1. The slope of any line through $(x, 1+x+x^2)$ and $(1,3)$ can be written $\dfrac{(1+x+x^2)-3}{x-1} = \dfrac{x^2+x-2}{x-1}$. Use this expression to quickly find the necessary slopes.

   (a)

x	2	1.5	1.1	1.01	1.001
Slope	4	3.500	3.100	3.010	3.001

x	0	0.500	0.900	0.990	0.999
Slope	2	2.500	2.900	2.990	2.999

   (b) It appears that at x gets closer and closer to 1 (from the left and right) that the slope gets closer and closer to 3. Thus $m = 3$.

   (c) $y - 3 = 3(x-1)$

2. Average velocity is given by $\dfrac{\text{change in position}}{\text{change in time}}$ which in this case is given by $\dfrac{y(t_2)-y(t_1)}{t_2-t_1}$. We are essentially looking for the slope of a line through $(t, 40t - t^2)$ and $(2,16)$. Thus average velocity is $\dfrac{40t - 16t^2 - 16}{t-2}$.

   (a) $t_1 = 2,\ t_2 = 2.5 \longrightarrow v = -32$
   $t_1 = 2,\ t_2 = 2.1 \longrightarrow v = -25.6$
   $t_1 = 2,\ t_2 = 2.05 \longrightarrow v = -24.800$
   $t_1 = 2,\ t_2 = 2.01 \longrightarrow v = -24.160$
   $t_1 = 2,\ t_2 = 2.001 \longrightarrow v = -24.016$

   (b) It appears that as the interval of time gets smaller and smaller near 2, the velocity approaches -24, thus the average velocity is -24 feet per second.

3. Average velocity is given by $\dfrac{\text{change in position}}{\text{change in time}}$ which in this case is given by $\dfrac{s(t_2)-s(t_1)}{t_2-t_1}$. We are essentially looking for the slope of a line through $\left(t, \dfrac{t^3}{6}\right)$ and $\left(1, \dfrac{1}{6}\right)$. Thus average velocity is $\dfrac{\frac{t^3}{6} - \frac{1}{6}}{t-1} = \dfrac{t^3-1}{6t-6}$.

   (a) On $[1,3] \longrightarrow v = 2.167$
   On $[1,2] \longrightarrow v = 1.167$
   On $[1,1.5] \longrightarrow v = .7927$
   On $[1,1.1] \longrightarrow v = .552$
   On $[1,1.01] \longrightarrow v = .505$
   On $[1,1.001] \longrightarrow v = .501$

   (b) It appears that as the interval of time gets smaller and smaller near $t = 1$, the velocity approaches .500, thus the average velocity is .500 feet per second.