

1. A snowball is melting such that its radius is decreasing by 0.15 cm/minute. How fast is its volume changing when the radius is 6 cm? How fast is its surface area changing at this time?
2. A 17 ft. ladder is sliding down a wall. The base of the ladder is moving away from the wall at a rate of 2 ft/second. How fast is the top of the ladder moving down the wall when the base of the ladder is 8 feet from the wall?
3. An upside-down conical tank full of water has a radius of 2 meters and a height of 6 meters. The water is being drained at a rate of 1 cubic meter per minute. What is the rate of change in the height of the water when its height is 4 meters?
4. A helicopter leaves the ground at a point 30 meters horizontally away from an observer and rises vertically at a rate of 2 m/sec. At what rate is the distance between the observer and the helicopter changing 20 seconds after the helicopter leaves the ground?
5. A spot light is on the ground 20 ft away from a wall and a 6 ft tall person is walking towards the wall at a rate of 2.5 ft/sec. How fast is the height of the shadow changing when the person is 8 feet from the wall? Is the shadow increasing or decreasing in height at this time?
6. Two people on bikes are separated by 350 m. Person A starts riding north at a rate of 5 m/sec and 7 minutes later Person B starts riding south at 3 m/sec. At what rate is the distance separating the two people changing 25 minutes after Person A starts riding?
7. Air is being evacuated from a conical tube, causing its radius to shrink at a rate of 1 mm per second but its height to remain fixed at 6 cm. Find the rate of change of the tube's volume at the moment when its volume is $800\pi \text{ cm}^3$.
8. A boat is pulled into a dock by a rope attached to the bow of the boat. The rope passes through a pulley on the dock that is 1 metre higher than the bow of the boat. If the rope is pulled in at a rate of 1 metre per second, how fast is the boat approaching the dock when it is 8 metres from the dock? Approximate your answer to two decimal places.

9. A spotlight on the ground shines on a wall 12 metres away. If a man 2 metres tall walks from the spotlight toward the building at a speed of 1.6 metres/sec, how fast is the height of his shadow on the building shrinking when he is 4 metres from the building?
10. Air is being pumped into a spherical beach ball at a rate of $648 \text{ cm}^3/\text{sec}$. Find the rate at which the beach ball's radius is increasing at the moment when its volume is $972\pi \text{ cm}^3$.
11. Jim, who is 180 cm tall, is walking towards a lamp post which is 3 metres high. The lamp casts a shadow behind him. He notices that his shadow gets shorter as he moves closer to the lamp. He is walking 2.4 metres per second.
- (a) When he is 2 metres from the lamp post, how fast is the length of his shadow decreasing?
(b) How fast is the tip of his shadow moving?