

$$1. (a) f(x) = 7x^2 - 4x + 6$$

$$f'(x) = 14x - 4$$

$$f'(2) = 14(2) - 4 = 24$$

$$f'(x) = 14x - 4 = 0$$

$$14x = 4$$

$$x = \frac{2}{7}$$

$$(b) f(x) = 3xe^{2x}$$

$$f'(x) = 3e^{2x} + 6xe^{2x}$$

$$f'(2) = 3e^{2(2)} + 6(2)e^{2(2)} = 15e^4$$

$$f'(x) = 3e^{2x} + 6xe^{2x} = 0$$

$$6xe^{2x} = -3e^{2x}$$

$$x = \frac{-3e^{2x}}{6e^{2x}} = -\frac{1}{2}$$

$$2. C(x) = 1 + 2\sqrt{x}$$

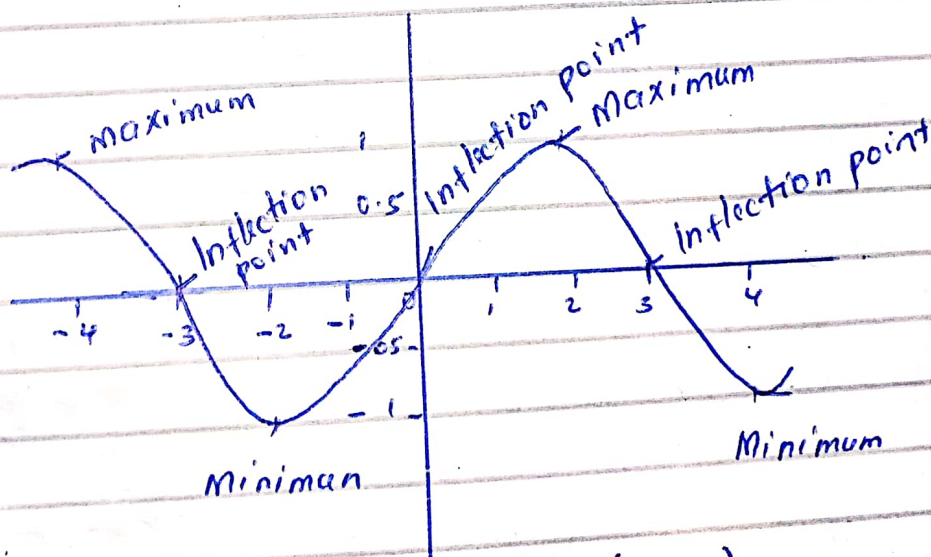
$$MC = C'(x) = 2\left(\frac{1}{2}\right)x^{-1/2} = \frac{1}{\sqrt{x}}$$

$$C'(15) = \frac{1}{\sqrt{15}} = \$0.258$$

He should make more magnets

3.

(a)



$$(b) \text{Increasing} = (-\infty, -4) \cup (-2, 2) \cup (4, \infty)$$

$$\text{Decreasing} = (-4, -2) \cup (2, 4)$$

$$(c) (-4, -3) \cup (-2, 0) \cup (2, 3)$$

$$(d) \text{Concave down} = (-\infty, -4) \cup (-\infty, -3) \cup (0, 3)$$

$$\text{Concave up} = (-3, 0) \cup (3, \infty)$$

$$4. f(x) = 3x^3 - 2x^2 + 5$$

$$f'(x) = 9x^2 - 4x$$

$$f''(x) = 18x - 4$$

$$18x - 4 = 0$$

$$18x = 4$$

$$x = \frac{2}{9}$$

$$5. f(x) = 5x^3 - 45x + 4$$

$$f'(x) = 15x^2 - 45$$

$$f'(x) = 15x^2 - 45 = 0$$

$$15(x^2 - 3) = 0$$

$$x^2 - 3 = 0$$

$$x = \pm\sqrt{3}$$

$$f(\sqrt{3}) = 5(\sqrt{3})^3 - 45(\sqrt{3}) + 4 = 4 - 30\sqrt{3} < 0$$

$$f(-\sqrt{3}) = 5(-\sqrt{3})^3 - 45(-\sqrt{3}) + 4 = 4 + 30\sqrt{3} > 0$$

$$x = \sqrt{3} \quad \text{local minimum}$$

$$x = -\sqrt{3} \quad \text{local maximum}$$

$$6. f(t) = t + e^t \quad [0, 3]$$

$$f'(t) = 1 + e^t = 0$$

$$e^t = -1$$

$$\ln t = \ln(-1) \quad \text{Does not exist}$$

There are no global extremes

$$\begin{aligned}
 7. \quad P &= 410 - 0.06q & R(q) &= P(q)(q) = 410q - 0.06q^2 \\
 C &= 4000 + 20q \\
 \text{Profit} &= R(q) - C(q) \\
 &= 410q - 0.06q^2 - (4000 + 20q) \\
 P &= 390q - 0.06q^2 - 4000 \\
 &= -0.06q^2 + 390q - 4000 \\
 P' &= -0.12q + 390 = 0 \\
 &\quad -0.12q = -390 \\
 &\quad q = 3250 \quad \text{e745}
 \end{aligned}$$

$$8. C(q) = 250 + 3q + 0.21q^2$$

$$(a) C'(q) = 3 + 0.42q$$

$$3 + 0.42q = 0$$

$$q = -\cancel{7.14} \quad q = -7.14$$

cost cannot be minimized

$$(b) \bar{C}(q) = \frac{C(q)}{q} = \frac{250 + 3q + 0.21q^2}{q}$$

$$= 250q^{-1} + 3 + 0.21q$$

$$\bar{C}'(q) = -250q^{-2} + 0.21 = 0$$

$$+ 250q^{-2} = 0.21$$

$$q^{-2} = \frac{0.21}{250}$$

$$q = 34.5 \approx 35 \text{ pairs of shoes}$$

$$9. q = -0.32p + 160$$

$$E = -\frac{dq}{dp} \times \frac{p}{q}$$

$$= -\frac{(0.32)p}{-0.32p + 160}$$

$$-0.32p + 160$$

$$E \text{ at } p = 4 = \frac{-0.32(4)}{-0.32(4) + 160} = -0.008$$

Tony should raise price

10. $3x^2 + 2xy + y^2 = 11 \quad (1, 2)$

$$6x + 2y + 2x \frac{dy}{dx} + 2y \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} (2x + 2y) = -6x - 2y$$

$$\frac{dy}{dx} = \frac{-6x - 2y}{2x + 2y} = \frac{-3x - y}{x + y}$$

$$\left. \frac{dy}{dx} \right|_{(1,2)} = \frac{-3(1) - 2}{1 + 2} = \frac{-5}{3}$$

11. $V = \frac{4}{3} \pi r^3$

$$\frac{dV}{dt} =$$

11. $V = \frac{4}{3} \pi r^3$

$$\frac{dr}{dt} = 0.3, r = 3$$

$$\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$$

$$\frac{dV}{dt} = 4\pi (3)^2 (0.3) = \frac{54}{5} \pi \text{ cubic inches per minute}$$

12. Complete squares from -4 to $2 = 16$
 Incomplete squares from -4 to $2 = 16$

$$\text{Area} = 16 + \frac{16}{2} = 16 + 8 = 24 \text{ unit sq.}$$