1. Use the <u>power rule</u> to find the derivative of $y = 3x^5 - \frac{3}{x^2} + \sqrt{x}$

$$y = 3x^5 - 3x^{-2} + x^{1/2}$$

$$y' = 15x^4 + 6x^{-3} + \frac{1}{2}x^{-1/2}$$

$$y' = 15x^4 + \frac{6}{x^3} + \frac{1}{2\sqrt{x}}$$

2. Use the <u>product rule</u> to find the derivative of $y = (2x^2+5)(3x-10)$

$$y' = 4x(3x-10) + 3(2x^2+5)$$

$$= 12x^2 - 40x + 6x^2 + 15$$

$$= 18x^2 - 40x + 15$$

5c) $y=(3-2x-x^2)(x^2+x-2)$

p.90 $\frac{dy}{dx}=(-2-2x)(x^2+x-2)+(2x+1)(3-2x-x^2)$

$=-2x^2-2x+4-2x^3-2x^2+4x+6x-4x^2-2x^3+3-2x-x^2$

$=-4x^3-9x^2+6x+7$

$\frac{dy}{dx}\Big|_{x=-2}=-4(-2)^3-9(-2)^2+6(-2)+7$

$=32-36-12+7$

$=-9$

9.
p.91

$$V(t) = 75\left(1 - \frac{t}{24}\right)^2 \quad , 0 \le t \le 24$$

$$= 75\left(1-\frac{t}{24}\right)\left(1-\frac{t}{24}\right) \qquad V = 0.60 \times 75 L$$

$$V'(t) = 75\left(-\frac{1}{24}\right)\left(1-\frac{t}{24}\right) + 75\left(-\frac{1}{24}\right)\left(1-\frac{t}{24}\right)$$

$$= 150\left(-\frac{1}{24}\right)\left(1-\frac{t}{24}\right)$$

To find t: sub $V = 0.6 \times 75$ into $V(t)$:

$$0.6 \times 75 = 75\left(1-\frac{t}{24}\right)^2$$

$$0.6 = \left(1-\frac{t}{24}\right)^2$$

$$\pm\sqrt{\frac{6}{10}} = 1 - \frac{t}{24}$$

$$\frac{t}{24} = 1 \pm \sqrt{\frac{6}{10}}$$

$$t = 24\left(1 \pm \sqrt{\frac{6}{10}}\right)$$

$t = 24\left(1+\sqrt{\frac{6}{10}}\right)$ OR $t = 24\left(1-\sqrt{\frac{6}{10}}\right)$

$= 24 + 24\sqrt{\frac{6}{10}}$ $\qquad = 24 - 24\sqrt{\frac{6}{10}}$

$\doteq 42.6$ ~ inadmissable since outside domain. $\qquad \doteq 5.4$ ~ Kept in mem.

$$V'(5.4) \doteq 150\left(-\frac{1}{24}\right)\left(1-\frac{5.4}{24}\right)$$

$$\doteq -4.84$$

$\therefore$ The gas is leaking out of the tank after approx 5.4 hours at a rate of $4.84 \frac{L}{h}$.

L9 (2.4) The Quotient Rule

If $q(x) = \frac{f(x)}{g(x)}$, then $q'(x) = \frac{f'(x)g(x) - g'(x)f(x)}{[g(x)]^2}$,
where g(x)$\neq$ 0.

NOTE: Proof of Quotient Rule can be found on p.94

$$q(x) = \frac{f(x)}{g(x)}$$

$$g(x)\,q(x) = f(x)$$

Ex1: Find the derivative of each function.

a) $y = \dfrac{3x}{x^2+5}$ f(x) g(x)

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

$$= \frac{3x^2+15-6x^2}{(x^2+5)^2}$$

$$= \frac{-3x^2+15}{(x^2+5)^2}$$

b) $y = \dfrac{x^2-4x-12}{x^3-8}$

$$y' = \frac{(2x-4)(x^3-8) - (3x^2)(x^2-4x-12)}{(x^3-8)^2}$$

$$= \frac{2x^4 - 16x - 4x^3 + 32 - 3x^4 + 12x^3 + 36x^2}{(x^3-8)^2}$$

$$= \frac{-x^4 + 8x^3 + 36x^2 - 16x + 32}{(x^3-8)^2}$$

NOTE: The Quotient Rule is not needed when the denominator of a function is a monomial.

ex: $y = \dfrac{x^2-5x}{3}$ or $y = \dfrac{x^3+1}{x^2}$

Ex2: Find the coordinate(s) on the curve $f(x)=\dfrac{2x+8}{\sqrt{x}}$

where the tangent line is horizontal.

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

$$=\frac{2\sqrt{x}}{x}-\frac{2x+8}{2x\sqrt{x}}$$

$$=\frac{4x-2x-8}{2x\sqrt{x}}$$

$$=\frac{2x-8}{2x\sqrt{x}}$$

$$=\frac{x-4}{x\sqrt{x}}$$

Set $f'(x)=0$ to solve for x

$$0=\frac{x-4}{x\sqrt{x}}$$

$$0=x-4$$

$$x=4$$

$f(4)$ . . .

Assigned Work:

p. 97 #4, 5cd, 6, 7, 8, 9, 13