(1) [6] The equation of motion of a particle is $s(t) = t^3 - 3t$, where s is in meters and t is in seconds. Determine the acceleration of the particle when the velocity is zero.

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

$v(t) = s'(t) = 3t^2 - 3$

$a(t) = v'(t) = 6t$

velocity is zero $\Rightarrow v(t) = 0$

$\Rightarrow 3t^2 - 3 = 0$

$\therefore t^2 = 1$

$t = 1$

$\therefore a(1) = (6)(1) = \boxed{6 \ \frac{m}{s^2}}$

(2) [3] Differentiate

$$f(x) = x - 3\sin x$$

$f'(x) = 1 - 3\cos x$

(3) [3] Differentiate

$$y = \frac{r^2}{1+\sqrt{r}} = \frac{r^2}{1+r^{1/2}}$$

$$y' = \frac{(1+r^{1/2})(2r) - (r^2)(\frac{1}{2}r^{-\frac{1}{2}})}{(1+r^{1/2})^2}$$

(4) [3] Differentiate

$$y = t^3 \cos t$$

$$y' = 3t^2\cos t - t^3 \sin t$$