8. Trigonometry 1 – SOH-CAH-TOA

NB There is some overlap between these questions and those on Pythagoras and the Circle.

1. In the diagram

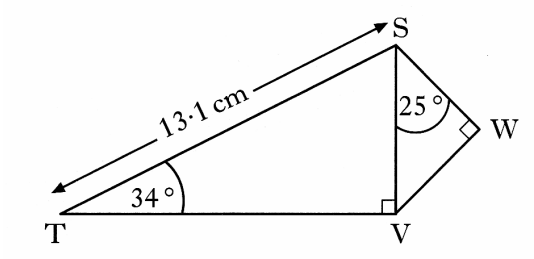
Angle STV = 34°

Angle VSW = 25°

Angle SVT = Angle SWV = 90°

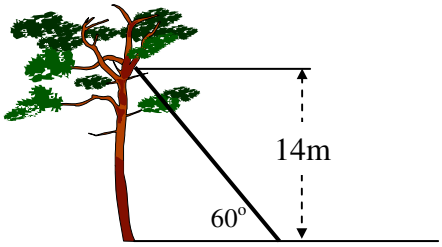
ST = 13.1 centimetres

Calculate the length of SW

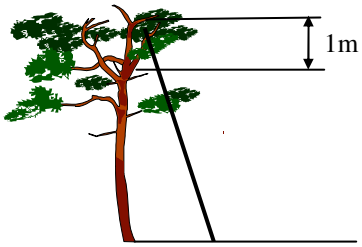


4 KU

2. A cat is trapped in a tree and a ladder is placed against the tree in an attempt to rescue it.



The ladder rests against the tree making an angle of 60^{o} with the horizontal and reaching 14 metres up the tree, allowing the rescuer to reach the cat.



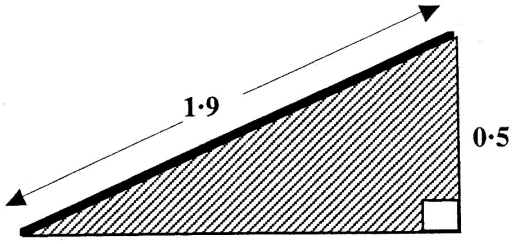
Just as the cat is about to be rescued, it jumps to a branch 1 metre above its original resting place.

Calculate the size of the angle, to the nearest degree, that the ladder now has to make with the horizontal to allow the rescuer to reach the cat.

5 RE

3. The owners of Stately Hall Manor erected an entrance ramp for disabled people at the main front entrance.

Local building regulations state that ramps must be built at an angle of **not more than** 15° to the horizontal ground.



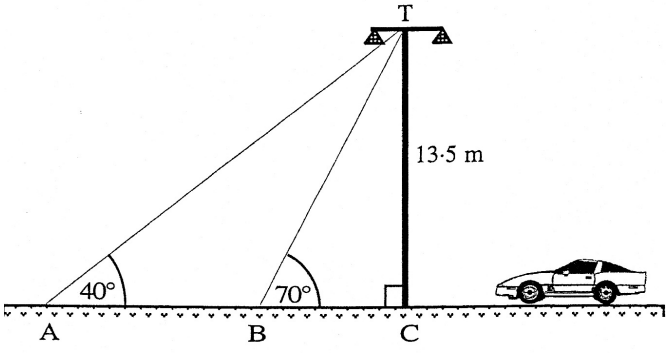
A side view of the ramp which was actually erected is shown above.

Does this ramp satisfy the local building regulations ?

You must explain your answer with mathematical reasoning.

4 RE

4. Two support cables, from the top (T) of a motorway light, are attached to a pair of points, A and B, on the ground, as shown in the diagram.



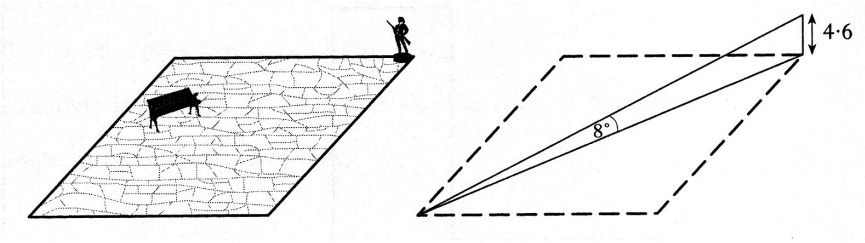
a) Calculate the distance from B to C.

2 KU

b) Calculate the distance from A to B.

3 RE

5. A statue stands at the corner of a square courtyard.



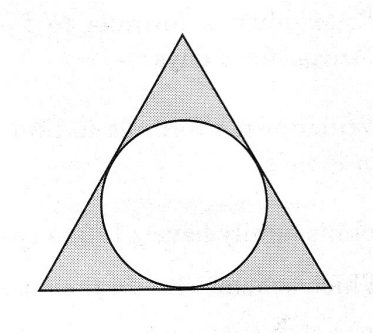
The statue is 4.6 metres high.

The angle of elevation from the opposite corner of the courtyard to the top of the statue is 8°.

a) Find the distance from the base of the statue to the opposite corner of the courtyard. 2 RE

b) Show that the length of the side of the courtyard is approximately 23 metres. 2 RE

6. The diagram shows the design of an earring.



The earring consists of a circle inside an equilateral triangle.

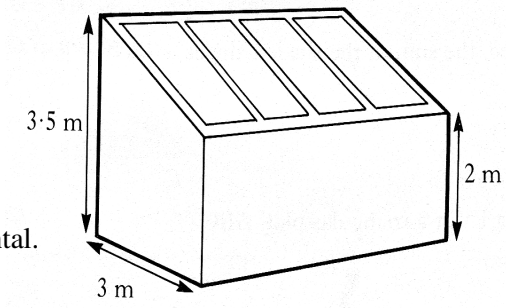
The sides of the triangle are tangents to the circle.

The radius of the circle is 8 mm

The distance from the centre of the circle to **each** vertex of the triangle is 17mm.

Calculate the perimeter of the triangle. 4 RE

7. The Scott family want to build a conservatory as shown in the diagram.



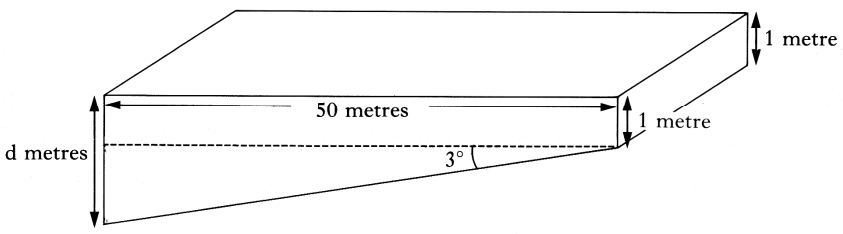
The conservatory is to be 3 metres wide.
The height of the conservatory at the lower end is to be 2 metres and at the higher end 3.5 metres.

To obtain planning permission, the roof must slope at an angle of (25 ± 2) degrees to the horizontal.

Should planning permission be granted.

Justify your answer. 4 RE

8. The diagram shows the design of a swimming pool 50 metres in length.



The pool is 1 metre deep at one end and its base slopes downwards at an angle of 3° to the horizontal.

Calculate the depth, *d* metres, of the other end of the pool, giving your answer to 2 significant figures.

Do not use a scale drawing. 5 KU

9. Trigonometry 2 – Sine, Cosine Rule, Area of Triangle

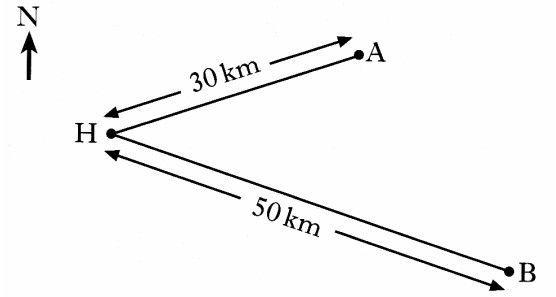
1. Two yachts leave from harbour H.

Yacht A sails on a bearing of 072° for 30 kilometres and stops.

Yacht B sails on a bearing of 140° for 50 kilometres and stops.

How far apart are the two yachts when they have both stopped?

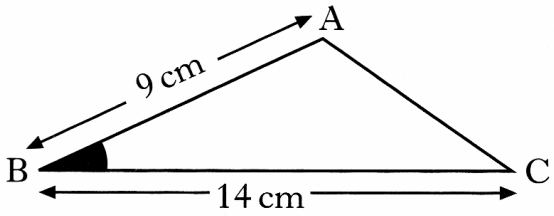
Do not use a scale drawing.



4 RE

2. The area of triangle is 38 square centimeters.

AB is 9 centimetres and BC is 14 centimetres.



Calculate the size of the acute angle ABC

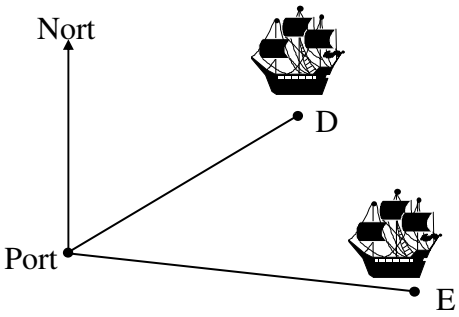
3 RE

3. Two boats leave port together.

Boat D sails on a course of 057° at 13 miles per hour.

Boat E sails on a bearing of 104° at 15 miles per hour.

After 45 minutes Boat D receives a distress call from Boat E requesting their help as soon as possible.

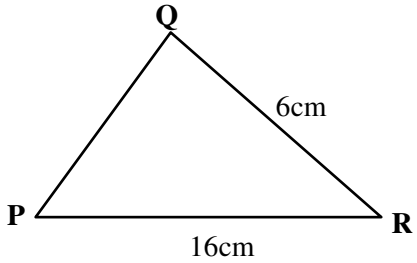


How far, to the nearest mile, would Boat D have to travel to reach Boat E?

4 RE

4. The area of the triangle shown is 36 cm^2.

Show that $\sin R = \frac{3}{4}$.

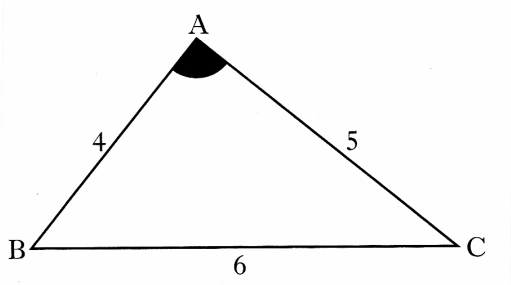


4 RE

5. In triangle ABC

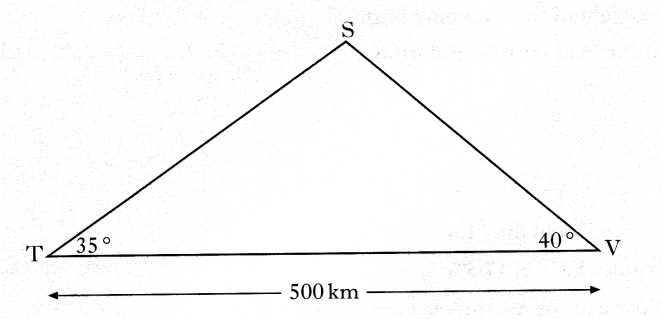
AB = 4 units
AC = 5 units
BC = 6 units

Show that $\cos A = \frac{1}{8}$



3 KU

6. A TV signal is sent from a transmitter T, via a satellite S, to a village V, as shown in the diagram.

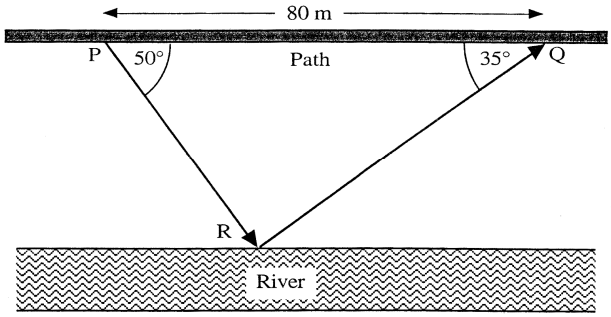


The village is 500 kilometres from the transmitter.

The signal is sent out at an angle of 35° and is received in the village at an angle of 40°.

Calculate the height of the satellite above the ground. 5 RE

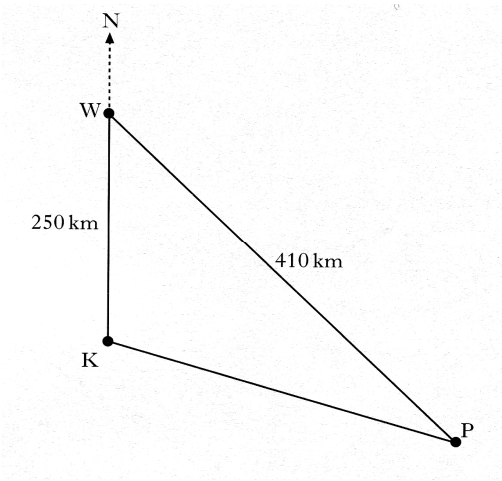
7. The path in the diagram opposite runs parallel to the river.



Jennifer leaves the path at P, walks to the river to bathe her feet at R and rejoins the path further on at Q.

Calculate the distance between the river and the path. 5 RE

8. The radio masts, Kangaroo (K), Wallaby (W) and Possum (P) are situated in the Australian outback.



Kangaroo is 250 kilometres due south of Wallaby.

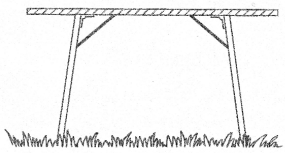
Wallaby is 410 kilometres from Possum

Possum is on a bearing of 130° from Kangaroo.

Calculate the bearing of Possum from Wallaby.

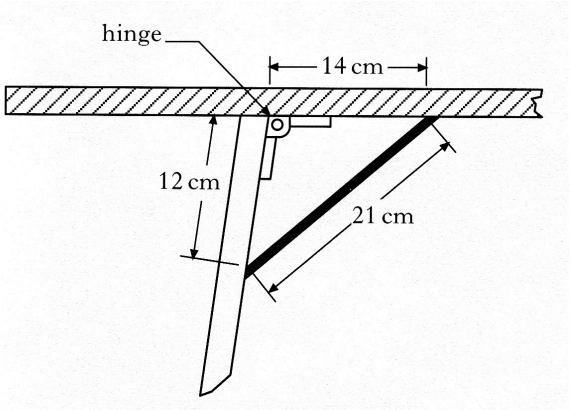
Do not use a scale drawing. 4 RE

9. Each leg of a folding table is prevented from opening too far by a metal bar.



The metal bar is 21 centimetres long.

It is fixed to the table **top** 14 centimetres from the hinge and to the table **leg** 12 centimetres from the hinge.



a) Calculate the size of the obtuse angle which the table top makes with the leg. 3 KU

b) Given that the table leg is 70 centimetres long, calculate the height of the table. 3 RE

10. A newspaper group advertises a new magazine on a helium balloon.

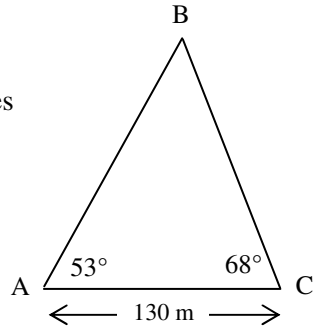
From the base of the balloon, B, two holding wires are attached to the ground at A and C.

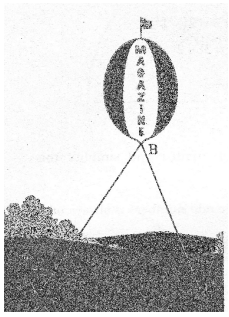
The distance from A to C is 130 metres.

From A, the angle of elevation of B is 53°.

From C, the angle of elevation of B is 68°

Calculate the height of point B above the ground.





Do not use a scale drawing 5 RE

11. The bonnet of a car is held open, at an angle of 57°, by a metal rod.

In the diagram,

PQ represents the bonnet

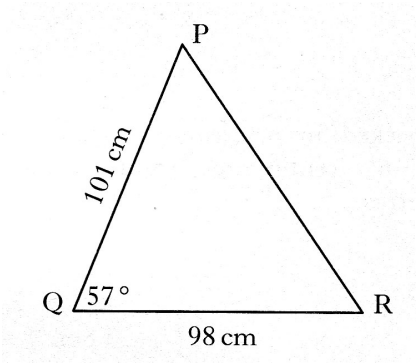
PR represents the metal rod.

QR represents the distance from the base of the bonnet to the front of the car.

PQ is 101 centimetres

QR is 98 centimetres

Calculate the length of the metal rod, PR.



Do not use a scale drawing. 4 KU

12. Triangle ABC has an area of 14 square centimetres.

AB is 6 centimetres and AC is 7 centimetres.

Calculate the possible **sizes** of angle BAC 4 RE

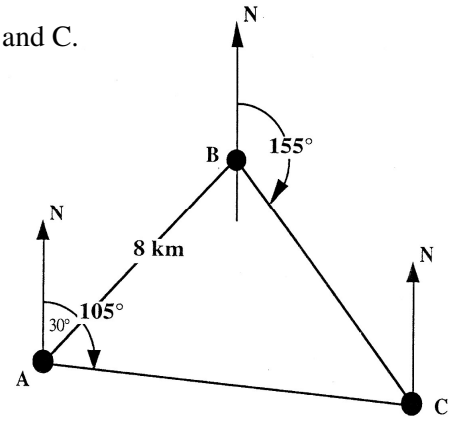
13. An orienteering course has 3 checkpoints – A, B and C.

B is on a bearing of 030° and a distance of 8 km from A.

C is on a bearing of 155° from B and a bearing of 105° from A.

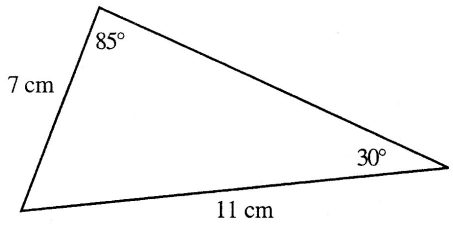
a) Explain clearly why ∠ABC = 55° 2 KU

b) Calculate the distance between points B and C.



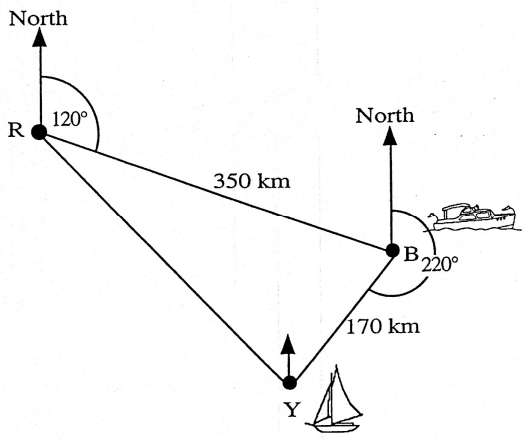
Do not use a scale drawing. 4 RE

14. Calculate the area of the triangle. 3 RE



15. A rescue boat, at R, picks up a distress call from a boat B, 350 km away, on a bearing of 120°.

At the same time another distress call comes from a yacht Y, which is 170 km away from B and on a bearing of 220° from B.



a) Prove that ∠RBY = 80° 2 KU

b) The rescue boat is obliged to respond to the nearest distress call first.

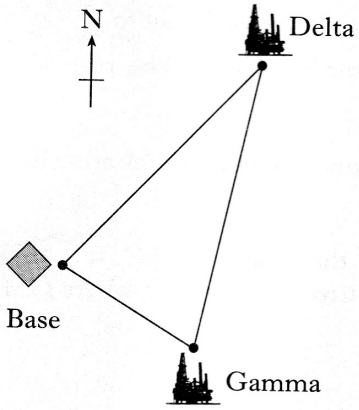
Will the people on the boat or those on the yacht be rescued first ?

(You must support your answer by showing working). 4 RE

16. The diagram shows the position of a helicopter base and two oil rigs, Delta and Gamma.

From the helicopter base, the oil rig Delta is 35 kilometres away on a bearing of 050°.

From the same base, the oil rig Gamma is 20 kilometres away on a bearing of 125°.



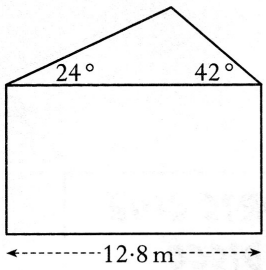
Calculate the distance between Delta and Gamma.

Do not use a scale drawing. 5 RE

17. The end wall of a bungalow is in the shape of a rectangle and a triangle as shown in the diagram.

The roof has one edge inclined at an angle of 24° to the horizontal and the other edge inclined at 42° to the horizontal.

The width of the house is 12.8 metres.

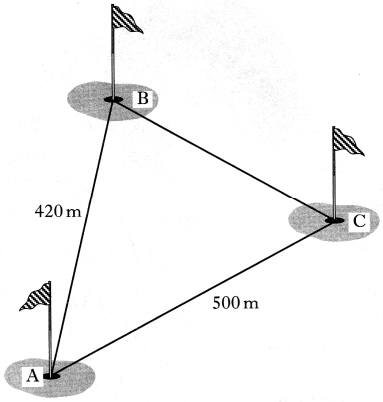


Calculate the length of the longer sloping edge of the roof.

Do not use a scale drawing. 4 KU

18. The diagram shows part of a golf course.

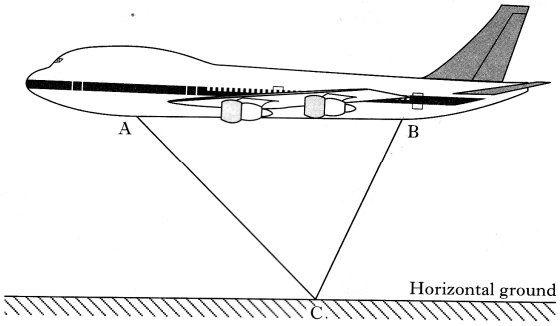
The distance AB is 420 metres, the distance AC is 500 metres and angle BAC = 52°.



Calculate the distance BC.

Do not use a scale drawing. 3 KU

19. An aeroplane is flying parallel to the ground.



Lights have been fitted at A and B as shown in the diagram.

When the aeroplane is flying at a certain height, the beams from these lights meet exactly on the ground at C.

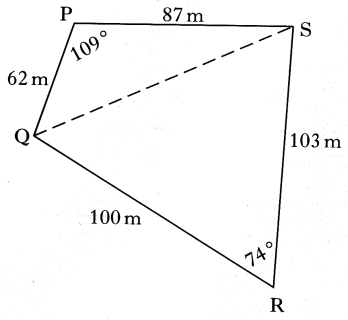
The angle of depression of the beam of light from A to C is 50°.

The angle of depression of the beam of light from B to C is 70°.

The distance AB is 20 metres.

Find the height of the aeroplane above C. 6 RE

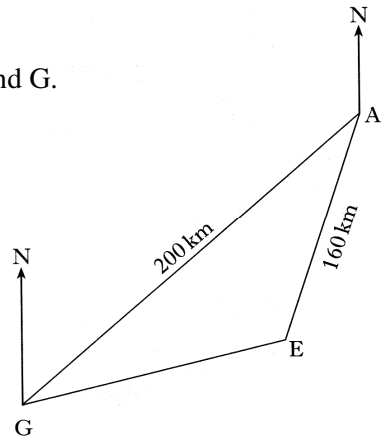
20. The sketch shows a plot of ground,



PQRS, split into two triangles.

Calculate the area of the plot of ground. 4 KU

21. The diagram shows the position of three airports, A, E and G.



G is 200 kilometres from A

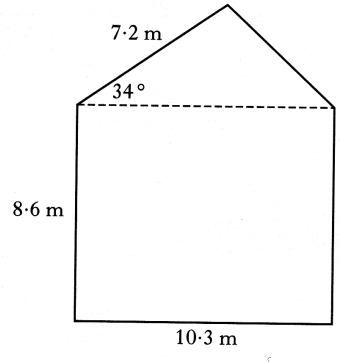
E is 160 kilometres from A

From G the bearing of A is 052°

From A the bearing of E is 216°

How far apart are airports G and E ? 6 RE

22. The side wall of a house, with measurements as shown in the diagram, requires painting.



The wall is in the shape of a rectangle and a triangle.

On average, a litre of paint will cover 8 square metres.

A painter estimates that he will require 12 litres of paint.

Will this be enough paint?

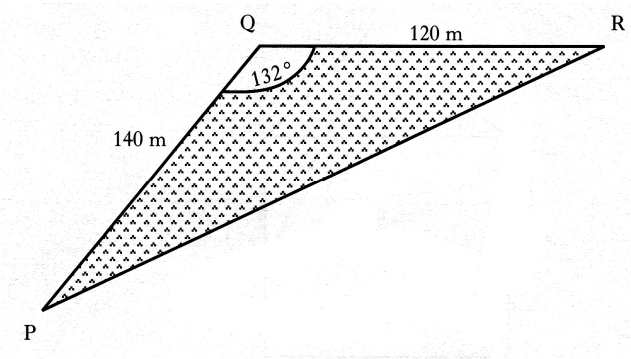
Justify your answer. 4 RE

23. A triangular field, PQR is shown in the diagram.

PQ = 140 metres,
QR = 120 metres
and angle PQR =132°

Calculate the length of PR.

Do not use a scale drawing.



4 KU

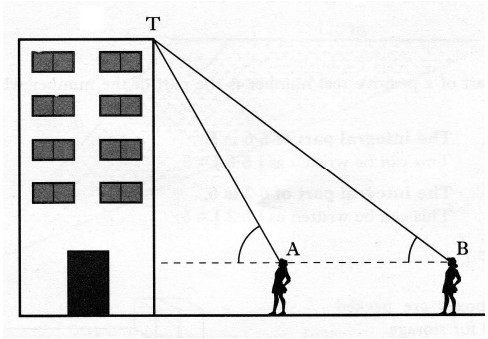
24. The diagram shows two positions of a student as she views the top of a tower.

From position B, the angle of elevation to T at the top of the tower is 64°.

From position A, the angle of elevation to T at the top of the tower is 69°.

The distance AB is 4.8 metres
and the height of the student to eye level is 1.5 metres.

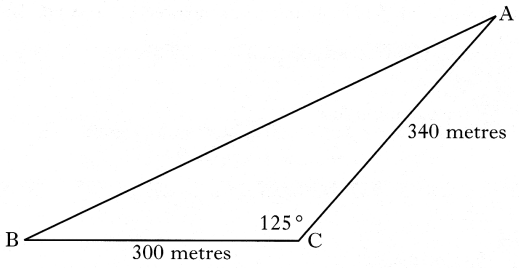
Find the height of the tower.



6 RE

25. A field, ABC, is shown in the diagram.

Find the area of the field.



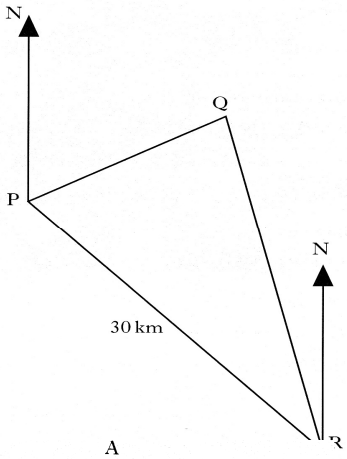
2 KU

26. A ship, at position P, observes a lighthouse at position Q on a bearing of 040°.

The ship travels 30 kilometres on a bearing of 125° to position R.

From position R, the ship observes the lighthouse on a bearing of 340°.

When the ship is at position R, how far is it from the lighthouse?



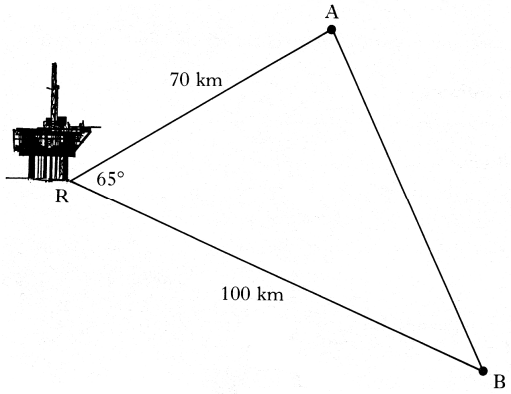
6 RE

27. The diagram shows the positions of an oilrig and two ships.

The oilrig at R is 70 kilometres from a ship at A and 100 kilometres from a ship at B. Angle ARB = 65°.

Calculate the distance AB.

Do not use a scale drawing.



4 KU