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This is a 1-D problem involving instantaneous velocity and speed.

The position of a particle is given by $x = 4 - 10t + 2t^2 - 3t^3$, where t is in seconds and x is in meters.

- (a) What is the velocity of the particle at $t = 2$ s?
- (b) Is the position of the particle increasing or decreasing at $t = 2$ s?
- (c) What is the speed of the particle at $t = 2$ s?

Solution:

$$(a) v = \frac{dx}{dt} = -10 + 4t - 9t^2$$

$$\text{Substitute } t=2: v = -10 + 4(2) - 9(2)^2$$
$$v = -38 \text{ m/s (answer)}$$

(b) Since $v < 0$, the position of the particle is decreasing at $t = 2$ s.

(c) Speed is a positive quantity, and $s = |v| = 38 \text{ m/s}$
(answer)