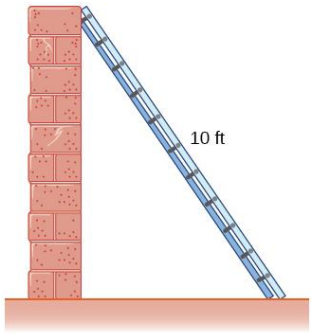
Related rates of change - Answers

For questions 1 – 10, sketch the situation if necessary and used related rates to solve for the quantities.

1. A 10-ft ladder is leaning against a wall. If the top of the ladder slides down the wall at a rate of 2 ft/sec, how fast is the bottom moving along the ground when the bottom of the ladder is 5 ft from the wall?



$2\sqrt{3}$ ft/sec

2. An airplane is flying at an altitude of 8 miles and passes over a radar station. When the airplane is 12 miles from the base of the station, the radar detects that its horizontal distance is changing at a rate of 320 mph. Find how fast the airplane is flying at this point in time.

238.51mi/h.

3. The length of a rectangle is increasing at a rate of 2 cms^{-1} while its width is decreasing at a rate of 2 cms^{-1}. When the length and width of the rectangle are 12 cm and 5 cm respectively, find the rate of change of:

(a) the area $-14cm^2s^{-1}$

(b) the perimeter 0

(c) the diagonal $\frac{14}{13}$ cms^{-1}

.

4. The volume of a cube decreases at a rate of 10 m^3/s. Find the rate at which the side of the cube changes when the side of the cube is 2 m.

$-\frac{5}{6}$ m/sec

5. The radius of a sphere decreases at a rate of 3 m/sec. Find the rate at which the surface area decreases when the radius is 10 m.

240π m^2/sec

6. The radius of a sphere is increasing at a rate of 9 cm/sec. Find the radius of the sphere when the volume and the radius of the sphere are increasing at the same numerical rate.

$\frac{1}{2\sqrt{\pi}}$ cm

7. Consider a right cone that is leaking water. The dimensions of the conical tank are a height of 16 ft and a radius of 5 ft. How fast does the depth of the water change when the water is 10 ft high if the cone leaks water at a rate of 10 ft^3/min?

The depth of the water decreases at $\frac{128}{125\pi}$ ft/min.

8. A person is standing 350 feet away from a model rocket that is fired straight up into the air at a rate of 15 ft/sec. At what rate is the distance between the person and the rocket increasing

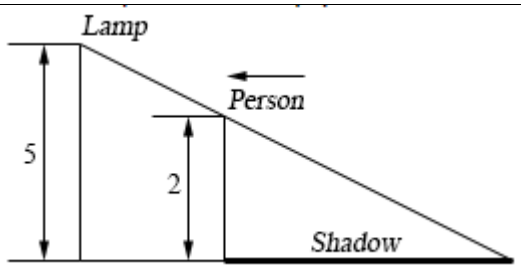
(a) 20 seconds after lift-off? 9.76187

(b) 1 minute after lift-off? 13.98007

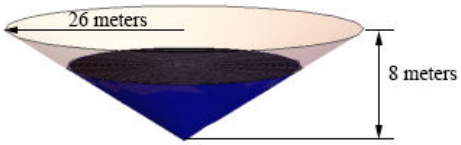
9. A light is mounted on a wall 5 meters above the ground. A 2 meter tall person is initially 10 meters from the wall and is moving towards the wall at a rate of 0.5 m/sec. After 4 seconds of moving is the tip of the shadow moving

(a) towards or away from the person and the shadow is moving towards the person at a rate of 1/3 m/s.

(b) towards or away from the wall? the shadow is moving towards the wall at a rate of 5/6 m/s



10. A tank of water in the shape of a cone is being filled with water at a rate of 12 m3/sec. The base radius of the tank is 26 meters and the height of the tank is 8 meters. At what rate is the depth of the water in the tank changing when the radius of the top of the water is 10 meters?



Not to scale

$$\frac{3}{25\pi}$$