AP Calculus Related Rates HW

1. The width of a rectangle is increasing at a rate of 2 cm/sec. and its length is increasing at a rate of 3 cm/sec. At what rate is the area of the rectangle increasing when its width is 4 cm and its length is 5 cm?

Ans. $22\,\text{cm}^2/\text{sec}$

2. A police car, approaching a right-angled intersection from the north is chasing a speeding car that has turned the corner and is now moving straight east. When the police car is 0.6 mi north of the intersection and the car is 0.8 mi to the east, the police determine with a radar gun that the distance between them and the car is increasing at 20 mph. If the police car is moving at 60 mph at the instant of measurement, what is the speed of the car?

police car

speeding car
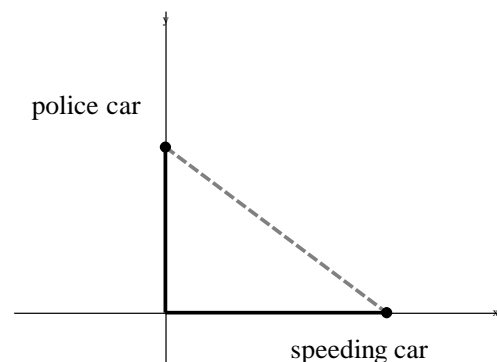
Ans. 70 mph

3. A man 6 ft tall is walking away from a spotlight (L) located on the ground. His shadow is cast on a wall 40 ft from the spotlight. If the man is walking at a rate of 4 ft per second away from the spotlight determine the rate of change of the shadow (PQ) when he is half way to the wall.

Q

B

6

L   A   P
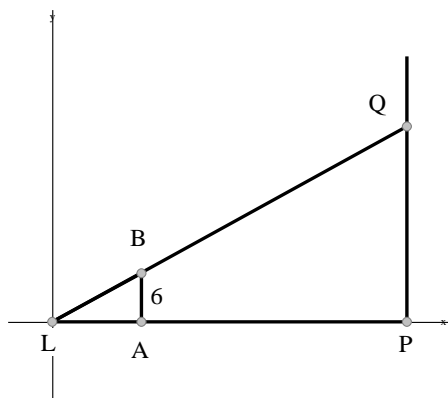
Ans. $\dfrac{-12}{5}\ \dfrac{\text{ft}}{\text{sec}}$

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10 cm

A container has the shape of an open right circular cone, as shown in the figure above. The height of the container is 10 cm and the diameter of the opening is 10 cm. Water in the container is evaporating so that its depth h is changing at the constant rate of $-\dfrac{3}{10}$ cm/hr.

10 cm
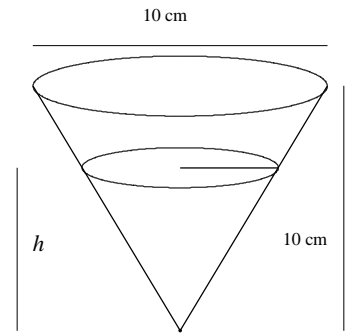
(Note: the volume of a cone of height h and radius r is given by $V = \dfrac{1}{3}\pi r^2 h$.)

(a) Find the volume V in the container when $h = 5$ cm. Indicate units of measure.

(b) Find the rate of change of the volume of water in the container, with respect to time, when $h = 5$ cm. Indicate units of measure.

(c) Show that the rate of change of the volume of water in the container due to evaporation is directly proportional to the exposed surface area of the water. What is the constant of proportionality?