

MCV 4U1 – More Related Rates

- Two small stunt planes take off from an airport at the same time. One flies north at a speed of 300 km/h, while the other flies east at a speed of 225 km/h. How fast are the planes separating after 4 minutes?
- A passenger car approaches a railway crossing from the east at 40 km/h, while a locomotive approaches the crossing from the north at 50 km/h. How fast is the distance between them changing at the moment when the car is 30 m and the train is 40 m from the intersection?
- A rocket rising vertically is being tracked by a radar command post on the ground which is 10 km from the launch pad. How fast is the rocket rising when it is 8 km high and its distance from the radar station is increasing at a rate of 1000 km/h?
- The angle of elevation of the sun is decreasing at a rate of $\frac{1}{4}$ rad/h. How fast is the shadow cast by a 50 m building lengthening, at the moment the angle of elevation of the sun is $\frac{\pi}{4}$?
- A kite is flying 40 m above the ground and is moving horizontally at a rate of 3 m/min. At what rate is the angle between the string and the ground decreasing at the moment 80 m of string has been let out?
- A revolving beacon is situated 925 m from a straight shore. It turns at a rate of 2 rev/min.
 - How fast does the beam sweep along the shore at a point which is 1275 m away from the nearest point?
 - How fast does the beam sweep along the shore at its nearest point?
- A ladder 10 m long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a speed of 2 m/s, how fast is the angle between the top of the ladder and the wall changing at the moment the angle is $\frac{\pi}{4}$?
- A woman 2 m tall walks away from a streetlight that is 6 m high at the rate of 1.5 m/s. At what rate is her shadow lengthening when she is:
 - 3 m from the base of the light?
 - 30 m from the base of the light?
- A man 2 m tall walks at 1 m/s toward a streetlight 6 m high. How fast is his shadow shortening?
- A female pedestrian 2 m tall walks directly away from a streetlight 6 m above the ground at 80 m/min. Determine the rate of increase in the length of her shadow at the instant she is 8 m from the base of the streetlight.
- A spotlight on the ground shines on a wall 12 m away. A man 1.9 m tall walks from the spotlight toward the wall at a speed of 1.2 m/s. How fast is his shadow on the wall changing when he is 4 m from the wall?

ANSWERS

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|------------------------------|-----------------------------|--------------------------|-------------------------------|
| 1. 375 km/h | 2. -64 km/h | 3. 1601 km/h | 4. 25 m/h |
| 5. 0.01875 rad/min | 6a) 33708 m/min | 6b) 11624 m/min | 7. $\frac{\sqrt{2}}{5}$ rad/s |
| 8a) lengthening at 0.75 m/s | 8b) lengthening at 0.75 m/s | 9. shortening at 0.5 m/s | 10. 40 m/min |
| 11. shortening at 0.4275 m/s | | | |