Clicker #1.

$s^2 - r^2 = 11$ Find $\frac{dr}{ds}$ when $r = 5$ and $s = 6$.

$$2s - 2r\frac{dr}{ds} = 0.$$

$$\frac{-2r}{-2r}\frac{dr}{ds} = \frac{-2s}{-2r}$$

$$\frac{dr}{ds} = s/r.$$

$$= 6/5.$$

Related rates.

- Problem Solving.
- Review of geometry.

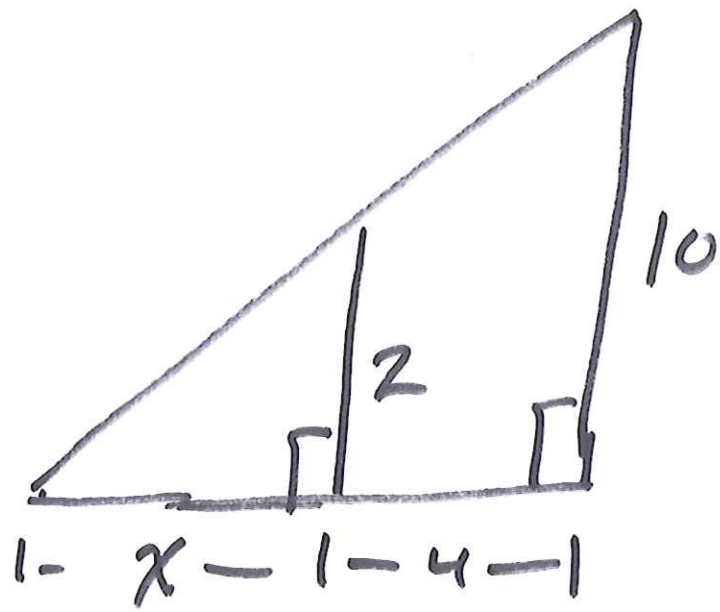
Find x

(A) 1

(B) 2

(C) 3

(D) 4



$$\frac{x+4}{x} = \frac{10}{2}$$

$$x+4 = 5x$$

$$4 = 4x$$

$$x = 1$$

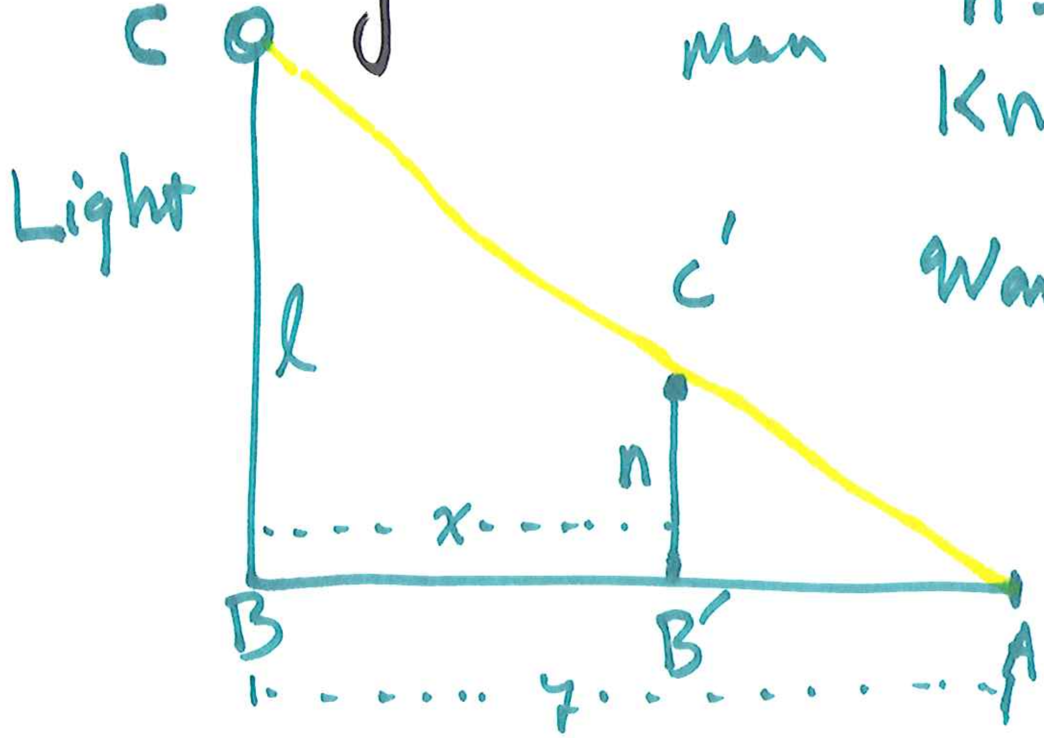
Example A man is 2 meters and is walking away from a streetlight at a rate of $0.9\ m/s$. The streetlight is 20 m tall. How fast is the tip of the man's shadow moving?

$l = 20\ m$

$n = 2\ m$

Know $\frac{dx}{dt} = 0.9$.

Want $\frac{dy}{dt}$



Similar triangles give

$$\frac{y}{l} = \frac{y-x}{n} \qquad \cancel{\frac{y}{y-x} = \frac{l}{n}.}$$

l, n are constants.

Apply $\frac{d}{dt}$ both sides

$$\frac{1}{l}\frac{dy}{dt} = \frac{1}{n}\frac{dy}{dt} - \frac{1}{n}\cdot\frac{dx}{dt}$$

$$\frac{1}{20}\frac{dy}{dt} = \frac{1}{2}\frac{dy}{dt} - \frac{1}{2}\,0.9.$$

$$\left(\frac{1}{2} - \frac{1}{20}\right)\frac{dy}{dt} = \frac{1}{2}\,0.9 = 0.45.$$

$$\frac{9}{20}\frac{dy}{dt} = \frac{9}{20}$$

$$\frac{dy}{dt} = 1.$$

The shadow moves at 1 m/s.

— Use units

— Write a sentence that answers the question.

Two roads meet at a right angle. one is north-south, the other east-west. Joe is north of the corner driving north. Elizabeth is east of the corner & driving west. ~~Wh~~ Joe is driving at a speed of 50 km/hr. E is driving at 35 km/hr. At a time when J is 2km north of the corner & E 3km east of the corner, find the rate of change of the distance between them.

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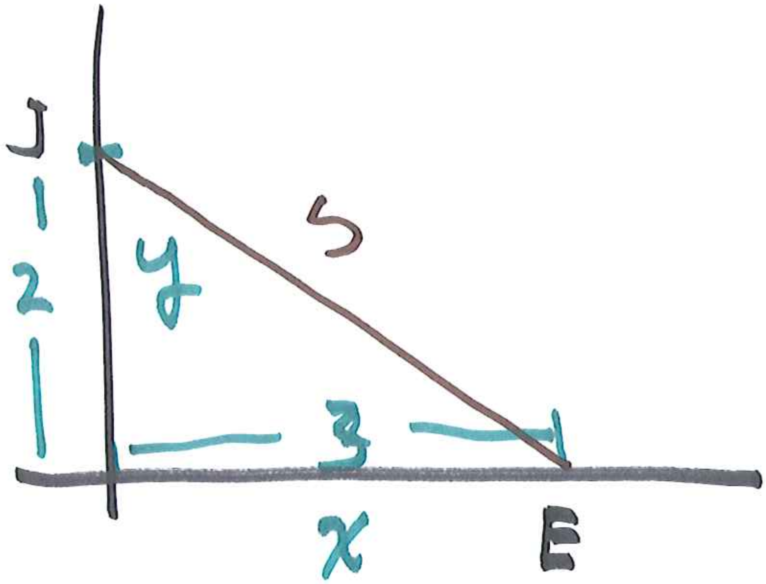

$$\frac{dx}{dt} = -35 \text{ km/hr.}$$

$$\frac{dy}{dt} = +50 \text{ km/hr.}$$

Equation relating s, x, y is

$$s^2 = x^2 + y^2$$

Differentiate

$$2s\frac{ds}{dt} = 2x\frac{dx}{dt} + 2y\frac{dy}{dt}.$$

$$\frac{ds}{dt} = \frac{1}{s}\left(3(-35) + 2 \cdot 50\right)$$

$x = 2, y = 3, \quad s^2 = 2^2 + 3^2 = 13$

$$s = \sqrt{13}.$$

$$\frac{ds}{dt} = \frac{-5}{\sqrt{13}} \text{ km/hr.}$$

Thus the distance is decreasing.