HW # 3.2 part I

1) $y = -x^2 + 3$

$y' = -2x$, $y'' = -2$

2) $y = x^2 + x + 8$

$y' = 2x + 1$ $y'' = 2$

3) $s = 5t^3 - 3t^5$

$s' = 15t^2 - 15t^4 = 15(t^2 - t^4)$

$s'' = 15(2t - 4t^3)$

$= 30t - 60t^3$

4) $w = 3z^7 - 7z^3 + 21z^2$

$w' = 21z^6 - 21z^2 + 42z$

$w'' = 126z^5 - 42z + 42$

5) $y = \frac{4x^3}{3} - x$

$y' = \frac{3}{3} \cdot 4x^2 - 1 = 4x^2 - 1$

$y'' = 8x$

6) $y = \frac{1}{3}x^3 + \frac{1}{2}x^2 + \frac{1}{4}x$

$y' = x^2 + x + \frac{1}{4}$

$y'' = 2x + 1$

7) $w = 3z^{-2} - \frac{1}{z} = 3z^{-2} - z^{-1}$

$w' = -6z^{-3} + z^{-2}$

$w'' = 18z^{-4} - 2z^{-3}$

8) $s = -2t^{-1} + 4t^{-2}$

$s' = 2t^{-2} - 8t^{-3}$

$s'' = -4t^{-3} + 24t^{-4}$

9) $y = 6x^2 - 10x - 5x^{-2}$

$y' = 12x - 10 + 10x^{-3}$

$y'' = 12 - 30x^{-4}$

10) $y = 4 - 2x - x^{-3}$

$y' = -2 + 3x^{-4}$

$y'' = -12x^{-5}$

11) $r = \frac{1}{3}\frac{1}{s^2} - \frac{5}{2s} = \frac{1}{3}s^{-2} - \frac{5}{2}s^{-1}$

$r' = -\frac{2}{3}s^{-3} + \frac{5}{2}s^{-2}$

$r'' = 2s^{-4} - 5s^{-3}$

12) $r = \frac{12}{\theta} - \frac{4}{\theta^3} + \frac{1}{\theta^4} = 12\theta^{-1} - 4\theta^{-3} + \theta^{-4}$

$r' = -12\theta^{-2} + 12\theta^{-4} - 4\theta^{-5}$

$r'' = 24\theta^{-3} - 48\theta^{-5} + 20\theta^{-6}$

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

$y' = 2x^3 - 3x - 1$

$y'' = 6x^2 - 3$

$y''' = 12x$

$y^{(4)} = 12$

$y^{(n)} = 0$, for all $n \geq 5$

30) $y = \frac{x^5}{120}$

$y' = \frac{1}{24}x^4$ $\quad y'' = \frac{1}{6}x^3$ $\quad y^{(3)} = \frac{1}{2}x^2$

$y^{(4)} = x$ $\quad y^{(5)} = 1$ $\quad y^{(n)} = 0$

For all $n \geq 6$

42 a) $y = x^3 - 3x - 2$

has horizontal tangents at $y' = 0$

i.e $3x^2 - 3 = 0$

$$3(x^2 - 1) = 3(x-1)(x+1) = 0$$

$$\rightarrow x = \pm 1$$

each h.t of form $y = 0 \cdot x + b$

for $x = -1$; tangent goes through $(-1, (-1)^3 - 3(-1) - 2)$
$= (-1, 0)$

so $0 = 0(-1) + b \rightarrow b = 0$

so one tangent is $y = 0$ ($x = -1$ is perpendicular)

For $x = 1$, goes through $(1, 1^3 - 3(1) - 2)$
$= (1, -4)$

So $-4 = 0(1) + b \rightarrow b = -4$

So tangent is $y = -4$

($x = 1$ is perpendicular)

50) $R = M^2\left(\frac{5}{2} - \frac{M}{3}\right)$

$= \frac{5}{2}M^2 - \frac{1}{3}M^3$

$R' = 5M - M^2$