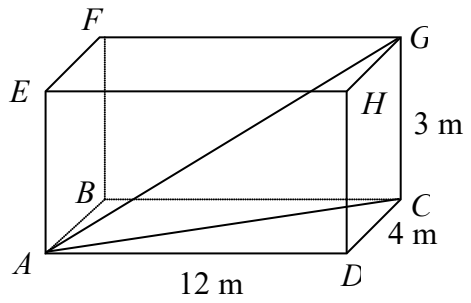
Applications of Trigonometry
Simple Three-Dimensional Problems III

1.



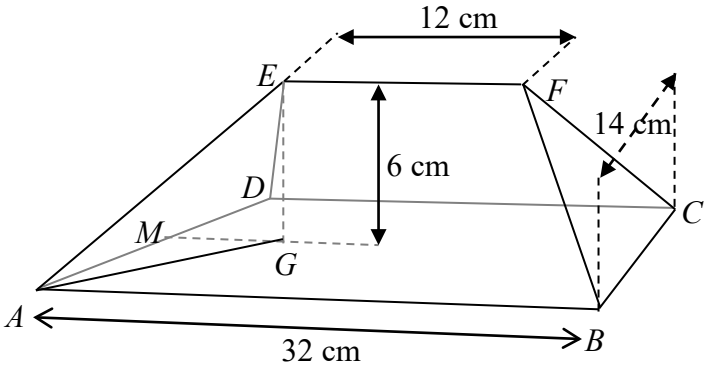
A room is 12 m long, 4 m wide and 3 m high as shown in the figure below.

(a) Find the length AC, the diagonal of the rectangular floor.

(b) Hence, find the length of AG, the line from A, a corner of the floor to G, the opposite corner of the ceiling.

(a) 12.7 m (b) 13 m

2.

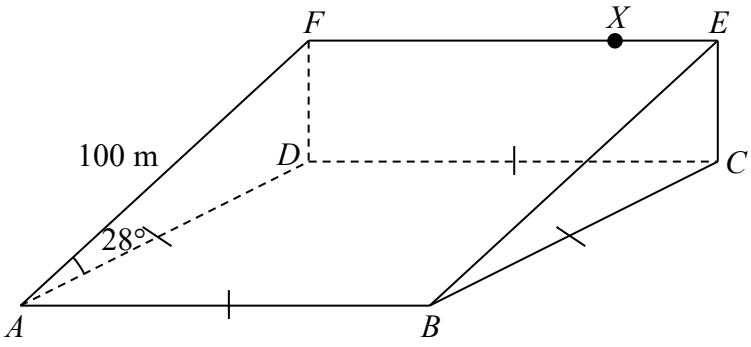


The diagram represents the roof of a house. The ridge EF is horizontal and built centrally above the flat rectangular base $ABCD$. EG is the height of the ridge above $ABCD$ and M is the midpoint of AD. Calculate

(a) the length of MG,
(b) the length of AG,
(c) $\angle EAG$,
(d) the length of BG,
(e) the length of BE.

(a) 10 cm (b) 12.2 cm (c) 26.2° (d) 23.1 cm (e) 23.9 cm

3.

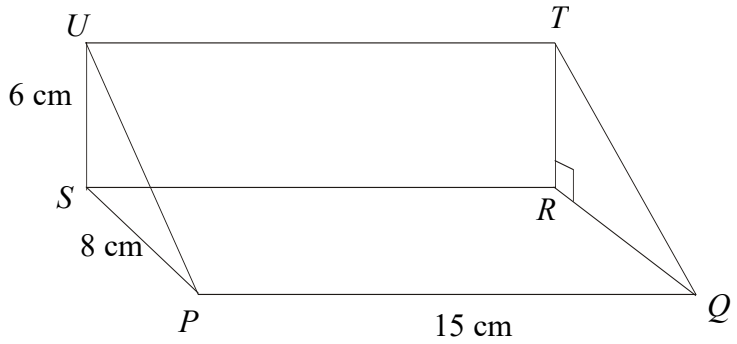


In the diagram, $ABEF$ represents the rectangular sloping surface of a ramp. $ABCD$, a square is on level ground. CE and DF are vertical lines, $\angle FAD = 28°$ and AF = 100 m. Point X is on FE such that $FE = 4XE$. Calculate

(a) FD,
(b) BC,
(c) AC,
(d) $\angle EAC$,
(e) $\angle EXB$.

(a) 46.9 m (b) 88.3 m (c) 125 m (d) 20.6° (e) 77.6°

4.



The diagram shows a triangular prism in which $\angle QRT = 90°$, $US = 6$ cm, $SP = 8$ cm and $PQ = 15$ cm. Find

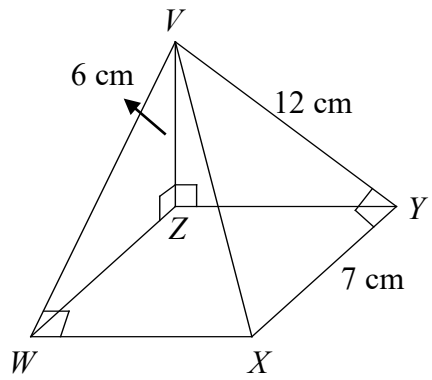
(a) the length of RP,

(b) $\angle RPT$.

(c) V is a point on TU such that $VU = VT$, find $\angle VPQ$.

(a) 17 cm (b) 19.4° (c) 53.1°

5.



The diagram shows a pyramid, $VWXYZ$. $WXYZ$ is a horizontal rectangle and VZ is vertical. Angles VZW, VZY and VYX are right angles. $VY = 12$ cm, $XY = 7$ cm and $VZ = 6$ cm.

(a) Calculate VX^2 and hence show that $\angle VWX = 90°$.

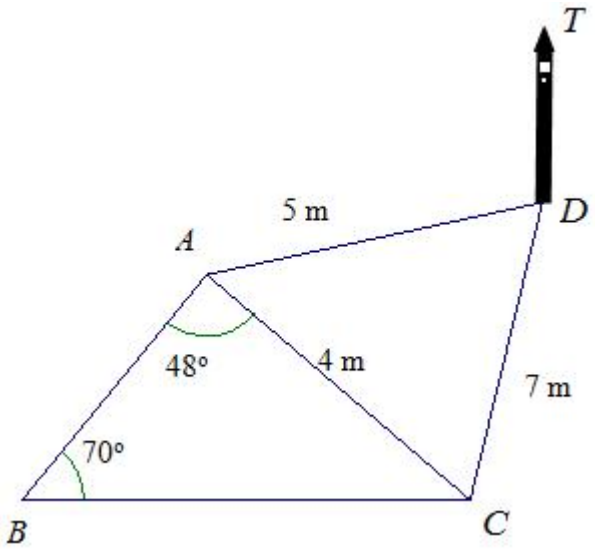
(b) Calculate the volume of the pyramid.

(c) Calculate the surface area of the pyramid.

(a) $VX^2 = 193$ (b) 146 cm^3 (c) 215 cm^2

6.

In the diagram, A, B, C and D are four points on level ground. Given that $AC = 4$ m, $AD = 5$ m, $CD = 7$ m, $\angle ABC = 70°$ and $\angle CAB = 48°$.



(a) Find the

(i) length of AB,

(ii) $\angle ACD$,

(iii) area of ΔACD,

(iv) shortest distance from D to AC.

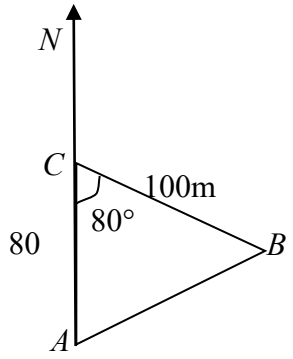
(b) A vertical tower, whose tip is T, is erected at D. Given that the angle of elevation of T from C is 55°, find the

(i) height of the tower,

(ii) the greatest angle of elevation of T, when viewed from a point along AC.

(a) (i) 3.76 m (ii) 44.4° (iii) 9.80 m^2 (iv) 4.90 m
(b) (i) 10.0 m (ii) 63.9°

7.



A, B, and C are three points on level ground such that C is due north of A. AC = 80 m, BC = 100 m and $\angle ACB = 80°$.

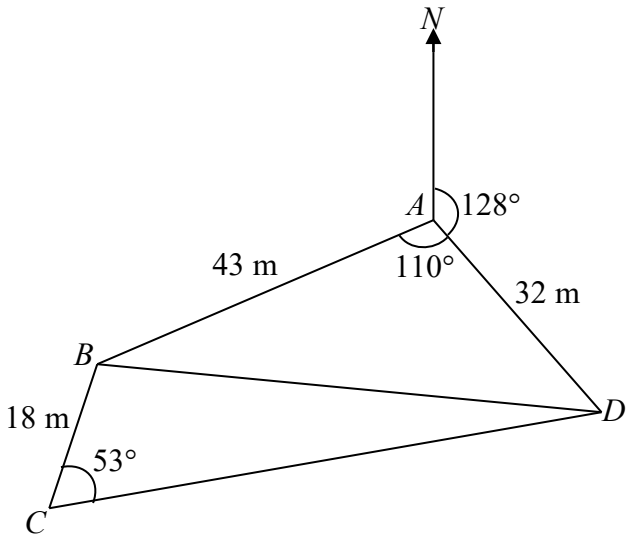
(a) Calculate
  (i) the distance AB.
  (ii) the bearing of C from B.
  (iii) the shortest distance between B and AC.

(b) A vertical mast stands at the point C and the angle of elevation of the top of the mast from point A is $18°$. Calculate the height of the mast.

(a) (i) 117 m (ii) 280° (iii) 98.5 m (b) 26 m

8.

A, B, C and D are points on horizontal ground. D is 32 m from A on a bearing of $128°$. $\angle BAC = 110°$, $\angle BCD = 53°$, $BC = 18$ m and $AB = 43$ m.

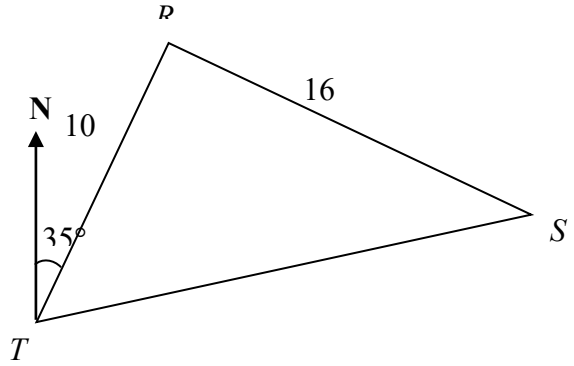


(a) Calculate
  (i) the length of BD,
  (ii) $\angle BDC$,
  (iii) the area of triangle ABD,
  (iv) the bearing of A from B.

(b) A tower of height 70 m is erected vertically at point A. Find the angle of elevation when viewed from the point B.

9.

R, S and T are points on level ground. Distance of $RS = 16$ km, $RT = 10$ km, bearing of R from T is $035°$ and bearing of R from S is $305°$.



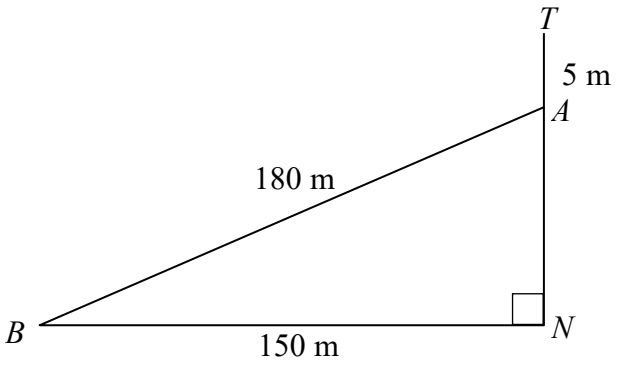
(a) Find $\angle SRT$.

(b) Calculate the shortest distance from R to ST.

(c) A bird is hovering at a height of 20 metres above point R. Calculate the greatest angle of elevation of the bird when viewed from any point on the path ST.

(a) 90° (b) 8.48 km (c) 0.135°

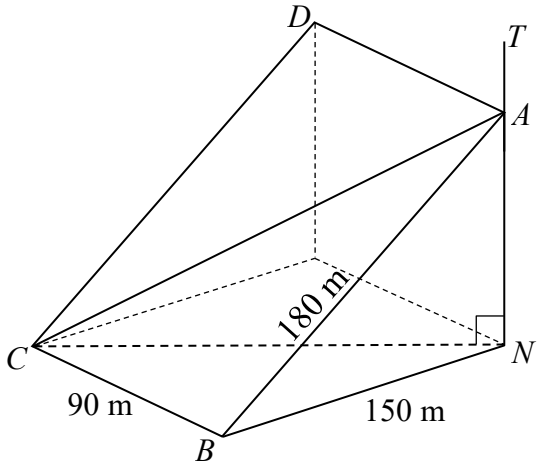
10.
The diagram shows a vertical flag pole AT of height 5 metres at the top of a hill. The slope of the hill AB is 180 metres. N lies vertically below A and BN =150 metres.



(a) Find AN, correct to the nearest whole number.

(b) Find the angle of elevation of the top of the flag pole from point B.

The diagram below shows two other points C and D, on the hill. The slope $ABCD$ is a rectangle and BC = 90 metres.

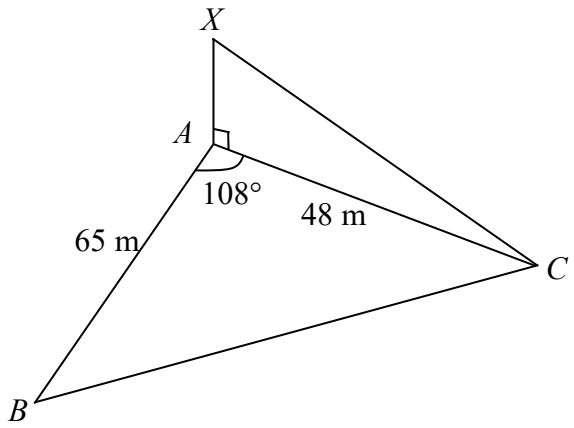


(c) A man has to walk up from C to A. The maximum angle of slope that he is capable of moving up is 30°. Determine whether or not the man is capable of walking up the slope CA.

(d) The steepness of the hill is to be reduced by removing soil from the portion $AEBCFD$. Given that angle $EBN = 25°$ and $ADFE$ is a rectangle, find the angle of slope from C to E.

(a) 99 m (b) 34.86° (c) He is capable of walking up (d) 21.8°

11.
In the diagram, ABC is a horizontal triangular field in which AB = 65 m, AC = 48 m and $\angle BAC = 108°$.



(a) Calculate
(i) the length of BC,
(ii) the area of triangle ABC,
(iii) the shortest distance from A to BC.

(b) A vertical tower XA stands at A. The angle of elevation of the top of the tower from C is 14°. Calculate the height of the tower.

(c) Calculate the greatest angle of elevation of the top of the tower when viewed from any point along BC

(a) (i) 92.0 m (3sf) (ii) 1 480 m^2 (3sf) (iii) 32.3 m (b) 12.0 m (3sf) (c) 20.4° (1dp)