# *Trigonometric Problem Solving*

**Objectives:** Solve applications of trigonometric function questions

Problem Solving:

- Draw a diagram, label things that change with variables.
- Match the number of variables to the number of rates in the problem.
- Determine which trig ratio to work with – you may have two choices, select the easiest one to derive.
- Put rates into the question – it's usually time: $^{d}/_{dt}$
- Solve for the moment – we usually need to solve for one piece of the puzzle on our own.

1. The beam of a lighthouse sweeps across the path of a boat cruising at a speed of 30 km/h parallel to the shoreline. If the boat is 2 km from the shore and stays within the beam of the light, at what rate is the beam revolving (in rad/h) when the boat has sailed 4 km from a point opposite the lighthouse.

2. Two sides of a triangle have lengths of 15m and 20m. The angle between them is increasing at $\frac{\pi}{90} {}^{rad}/_{s}$. How fast is the length of the third side changing when the angle between the sides is $\frac{\pi}{3}$?

3. The angle of elevation of the sun is decreasing at $\frac{1}{3}$ rad/h. How fast is the shadow cast by a tree 10 m tall lengthening when the angle of elevation of the sun is $\frac{\pi}{3}$ rad?

4. 4. A ladder 8 m long is resting against the vertical wall of a house. If the top of the ladder is sliding down the wall and the angle the ladder makes with the ground is decreasing at a rate $\frac{1}{4}$ of rad/s, how fast is the ladder sliding down the wall, when the angle is $\frac{\pi}{4}$ rad?

5. Find the maximum perimeter of a right triangle with hypotenuse 20 cm.

6. An airplane, in level flight, is approaching the spot where you are standing. The speed of the airplane is 100 m/s and it is flying at an altitude of 1000 m. What is the rate of change of the angle of elevation $q$ when the distance from where you are standing to a point directly below the plane is 2000 m?

7. A video camera at ground level is filming the liftoff of a hot-air balloon that is rising vertically according to the position equation $h = 2t$, where $h$ is in metres and $t$ is in seconds. If the camera is 100 m from the launch site, find the rate of change of the angle of elevation of the camera 5 s after liftoff.

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