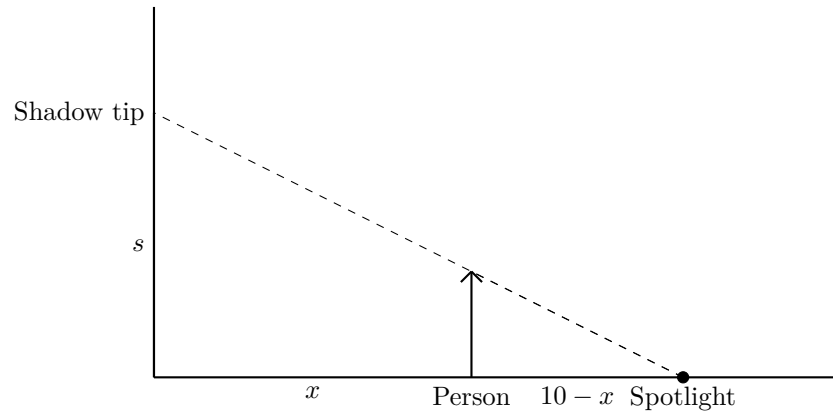


Question 7

Problem:

A spotlight is located on the ground 10 meters from a vertical wall. A person 2 meters tall walks away from the wall at a speed of 1.5 m/s. How fast is the length of their shadow on the wall increasing when the person is 6 meters from the wall?



Question 7 - Solution

Let:

- x : distance from person to wall (in m)
- s : length of the shadow on the wall (in m)
- Person's height: 2 m
- Spotlight is 10 m from the wall

Using similar triangles (person is between wall and spotlight, so spotlight-person distance is $10 - x$):

$$\frac{2}{10 - x} = \frac{s}{10} \quad \Rightarrow \quad s = \frac{20}{10 - x}$$

Differentiate with respect to t :

$$\frac{ds}{dt} = 20 \cdot \frac{d}{dt} ((10 - x)^{-1}) = 20(10 - x)^{-2} \cdot \frac{dx}{dt}$$

Substitute $x = 6$ and $\frac{dx}{dt} = 1.5$:

$$\frac{ds}{dt} = \frac{20(1.5)}{(10 - 6)^2} = \frac{30}{16} = \frac{15}{8}$$

Answer:

$\frac{ds}{dt} = \frac{15}{8} \text{ m/s}$
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 (The shadow is increasing at this rate.)