3.3 Rules For Differentiation

Sum and Difference Rule

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Sum Rule

If both $f(x)$ and $g(x)$ are differentiable functions, then if $y = f(x) + g(x)$, then $y' = f'(x) + g'(x)$

Difference Rule

If both $f(x)$ and $g(x)$ are differentiable functions, then if $y = f(x) - g(x)$, then $y' = f'(x) - g'(x)$

Ex1. Differentiate the following:

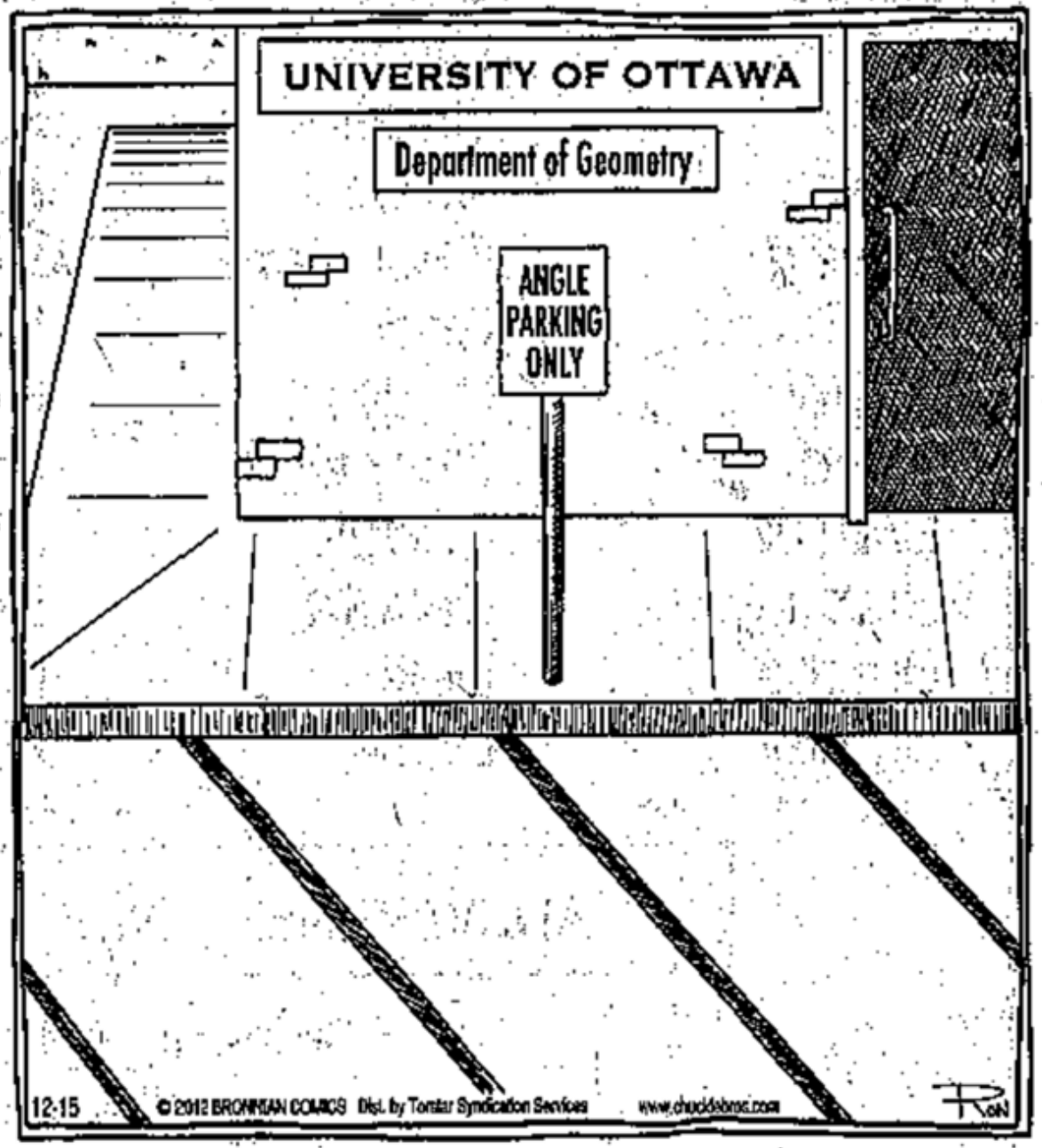
$a)\ f(x) = 2x^4 + \sqrt{x}$

$f(x) = 2x^4 + x^{1/2}$

$f'(x) = 8x^3 + \frac{1}{2}x^{-1/2}$

$= 8x^3 + \frac{1}{2x^{1/2}}$

CHUCKLE BROS.



$$b)\ g(x) = 2.3x^4 - 5\pi x^3 - 2x + 17$$

$$g'(x) = 9.2x^3 - 15\pi x^2 - 2$$

$$-2$$

c) $f(x) = \sqrt{3x} + 5\sqrt[3]{x} - 4x + 1$

$f(x) = \sqrt{3} \cdot \sqrt{x} + 5x^{1/3} - 4x + 1$

$= \sqrt{3}\, x^{1/2} + 5x^{1/3} - 4x + 1$

$f'(x) = \frac{\sqrt{3}}{2} x^{-1/2} + \frac{5}{3} x^{-2/3} - 4$

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

Ex.2 Find the derivative of:

$$y = \left(x - \frac{2}{\sqrt{x}} \right)^2$$

$$y = \left(x - \frac{2}{\sqrt{x}}\right)\left(x - \frac{2}{\sqrt{x}}\right)$$

$$= x^2 - \frac{2x}{\sqrt{x}} - \frac{2x}{\sqrt{x}} + \frac{4}{x}$$

$$= x^2 - 2x^{1/2} - 2x^{1/2} + 4x^{-1}$$

$$f(x) = x^2 - 4x^{1/2} + 4x^{-1}$$

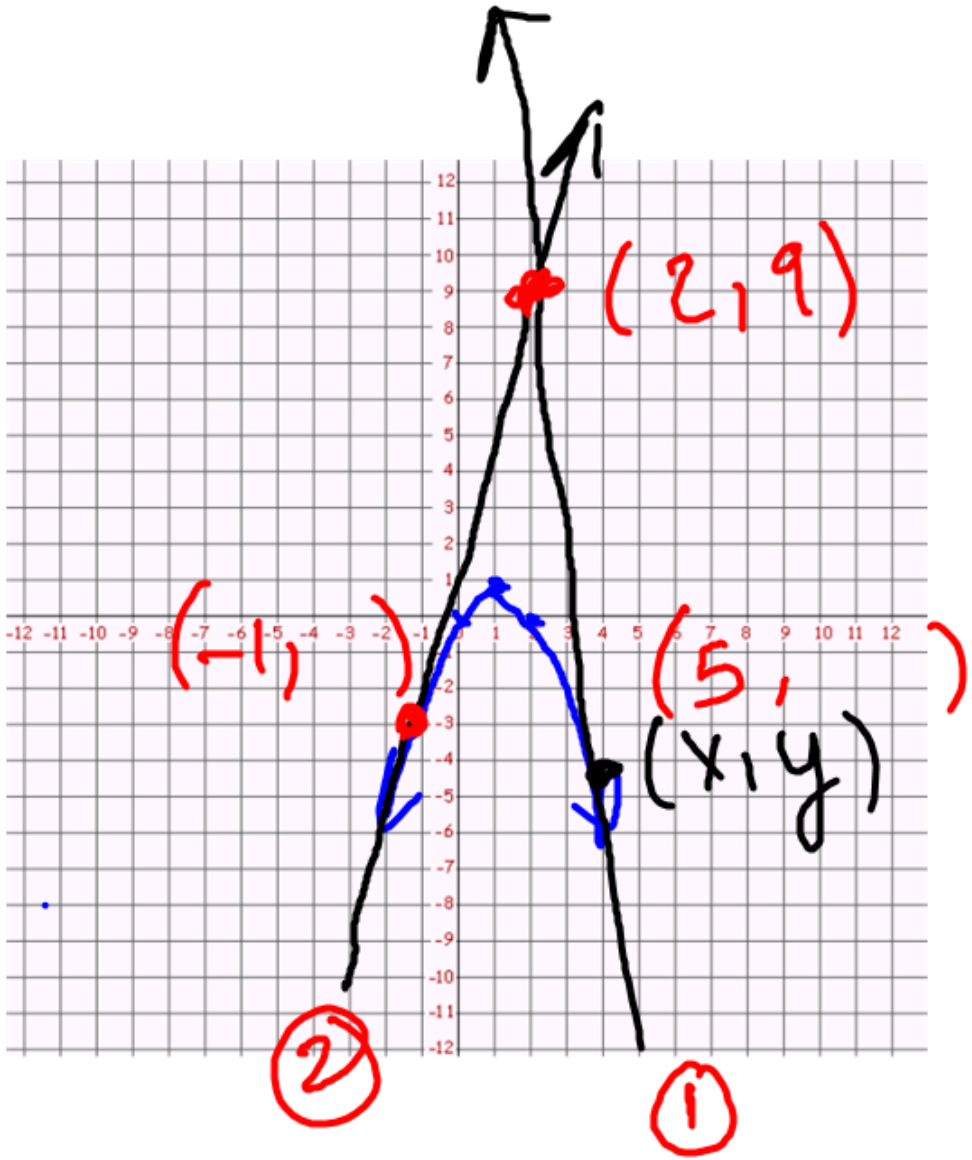
$$f' = 2x - 2x^{-1/2} - 4x^{-2}$$

$$= 2x - \frac{2}{x^{1/2}} - \frac{4}{x^2}$$

Ex.3 Find the **equations of both lines** that pass through the point (2,9) and are tangent to the parabola $y = 2x - x^2$. A sketch may be useful.

$y = x(2-x)$

x	y
1	1
0	0
2	0



$$m = \frac{y - 9}{x - 2} = \frac{2x - x^2 - 9}{x - 2}$$

$y - 2 = 2x$

$$(x-2)2 - 2x = \frac{2x - x^2 - 9}{(x-2)}(x-2)$$

$$2x - 2x^2 - 4 + 4x = 2x - x^2 - 9$$

$$0 = x^2 - 4x - 5$$

$$0 = (x-5)(x+1)$$

$x = 5$ $\quad x = -1$

Tangent

$y' = 2 - 2x$

$y'(5) = 2 - 2(5)$

$= -8$

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

$y - 9 = -8(x - 2)$

$y - 9 = -8x + 16$

$\boxed{y = -8x + 25}$

(2, 9)

$y'(-1) = 2 - 2(-1)$

$y'(-1) = 4$

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

$y - 9 = 4(x - 2)$

$y - 9 = 4x - 8$

$y = 4x - 1$

Assignment
Calc 30 Text Page 186
#'s 1 a - n, 3 a, b, 5, 7, 10

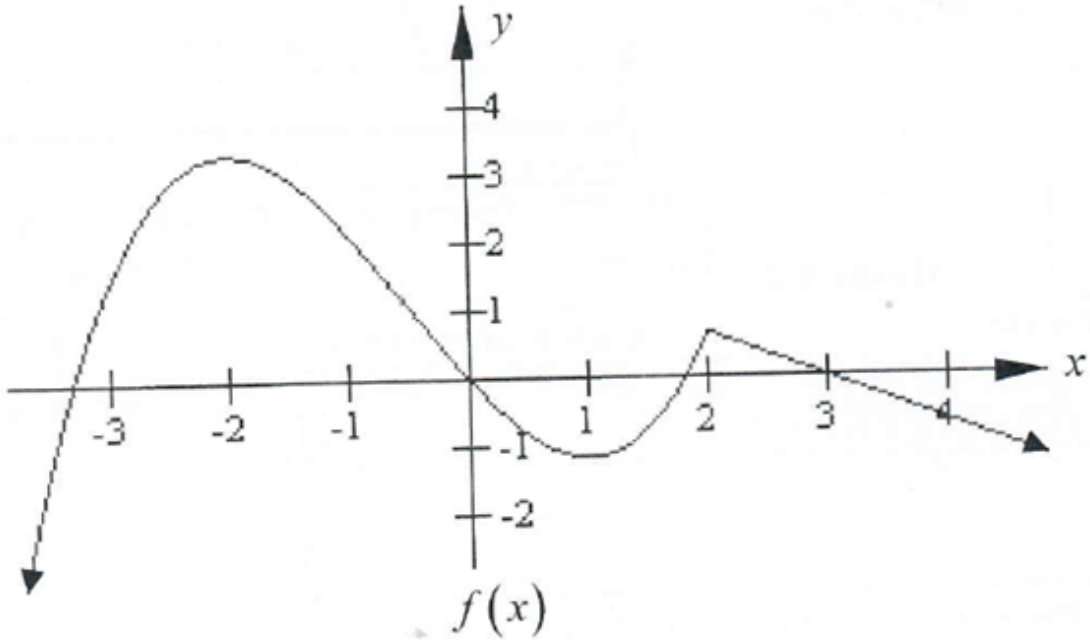
Page 176 #8 do as a group

AP Text
Page 112 #29
Page 120 #'s 27-30

8. Examine the graph of the function $f(x)$ below. Based on your study of the graph describe each of the following as being "zero", "positive", "negative", or "does not exist".

(a) $f(-3)$ (b) $f'(-3)$ (c) $f(-2)$ (d) $f'(-2)$ (e) $f(-1)$ (f) $f'(-1)$ (g) $f(0)$ (h) $f'(0)$

(i) $f(1)$ (j) $f'(1)$ (k) $f(2)$ (l) $f'(2)$ (m) $f(3)$ (n) $f'(3)$ (o) $f(4)$ (p) $f'(4)$



$f(x)$