Section 3.8
Solutions and Hints

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for the book:

<u>Calculus, Early Vectors</u>
by James Stewart.

38. Given $s(t) = 2t^3 – 7t^2 + 4t + 1$ represents the position of a particle at time t. Find equations for the velocity and acceleration in terms of t. Calculate the acceleration at t =1. Find the particle's acceleration at times when its velocity is zero.

To find the velocity and acceleration equations means we must find the first and second derivatives of position:

$s(t) = 2t^3 – 7t^2 + 4t + 1$
$v(t) = s'(t) = 6t^2 – 14t + 4$
$a(t) = s''(t) = 12t – 14$

Finding the acceleration at t = 1 is just putting 1 into a(t):
$a(1) = 12*1 – 14 = –2$

The particle's acceleration at time = 1 sec is –2.

For the last question we must set v(t) = 0 and solve for t.
We will then put those times into a(t).

$6t^2 – 14t + 4 = 0,$ *divide everything by 2.*
$3t^2 – 7t + 2 = 0,$ *factor.*
$(3t – 1)(t – 2) = 0$

So at t = 1/3 and t = 2 the particle's velocity is zero.
$a(1/3) = 12*(1/3) – 14 = –10$ and $a(2) = 12*2 – 14 = 10$

At times t = 1/3 and 2 velocity is zero and acceleration is –10 and 10, respectively.

46. Find the acceleration at the given value of t:

$\mathbf{r}(t) = < 4\cos(t), 3\sin(t) >$ at $t = \pi/3$

velocity = $\mathbf{r}'(t) = < -4\sin(t), 3\cos(t) >$

acceleration = $\mathbf{r}''(t) = < -4\cos(t), -3\sin(t) >$

$$\mathbf{r}''(\pi/3) = < -4\cos(\pi/3), -3\sin(\pi/3) >$$
$$= < -2, \frac{-3\sqrt{3}}{2} >$$

The acceleration at $t = \pi/3$ is $< -2, \frac{-3\sqrt{3}}{2} >$.