

Review 2.2-2.6

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

$f'(x) = 3x^2 + 2$

2) $f(x) = \frac{-6x^3 + 3x^2 - 2x + 1}{x^2}$

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

$f(x) = -6x + 3 - 2x^{-1} + x^{-2}$

$f'(x) = -6 + \frac{2}{x^2} - \frac{2}{x^3}$

3) $g(x) = \frac{3x^2}{4} + \frac{5}{x}$

$= \frac{3}{4}x^2 + 5x^{-1}$

$= 2 \cdot \frac{3}{4}x - \frac{5}{x^2}$

$= \frac{3}{2}x - \frac{5}{x^2}$

4) $g(x) = x(2x+5)^2$

$g'(x) = x[2(2x+5) \cdot 2] + (2x+5)^2 \cdot 1$

$= 4x(2x+5) + (2x+5)^2$

$= (2x+5)(4x + (2x+5))$

$g'(x) = (2x+5)(6x+5)$

5) $f(x) = 6x^3(5x^2 + 2x - 1)$

$= 30x^5 + 12x^4 - 6x^3$

$f'(x) = 150x^4 + 48x^3 - 18x^2$

6) $f(x) = x^2(x-5)^2$

$f'(x) = x^2[2(x-5)] + (x-5)^2 \cdot 2x$

$= 2x(x-5)[x + (x-5)]$

$f'(x) = 2x(x-5)(2x-5)$

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

$f'(x) = 3x^2 + 2$

8) $f(x) = \frac{2x+3}{x-2}$

$f'(x) = \frac{(x-2)(2) - (2x+3) \cdot 1}{(x-2)^2}$

$= \frac{2x-4-2x-3}{(x-2)^2}$

$f'(x) = \frac{-7}{(x-2)^2}$

9) $f(x) = \sqrt{x+5} = (x+5)^{\frac{1}{2}}$

$f'(x) = \frac{1}{2}(x+5)^{-\frac{1}{2}} \cdot 1$

$f'(x) = \frac{1}{2\sqrt{x+5}}$

10) $h(x) = 5\sqrt{x+2}$

$h'(x) = \frac{5}{2\sqrt{x+2}}$

$$f'(x) = \frac{2}{3} X^3$$

$$f'(x) = \frac{2}{3 X^{\frac{1}{3}}}$$

$$(13) f(x) = \frac{3}{\sqrt{X^2-3}}$$

$$= \frac{3}{(X^2-3)^{\frac{1}{2}}}$$

$$f(x) = 3(X^2-3)^{-\frac{1}{2}}$$

$$f'(x) = -\frac{3}{2}(X^2-3)^{-\frac{3}{2}}(2X)$$

$$f'(x) = \frac{-3X}{(X^2-3)^{\frac{3}{2}}}$$

$$(15) f(x) = \frac{1}{2X^4}$$

$$f(x) = \frac{1}{2} X^{-4}$$

$$f'(x) = -\frac{4}{2} X^{-5}$$

$$f'(x) = \frac{-2}{X^5}$$

$$f'(x) = \frac{(x-1) \cdot 2 - (2x-3) [2(x-1)]}{(x-1)^4}$$

$$f'(x) = \frac{2(x-1) [(x-1) - (2x-3)]}{(x-1)^{3+1}}$$

$$f'(x) = \frac{2(x-1-2x+3)}{(x-1)^3}$$

$$f'(x) = \frac{2(-x+2)}{(x-1)^3}$$

$$(14) f(x) = (8x-9)^{-4}$$

$$f'(x) = -4(8x-9)^{-5} \cdot 8$$

$$f'(x) = \frac{-32}{(8x-9)^5}$$

$$(16) f(x) = \frac{2}{\sqrt{x}} = \frac{2}{x^{\frac{1}{2}}}$$

$$f(x) = 2X^{-\frac{1}{2}}$$

$$f'(x) = -1X^{-\frac{3}{2}}$$

$$f'(x) = \frac{-1}{X^{\frac{3}{2}}}$$

$$(17) f(x) = \frac{x}{(2x-5)^3}$$

$$f'(x) = \frac{(2x-5)^3 \cdot 1 - x [3(2x-5)^2 \cdot 2]}{(2x-5)^6}$$

$$= \frac{\cancel{(2x-5)^3} [(2x-5) - 6x]}{(2x-5)^{\cancel{6}4}}$$

$$f'(x) = \frac{-4x-5}{(2x-5)^4}$$

$$(18) f(x) = \frac{x^2 - 3x + 1}{x^2 - 1}$$

$$f'(x) = \frac{(x^2-1)(2x-3) - (x^2-3x+1)(2x)}{(x^2-1)^2}$$

$$= \frac{\cancel{2x^3} - 3x^2 - 2x + 3 - \cancel{2x^3} + 6x^2 - 2x}{(x^2-1)^2}$$

$$f'(x) = \frac{3x^2 - 4x + 3}{(x^2-1)^2}$$

$$(19) P(t) = 50 + 15t - t^2$$

$$\begin{aligned} a) P(3) &= 50 + 15(3) - 3^2 \\ &= 50 + 45 - 9 \\ &= 86 \text{ parts/billion} \end{aligned}$$

$$P'(t) = -2t + 15$$

$$\begin{aligned} P'(3) &= -2(3) + 15 \\ &= -6 + 15 \\ &= 9 \text{ parts/billion/hour} \end{aligned}$$

(20)

$$C(x) = 20x^3 - 360x^2 + 2300x - 1000$$

$$a) \bar{C}(x) = \frac{20x^3 - 360x^2 + 2300x - 1000}{x}$$

$$b) x_{\min} = -10$$

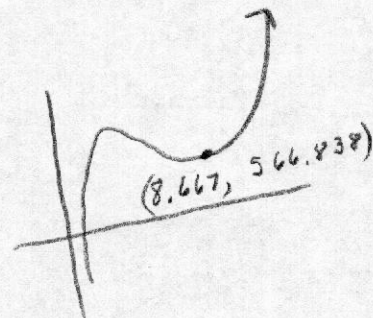
$$y_{\min} = -500$$

$$x_{\max} = 25$$

$$y_{\max} = 2500$$

$$x_{\text{sel}} = 0$$

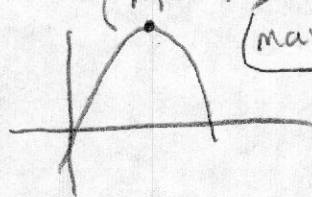
$$y_{\text{sel}} = 0$$



c) The minimum average cost to the nearest \$ is 8.667 thousand or \$8,667

(21) $C(x) = 5000 + 2x$
 $P(x) = 10 - .001x$

A) $R(x) = x(10 - .001x)$



max Revenue = 25,000

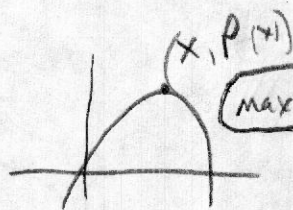
$x = 5000$

B) $P(x) = x(10 - .001x) - (5000 + 2x)$

C) $x = 4000$ radios

D) $P(4000) = 10 - .001(4000)$

$P(4000) = \$6$



max Profit = \$11,000

$x = 3999.9992 = 4000$

(22) A) $f(200) = 350$ Cost (dollars) g (gallons of ice cream)

The cost to produce 200 gallons of ice cream is \$350.

B) $f'(200) = 1.4$ $C'(200) = 1.4$

The cost of producing the 200th gallon of ice cream is changing at a rate of \$1.40/gallon.

C) $f(201) = 350 + 1.40$
 $= \$351.40$

(23) $P(t) = 50 + 15t - t^2$

$P(3) = 50 + 15(3) - 3^2$

$P(3) = 50 + 45 - 9$
 $= 41 + 45$

$P(3) = 89$

The ozone level at noon is 89 parts per billion.

$t = 0 \approx 9 \text{ AM}$

$t = 3$ at noon

$P'(t) = 15 - 2t$

$P'(3) = 15 - 2(3)$

$= 15 - 6$

$= 9 \text{ parts per billion}$

 hr

The ozone level is increasing at a rate of 9 ppb/hr at 12:00.

$$(24) h(t) = -16t^2 + 24t + 120$$

$$a) v(t) = -32t + 24$$

$$b) a(t) = -32$$

$$c) v(3) = -32(3) + 24 = -72 \text{ ft/sec}$$

$$d) a(3) = -32 \text{ ft/sec/sec}$$

$$(26) f(x) = 10x^2$$

$$f'(x) = 20x$$

$$f'(4) = 20(4)$$

$$f'(4) = 80$$

$$\boxed{80 \text{ ft/sec}}$$

$$(28) f(x) = x(x+1)^2$$

$$f'(x) = x[2(x+1) \cdot 1] + (x+1)^2 \cdot 1$$

$$= (x+1)[2x + (x+1)]$$

$$f'(x) = (x+1)(3x+1)$$

$$m = f'(2) = (2+1)(3 \cdot 2 + 1) = 3 \cdot 7$$

$$a) = 21$$

$$(29) f(x) = \frac{4x^2}{x+2}$$

$$f'(x) = \frac{(x+2)(8x) - (4x^2) \cdot 1}{(x+2)^2} = \frac{8x^2 + 16x - 4x^2}{(x+2)^2} = \frac{4x^2 + 16x}{(x+2)^2}$$

$$4x^2 + 16x = 0$$

$$4x(x+4) = 0$$

$$\boxed{\begin{matrix} x=0 \\ x=-4 \end{matrix}}$$

$$(25) h(t) = 24t - .8t^2$$

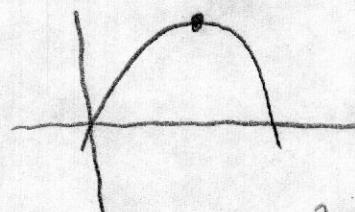
$$a) v(t) = 24 - 1.6t$$

$$b) A(t) = -1.6$$

$$c) h(15) = 24(15) - .8(15)^2$$

$$d) = h(15) = 180 \text{ ft}$$

$$e) 30 \text{ sec}$$



$$0 = 24t - .8t^2$$

$$.8t(3 - .1t) = 0$$

$$t = 0$$

$$3 = .1t$$

$$t = \frac{3}{.1}$$

$$t = 30$$

$$(27) a) f(x) = x^2 + 3x + 4$$

$$f'(x) = 2x + 3$$

$$m = f'(2) = 2(2) + 3$$

$$m = 7$$

$$b) y - y_1 = m(x - x_1)$$

$$f(2) = 2^2 + 3(2) + 4$$

$$f(2) = 4 + 6 + 4$$

$$f(2) = 14$$

$$(2, 14)$$

$$y - 14 = 7(x - 2)$$

$$y - 14 = 7x - 14$$

$$\boxed{y = 7x}$$

$$b) f(2) = 2(2+1)^2$$

$$(2, 18)$$

$$= 2(3)^2$$

$$= 2 \cdot 9$$

$$= 18$$

$$y - 18 = 21(x - 2)$$

$$y - 18 = 21x - 42$$

$$\boxed{y = 21x - 24}$$

$$(30) f(x) = x^3 + x \quad (1, -2)$$

$$y + 2 = 4(x - 1)$$

$$f'(x) = 3x^2 + 1$$

$$m = f'(1) = 3 \cdot 1 + 1 \\ = 4$$

$$(31) f(x) = 5\sqrt[3]{x} + 3\sqrt[5]{x}$$

$$= 5x^{\frac{1}{3}} + 3x^{\frac{1}{5}}$$

$$f'(x) = \frac{5}{3}x^{-\frac{2}{3}} + \frac{3}{5}x^{-\frac{4}{5}}$$

$$= \frac{5}{3x^{\frac{2}{3}}} + \frac{3}{5x^{\frac{4}{5}}}$$