( R \), and profit function \( P \).

b) Find the marginal cost, marginal revenue, and marginal profit function.

c) Find the marginal revenue, and marginal profit associated with producing the 2000th set.
3) The quantity demanded each week $x$ (in hundreds) of miraDo digital camera is related to the unit price $P$ (in dollars) by the demand equation $x = \sqrt{400 - 5p}$ ($0 \leq p \leq 80$)

a) Is the demand elastic or inelastic when $p = 60$?

b) When is the demand unitary?

4) Take the first, second, and third derivative of the function $f(x) = e^{x^2}$

1) $R(x) = px = (-0.04x + 800)x = -0.04x^2 + 800x$
   $R'(x) = -0.08x + 800$
   $R'(5000) = -0.08(5000) + 800 = 400$

2) $R(x) = px - c(x) = 600x - 0.05x^2 - 0.0000002x^3 + 0.003x^2 - 100x - 80000$
   $P(x) = -0.0000002x^3 - 0.02x^2 + 200x - 80000$

b) marginal cost: $C'(x) = 0.0000006x^2 + 0.06x + 400$

b) marginal revenue: $R'(x) = -0.1x + 600$

b) marginal profit: $P'(x) = -0.0000006x^2 - 0.04x + 200$

b) marginal revenue: $R'(2000) = -0.1(2000) + 600 = 400$

b) marginal profit: $P'(2000) = -0.0000006(2000)^2 - 0.04(2000) + 200 = 96$

b) marginal cost: $C'(2000) = 0.0000006(2000)^2 + 0.06(2000) + 400 = 544$
3) \( E(p) = \frac{-p + (p)}{f(p)} \quad x = \sqrt{400-5p} \)
   \( x = f(p) \quad x' = \frac{1}{2} (400 - 5p)^{-\frac{1}{2}} \cdot -5 = \frac{-5}{2 \sqrt{400-5p}} \)
   \( E(40) = -40 \left( \frac{-5}{2 \sqrt{400-5(40)}} \right) = \frac{100}{\sqrt{400}} = \frac{100}{200} = \frac{1}{2} \) [Inelastic]

   \( E(60) = -60 \left( \frac{-5}{2 \sqrt{400-5(60)}} \right) = \frac{150}{\sqrt{400}} = \frac{150}{100} = \frac{150}{100} = \) [Elastic]

\[ L = \frac{-p}{\sqrt{400-5p}} = \frac{5p}{2\sqrt{400-5p}} = \frac{5p}{2(400-5p)} = \frac{5p}{800-10p} = \frac{5p}{800-10p} \]

\[ p = 800/15 \]

4) \( f(x) = e^{x^2} \)
   \( f'(x) = 2xe^{x^2} \)
   \( f''(x) = 2e^{x^2} + 4xe^{x^2} = e^{x^2}(2 + 4x^2) \)
   \( f'''(x) = 4xe^{x^2} + 8xe^{x^2} + 8x^3e^{x^2} = 12xe^{x^2} + 8x^3e^{x^2} = 4xe^{x^2} + 2x^3 \)

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5) A car leaves an intersection traveling west. Its position 4 sec later is 20 ft from the intersection. At the same time, another car leaves heading north so that its position 4 sec later is 28 ft from the intersection. If the speed of the cars at that instant of time are 9 ft/sec and 11 ft/sec respectively. Find the rate at which the distance between the two cars is changing.

6) A manufacturer of tennis rackets finds that the total cost \( c(x) \) (in dollars) of manufacturing \( x \) rackets/day is given by \( c(x) = 400 + 4x + 0.001x^2 \).

Each racket can be sold at the price of \( P \) dollars where \( P \) is related to \( x \) by the equation

\[ P = 10 - 0.004x \]

If all the rackets that are manufactured can be sold, find the daily level of production that will yield the maximum profit for the manufacturer.

5) \[
\begin{align*}
\text{Intersection} & \quad \frac{dx}{dt} = 9 \quad \frac{dy}{dt} = 11 \\
\text{Intersection} & \quad 20^2 + 28^2 = c^2 \\
\text{Intersection} & \quad c = 34.41 \text{ ft} \\
\text{Intersection} & \quad 2x \cdot x' + 2y \cdot y' = 22 \cdot 21 \\
\text{Intersection} & \quad 2(20)(x') + 2(28)(1) = 2(34.41) \times 21 \\
\text{Intersection} & \quad 360 + 616 = 68.82 \text{ ft} \\
\text{Intersection} & \quad 976 = 68.82 \text{ ft} \\
\text{Intersection} & \quad 14.18 = 21 \\
\end{align*}
\]
(6) \( P(x) = R(x) - C(x) \)

\[ P(x) = 10x - 0.0001x^2 - 400 - 4x - 0.0001x^2 \]

\[ P(x) = 0.00005x^2 + 6x - 400 \]

\[ P'(x) = -0.0001x + 6 \]

\[-0.0001x = -6 \]

\[ x = \frac{6}{0.0001} = 60000 \]

\[ x = 6000 \text{ rockets} \]