The position x of particle with respect to time t along x-axis is given by X=9 t square - t cube, where x is in meters and t in seconds. What will be the position of this particle when it achieves maximum speed along the +x direction?

Solution.

$$x = (9t^2 - t^3)m;$$

$$x - ?$$

$$x = 9t^2 - t^3.$$

The speed is the derivative of the position as a function of time:

$$v = \frac{dx}{dt} = 18t - 3t^2.$$

$$v = (18t - 3t^2)\frac{m}{s}.$$

The acceleration is the derivative of the speed as a function of time:

$$a = \frac{dv}{dt} = 18 - 6t.$$

$$a = (18 - 6t)\frac{m}{s^2}.$$

When the particle achieves maximum speed the acceleration is zero: $a = 0$.

$$18 - 6t = 0;$$

$$t = 3s.$$

When the particle achieves maximum speed $t = 3s$.

The position of this particle at $t = 3s$:

$$x = (9 \cdot 3^2 - 3^3)m = 54m.$$

Answer: The position of this particle when it achieves maximum speed is $x = 54m$.