The position s of a particle moving on an "infinite number line" at any time t is given by

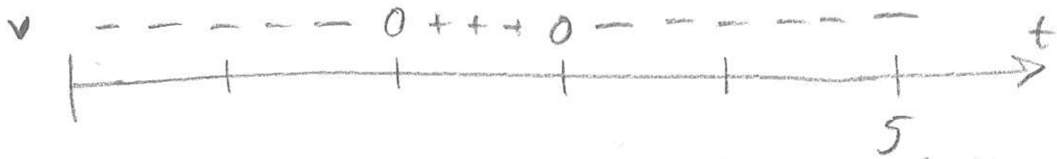
$$s = -2t^3 + 15t^2 - 36t - 2 \qquad \text{for} \qquad t \geq 0$$

Determine when the particle is moving to the right, and when it is moving to the left. Then determine when it is speeding up and when it is slowing down. Finally, draw a schematic diagram that shows the position of the particle as time progresses.

Moving left and right are determined by velocity $v = s'$.

$$v = s' = -6t^2 + 30t - 36 = -6(t^2 - 5t + 6) = -6(t-2)(t-3)$$

We see that the particle is stopped at $t = 2$ and $t = 3$.
For $t < 2$, $t-2$ and $t-3$ are both negative, as is -6, so the velocity is negative. This reasoning can be continued to get



Thus the particle is moving left from $t=0$ to $t=2$, and after $t=3$. It is moving right from $t=2$ to $t=3$.

The particle will speed up when the acceleration $(a = v' = s'')$ is in the same direction as the velocity.

$a = s'' = -12t + 30 = -6(2t-5)$ This equals zero when $2t - 5 = 0 \Longrightarrow t = \frac{5}{2} = 2\frac{1}{2}$. For $t < \frac{5}{2}$, a is positive and for $t > \frac{5}{2}$, a is negative:

The particle is speeding up for t in $[2, 2\frac{1}{2}]$ and $[3, \infty)$.
It is slowing down when t is in $[0, 2]$ and $[2\frac{1}{2}, 3]$.