11. A particle moves on a line with acceleration $s''(t) = -4t$. Suppose that $s(0) = 6$ and $s'(0) = 24$. Find the functions $s(t)$ and $s'(t)$. Graph the functions $s(t)$, $s'(t)$ and $s''(t)$ on the same set of axes and describe the motion in words.

The initial value problem is given by

$$s''(t) = -4t$$
$$s'(0) = 24$$
$$s(0) = 6$$

The solution to the i.v.p. is $s(t) = -\frac{2}{3}t^3 + 24t + 6$. We also know that $s'(t) = -2t^2 + 24$.

Describe motion of this man.

- At time 0 seconds, the particle is 6 units to the right of the reference point. It is moving to the right at a speed of 24.

- The velocity decreases throughout the entire motion, since the acceleration is negative.

- The particle moves to the right with decreasing speed for $2\sqrt{3}$ units of time.

- At time $t = 2\sqrt{3}$, the particle comes to an instant stop at $32\sqrt{3} + 6$.

- Following that, the particle moves to left with an increasing speed.

- The particle passes the reference point at $t = 6.1213$