Tips and Tricks: Illustrating Motion on an HP38G or HP39G

When solving or investigating problems involving equations of motion such as $x(t) = t^3 - 9t^2 + 23t - 15$ we would often like to be able to display the particle motion graphically. Using the *Parametric* aplet, we can display the motion so as to show visually not only the path but also the velocity and acceleration.

Enter the equation into **X1(T)** and enter **0.1*T** into **Y1(T).** You can then use the **NUM** view to investigate the range of particle positions so as to be able to sensibly set the axes. Setting the **NumStep** to 0.5 and investigating shows that an x axis range of –20 to 30 will suitably display most of the first 7 seconds of motion.

In **PLOT SETUP**, enter the values shown left. In addition, you should set the **XTick** value on the next page to 10 rather than 1. When you now press **PLOT** you will see the graph shown right.
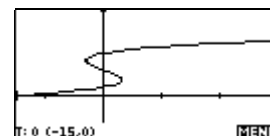
Although we can't show it on this page, the additional advantage of producing the graph in this fashion is that as the 'particle' approaches the turning points you can actually *see* it slow down and reverse direction! As it passes the second turning point the acceleration and increasing velocity is very apparent. In addition, the speed of the particle can be slowed down or speeded up by adjusting the value of TStep in **PLOT SETUP**.

Finally, the reason for the equation **Y1(T)=0.1*T** is just to supply a vertical component to the motion of the particle, so that its travels are not confined to the x axis. Because in this case we are looking at T=0 to 7 this means that **Y(T)** will run from 0 to 0.7. Hence the choice of values for the y axis in the **PLOT SETUP** screen above.