4.5 Problems in Three Dimensions
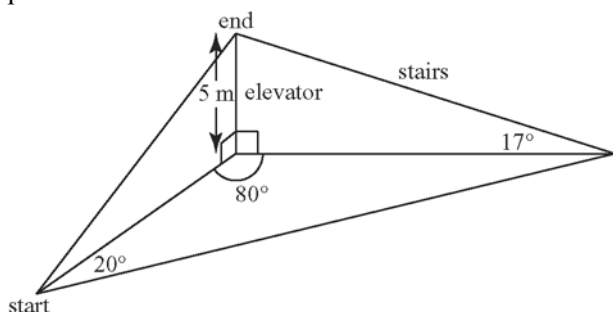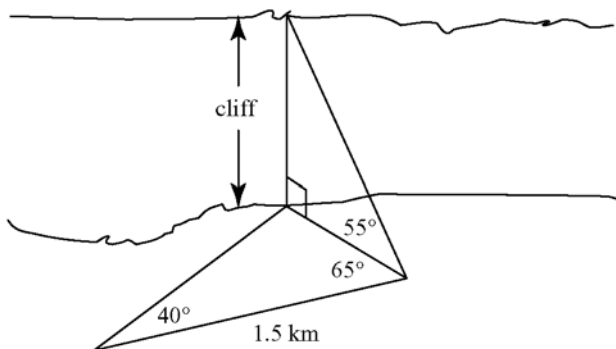
1. Adrian and Tejpal decide to determine which of two routes is faster in a shopping mall. They both agree to walk at a pace of 1 m/s as they travel the two routes. Adrian walks from the starting point to the elevator, and then takes the elevator up to the end point, just outside the doors of the elevator. The elevator travels at a speed of 0.4 m/s. Tejpal walks along a path that is 20° to the path taken by Adrian to a set of stairs that lead up to the end point.

a) Which route is faster?
b) How much faster is this route, compared to the other?

2. Surveyors are determining the height of a cliff that will be used to secure a tram car for travel into and out of the valley. They take the measurements shown. Determine the height of the cliff, to the nearest tenth of a kilometre.

3. A small private airfield is built such that the longest runway faces north toward a bank of trees. This is done in order to make the longest possible runway. From the departure end of the runway, the angle of elevation to the top of the trees is 4°. From a point 250 m perpendicular to the runway, the angle formed by the departure end of the runway and the trees is 75°.
a) Draw a diagram for this situation.
b) Determine the distance from the departure end of the runway to the trees.
c) Determine the height of the trees, to the nearest metre.

4. Alice and Brandon are playing basketball. They are standing at the centre of the court, on the centre line. At the end of the court a net is fastened to the wall at a fixed height. Alice estimates the angle of elevation of the net to be 27°. The angle formed by the net, Alice, and the centre line is 30°. The angle formed by the net, Brandon, and the centre line is 60°.
a) Draw a diagram for this situation.
b) How far away from the net is Alice?
c) What is the height of the net?

5. Jeremy is up in his tree fort, and his sisters Jessica and Janie are below, on the ground. Jessica is facing west and looks up with an angle of elevation of 38° to the tree fort. Janie is facing south and looks up with an angle of elevation of 41°. Jessica can see Janie if she turns her head 45° to the north. If Jessica and Janie are 4 m apart, what is the height of the tree fort?

6. Leonard is parasailing in the Caribbean while on vacation. He is exactly halfway between two small islands, and is 100 m in the air. His wife, Louise, is on the boat looking at Leonard. She knows that the distance from the boat to one island is 3.6 km and from the boat to the other island is 4.1 km. The angle from one of the islands to the boat and back out to the other island is 50°. Determine the angle of elevation from Louise to Leonard, to the nearest tenth of a degree.