Question

The position of a particle at time t is given by s, Find the velocity ds/dt.

$$2s^2 + \sqrt{st} - 4 = 3t$$

Solution

Differentiate both sides of $2s^2 + \sqrt{st} - 4 = 3t$ with respect to t:

1) $(2s^2)' + (\sqrt{st})' - (4)' = (3t)'$

2) Derivative of a constant is equal to 0: $-(4)' = 0$.

Derivative of a composite function: $(2s^2)' = 2 * 2s * s'$.

Derivative of the product of functions: $(\sqrt{st})' = \sqrt{s} + t * \frac{1}{2\sqrt{s}} * s'$.

$(3t)' = 3$.

3) $2 \cdot 2s \cdot s' + \sqrt{s} + t \cdot \frac{1}{2\sqrt{s}} \cdot s' = 3$;

$\frac{ds}{dt} = s'$;

$s'(4s + \frac{t}{2\sqrt{s}}) = 3 - \sqrt{s}$;

$\frac{ds}{dt} = \frac{3-\sqrt{s}}{4s+\frac{t}{2\sqrt{s}}} = \frac{6\sqrt{s}-2s}{8s^{\frac{3}{2}}+t}$.

Answer: The velocity $\frac{ds}{dt}$ is equal to $\frac{6\sqrt{s}-2s}{8s^{\frac{3}{2}}+t}$.