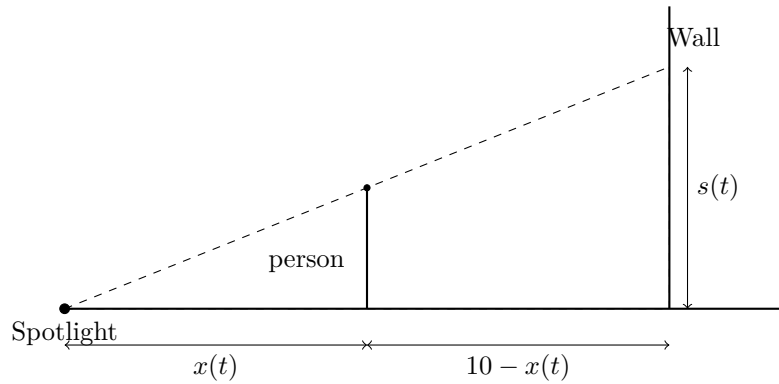


Question 6

A spotlight is located on the ground 10 m away from a vertical wall. A person 2 m tall walks directly away from the wall at a speed of 1.2 m/s.

- (a) How fast is the length of the shadow on the wall changing when the person is 5 m from the wall?
- (b) At that moment, how fast is the tip of the shadow moving up the wall?



Question 6 - Solution

Let:

$x(t)$ = horizontal distance from the spotlight to the person (m)

$s(t)$ = height of the shadow on the wall (m)

From similar triangles:

$$\frac{s(t)}{10} = \frac{2}{x(t)} \Rightarrow s(t) = \frac{20}{x(t)}$$

Differentiate both sides:

$$\frac{ds}{dt} = -\frac{20}{x^2} \cdot \frac{dx}{dt}$$

Given:

$$x = 5 \text{ m}, \quad \frac{dx}{dt} = -1.2 \text{ m/s}$$

$$\frac{ds}{dt} = -\frac{20}{25}(-1.2) = 0.96 \text{ m/s}$$

(a) Rate of change of shadow height:

$\frac{ds}{dt} = 0.96 \text{ m/s}$

(b) Speed of the tip of the shadow:

The tip moves upward at the same rate:

0.96 m/s upward
