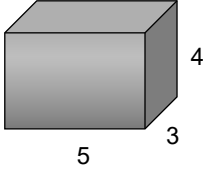
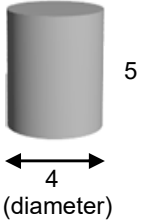
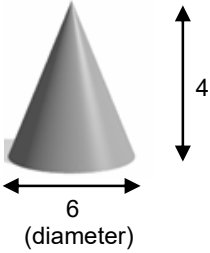
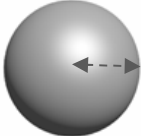


2. [Maximum mark: 16]

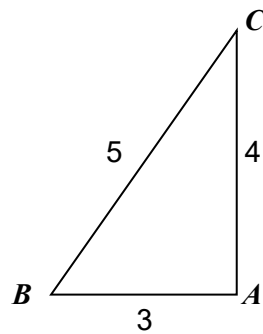
Complete the table

Solid	Volume	Surface area
<p data-bbox="352 398 445 427">cuboid</p> 		
<p data-bbox="347 779 450 808">cylinder</p> 		
<p data-bbox="363 1160 434 1189">cone</p> 		
<p data-bbox="352 1585 445 1615">sphere</p>  <p data-bbox="344 1854 450 1883">radius = 3</p>		

for each shape [1+3]

4. [Maximum mark: 16]

Consider the following right-angled triangle, where $\hat{A} = 90^\circ$



- (a) Find the size of angle \hat{B} in three different ways:
 - (i) by using the definition of $\sin \hat{B}$
 - (ii) by using the definition of $\cos \hat{B}$
 - (iii) by using the definition of $\tan \hat{B}$ [3]
- (b) **Hence** find the size of angle \hat{C} . [1]
- (c) Confirm that the **sine rule** holds. [3]
- (d) Confirm that all three versions of the **cosine rule** hold. [6]
- (e) Find the area of the triangle, by using all the three versions below:

$$Area = \frac{1}{2}ab \sin \hat{C} = \frac{1}{2}bc \sin \hat{A} = \frac{1}{2}ca \sin \hat{B} \quad [3]$$

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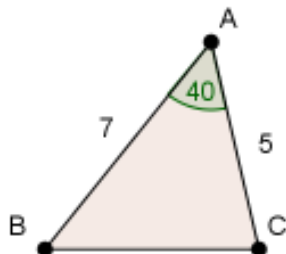
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5. [Maximum mark: 17]

In each of the following triangles one of the angles has size 40° , two of the sides have lengths 5 and 7 respectively.

(a) For the following triangle



- (i) find the area
- (ii) find BC
- (iii) find the size of B and **hence** the size of C.

[7]

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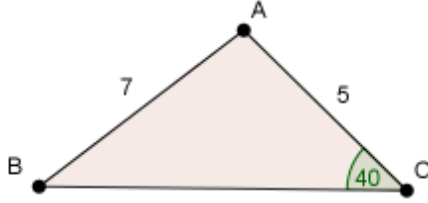
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- (b) For the following triangle find the size of B and **hence** the size of A.



[4]

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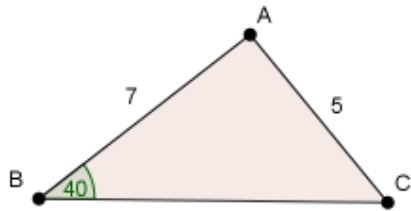
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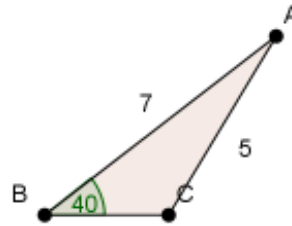
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- (c) *[This question is mainly for MAI HL – ambiguous case]*

For each of the following triangles find the size of C and **hence** the size of A.



C acute



C obtuse

[6]

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6. [Maximum mark: 6]

The following diagram shows triangle ABC.

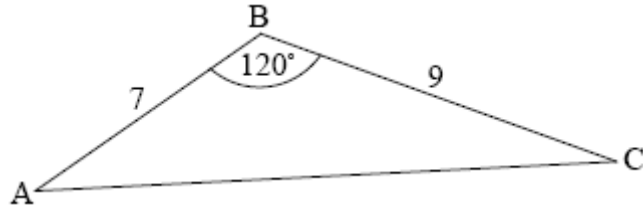


diagram not to scale

$AB = 7 \text{ cm}$, $BC = 9 \text{ cm}$ and $\hat{A}BC = 120^\circ$.

(a) Find AC.

[3]

(b) Find $\hat{B}AC$.

[3]

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7. [Maximum mark: 4]

A triangle has sides of length 4, 5, 7 units. Find, to the nearest tenth of a degree, the size of the largest angle.

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8. [Maximum mark: 4]

The following diagram shows a triangle with sides 5 cm, 7 cm, 8 cm.

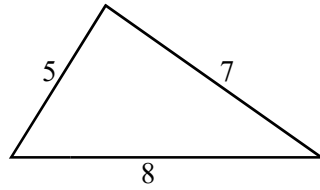


Diagram not to scale

Find

(a) the size of the smallest angle, in degrees;

[2]

(b) the area of the triangle.

[2]

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9. [Maximum mark: 6]

In the triangle PQR, PR = 5 cm, QR = 4 cm and PQ = 6 cm. Calculate

(a) the size of \hat{PQR} ;

[4]

(b) the area of triangle PQR.

[2]

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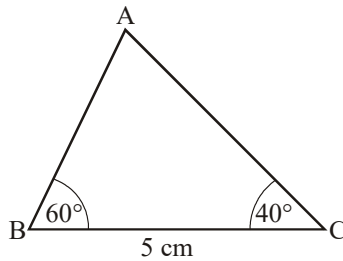
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10. [Maximum mark: 6]

The following diagram shows a triangle ABC, where $BC = 5 \text{ cm}$, $\hat{B} = 60^\circ$, $\hat{C} = 40^\circ$.



(a) Calculate AB. [3]

(b) Find the area of the triangle. [3]

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11. [Maximum mark: 6]

The diagram below shows triangle PQR. The length of [PQ] is 7 cm, the length of [PR] is 10 cm, and \hat{Q} is 75° .

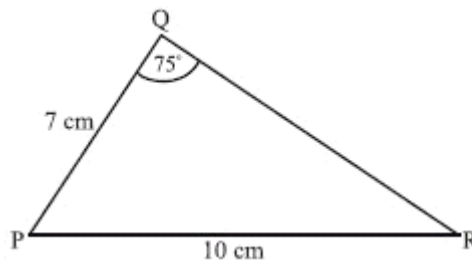


diagram not to scale

(a) Find \hat{R} . [3]

(b) Find the area of triangle PQR. [3]

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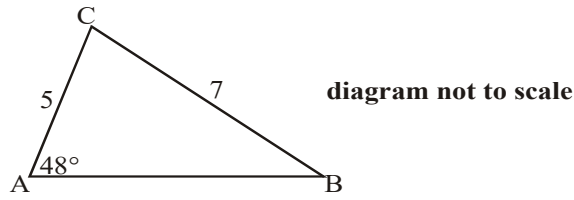
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12. [Maximum mark: 6]

In triangle ABC, $AC = 5$, $BC = 7$, $\hat{A} = 48^\circ$, as shown in the diagram.



Find \hat{B} , giving your answer correct to the nearest degree.

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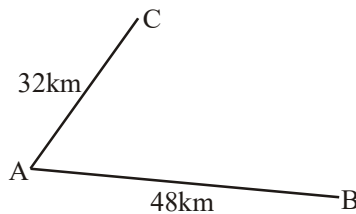
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13. [Maximum mark: 4]

Town A is 48 km from town B and 32 km from town C as shown in the diagram.



Given that town B is 56 km from town C, find the size of angle \hat{CAB} to the nearest degree.

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14. [Maximum mark: 6]

Two boats A and B start moving from the same point P. Boat A moves in a straight line at 20 km h^{-1} and boat B moves in a straight line at 32 km h^{-1} . The angle between their paths is 70° . Find the distance between the boats after 2.5 hours.

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15. [Maximum mark: 6]

In triangle PQR, PQ is 10 cm, QR is 8 cm and angle PQR is acute. The area of the triangle is 20 cm^2 . Find the size of angle $\hat{P}QR$.

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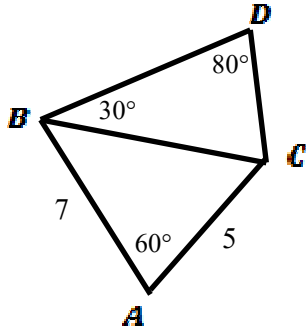
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21. [Maximum mark: 18]

Consider the following diagram



$$AB = 7$$

$$AC = 5$$

$$\hat{A} = 60^\circ$$

$$\hat{D} = 80^\circ$$

$$D\hat{B}C = 30^\circ$$

- (a) Find the length of the side BD . [5]
- (b) Find the area of the quadrilateral $ABDC$. [5]
- (c) Find the perimeter of the quadrilateral $ABDC$. [4]

It is given that the bearing of the course from B to D is 70° .

- (d) Find the bearing of the course from B to A . [4]

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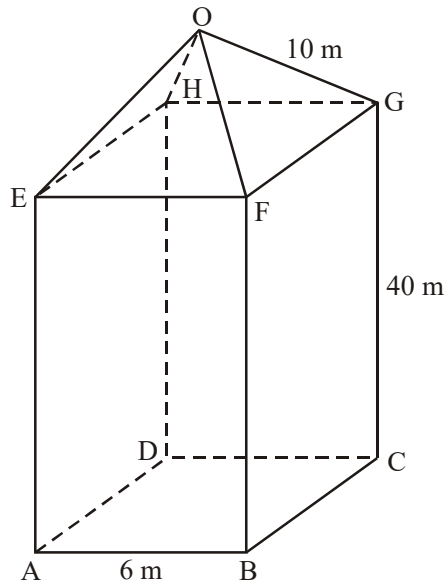
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24. [Maximum mark: 14]

An office tower is in the shape of a cuboid with a square base. The roof of the tower is in the shape of a square based right pyramid.

The diagram shows the tower and its roof with dimensions indicated. The diagram is **not** drawn to scale.



- (a) Calculate, correct to three significant figures,
- (i) the size of the angle between OF and FG; [3]
 - (ii) the shortest distance from O to FG; [2]
 - (iii) the total surface area of the four triangular sections of the roof; [3]
 - (iv) the size of the angle between the slant height of the roof and the plane EFGH; [2]
 - (v) the height of the tower from the base to O. [2]

A parrot's nest is perched at a point, P, on the edge, BF, of the tower. A person at the point A, outside the building, measures the angle of elevation to point P to be 79° .

- (b) Find, correct to three significant figures, the height of the nest from the base of the tower. [2]

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25. [Maximum mark: 15]

Three right pyramids *Andal*, *Batsu* and *Cartos* were discovered in the dense jungle of *Marhartmasol*. Each pyramid has a square base with centres A, B and C respectively.

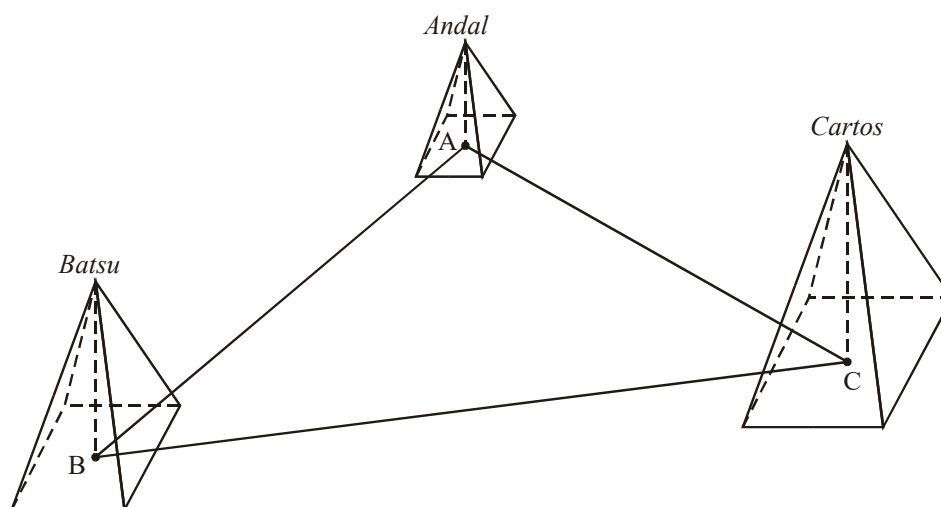


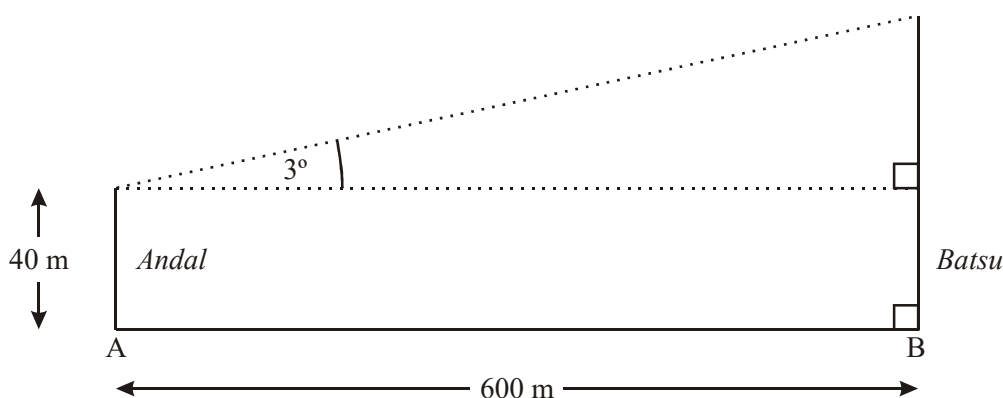
Diagram not to scale

A surveying team was lowered from a helicopter to the top of *Andal* to take measurements of the area. *Andal* is 40 metres high. The angle of elevation from the top of *Andal* to the top of *Batsu* is 3° . The horizontal distance from A, the centre of the base of *Andal*, to B, the centre of the base of *Batsu* is 600 metres.

(a) Use the diagram below to find the height of *Batsu*.

[3]

Diagram not to scale



(b) *Cartos* is found to be 92 metres high and the angle of elevation from the top of *Andal* to the top of *Cartos* is 4° .

(i) Draw a diagram similar to the diagram in part (a) to show the relationship between *Andal* and *Cartos*.

(ii) What is the horizontal distance from A to C?

[4]

26. [Maximum mark: 16]

The points P, Q, R are three markers on level ground, joined by straight paths PQ, QR, PR as shown in the diagram. QR = 9 km, $\hat{PQR} = 35^\circ$, $\hat{PRQ} = 25^\circ$.

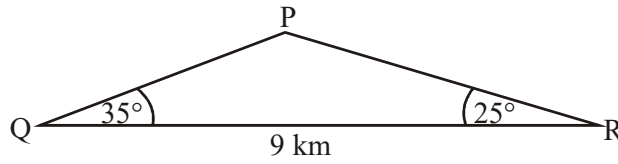
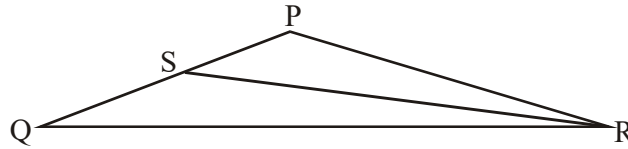


Diagram not to scale

- (a) Find the length PR. [3]
- (b) Tom sets out to walk from Q to P at a steady speed of 8 km h^{-1} . At the same time, Alan sets out to jog from R to P at a steady speed of $a \text{ km h}^{-1}$. They reach P at the same time. Calculate the value of a . [7]
- (c) The point S is on [PQ], such that $RS = 2QS$, as shown in the diagram.



Find the length QS. [6]

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27. [Maximum mark: 14]

The diagram below shows a quadrilateral ABCD with obtuse angles $\hat{A}BC$ and $\hat{A}DC$.

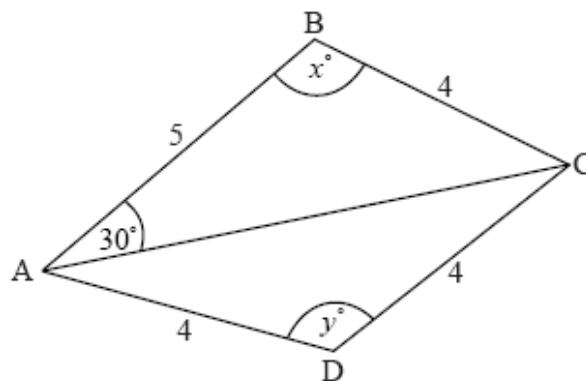


diagram not to scale

$AB = 5$ cm, $BC = 4$ cm, $CD = 4$ cm, $AD = 4$ cm, $\hat{B}AC = 30^\circ$, $\hat{A}BC = x^\circ$, $\hat{A}DC = y^\circ$.

- (a) Use the cosine rule to show that $AC = \sqrt{41 - 40 \cos x}$. [1]
- (b) Use the sine rule in triangle ABC to find another expression for AC. [2]
- (c) (i) Hence, find x , giving your answer to two decimal places.
- (ii) Find AC. [6]
- (d) (i) Find y .
- (ii) Hence, or otherwise, find the area of triangle ACD. [5]

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28. [Maximum mark: 15]

In the diagram below, the points $O(0, 0)$ and $A(8, 6)$ are fixed. The angle $\hat{O}PA$ varies as the point $P(x, 10)$ moves along the horizontal line $y = 10$.

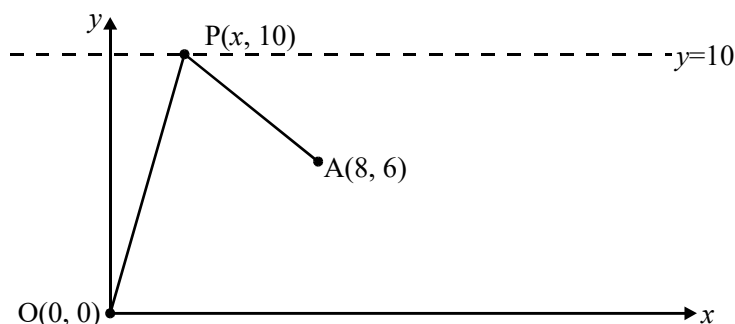


Diagram to scale

- (a) (i) Show that $AP = \sqrt{x^2 - 16x + 80}$.
 (ii) Write down a similar expression for OP in terms of x . [2]
- (b) Hence, show that $\cos \hat{O}PA = \frac{x^2 - 8x + 40}{\sqrt{\{(x^2 - 16x + 80)(x^2 + 100)\}}}$. [3]
- (c) Find, in degrees, the angle $\hat{O}PA$ when $x = 8$. [2]
- (d) Find the positive value of x such that $\hat{O}PA = 60^\circ$. [3]
- Suppose that O, A, P are collinear.
- (e) Write down the value of $\hat{O}PA$. [1]
- (f) Hence, or otherwise, find the value of x . [3]

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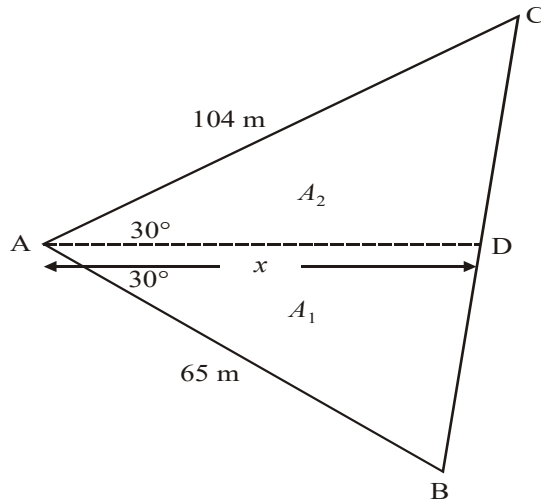
29. [Maximum mark: 10]

A farmer owns a triangular field ABC. One side of the triangle, [AC], is 104 m, a second side, [AB], is 65 m and the angle between these two sides is 60° .

(a) Use the cosine rule to calculate the length of the third side of the field. [3]

(b) Given that $\sin 60^\circ = \frac{\sqrt{3}}{2}$, find the area of the field in the form $p\sqrt{3}$ where $p \in \mathbb{Z}$.

Let D be a point on [BC] such that [AD] bisects the 60° angle. The farmer divides the field into two parts A_1 and A_2 by constructing a straight fence [AD] of length x metres, as shown on the diagram below.



(c) (i) Show that the area of A_1 is given by $\frac{65x}{4}$.
 (ii) Find a similar expression for the area of A_2 .
 (iii) **Hence**, find the value of x in the form $q\sqrt{3}$, where q is an integer. [7]

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