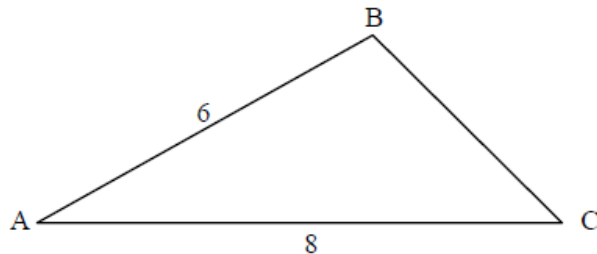


Sine and Cosine Rules *[134 marks]*

The following diagram shows triangle ABC, with $AB = 6$ and $AC = 8$.

diagram not to scale

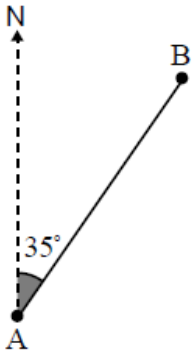


1a. Given that $\cos \hat{A} = \frac{5}{6}$ find the value of $\sin \hat{A}$. *[3 marks]*

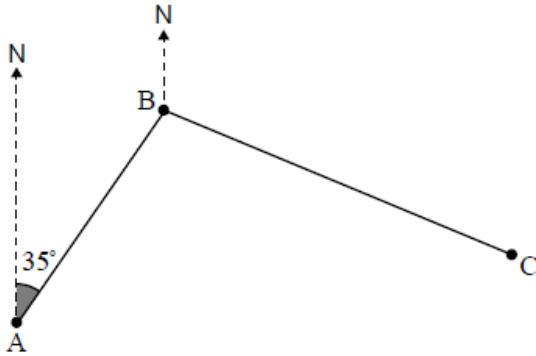
1b. Find the area of triangle ABC. *[2 marks]*

Adam sets out for a hike from his camp at point A. He hikes at an average speed of 4.2 km/h for 45 minutes, on a bearing of 035° from the camp, until he stops for a break at point B.

2a. Find the distance from point A to point B. *[2 marks]*



Adam leaves point B on a bearing of 114° and continues to hike for a distance of 4.6 km until he reaches point C.



2b. Show that \hat{ABC} is 101° . [2 marks]

2c. Find the distance from the camp to point C. [3 marks]

2d. Find \hat{BCA} . [3 marks]

Adam's friend Jacob wants to hike directly from the camp to meet Adam at point C.

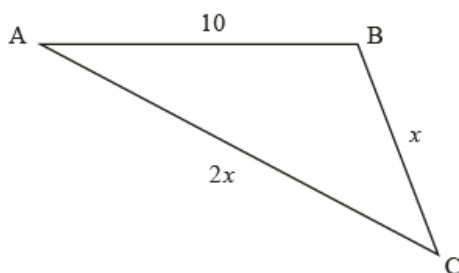
2e. Find the bearing that Jacob must take to point C. [3 marks]

2f. Jacob hikes at an average speed of 3.9 km/h. [3 marks]
Find, to the nearest minute, the time it takes for Jacob to reach point C.

3. Consider a triangle ABC , where $AC = 12$, $CB = 7$ and $\hat{BAC} = 25^\circ$. [5 marks]
Find the smallest possible perimeter of triangle ABC .

4. The following diagram shows triangle ABC , with $AB = 10$, $BC = x$ and $AC = 2x$. [7 marks]

diagram not to scale

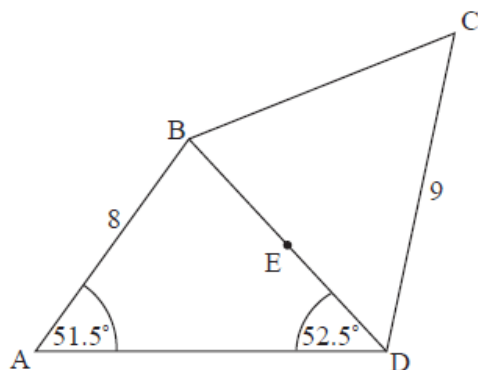


Given that $\cos \hat{C} = \frac{3}{4}$, find the area of the triangle.

Give your answer in the form $\frac{p\sqrt{q}}{2}$ where $p, q \in \mathbb{Z}^+$.

Using geometry software, Pedro draws a quadrilateral $ABCD$. $AB = 8$ cm and $CD = 9$ cm. Angle $BAD = 51.5^\circ$ and angle $ADB = 52.5^\circ$. This information is shown in the diagram.

diagram not to scale



- 5a. Calculate the length of BD .

[3 marks]

$CE = 7$ cm, where point E is the midpoint of BD .

- 5b. Show that angle $EDC = 48.0^\circ$, correct to three significant figures.

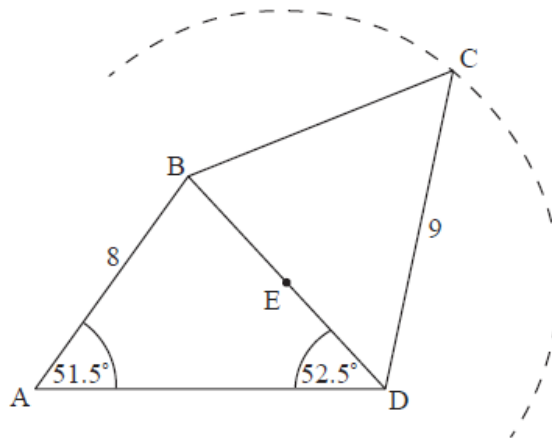
[4 marks]

- 5c. Calculate the area of triangle BDC .

[3 marks]

- 5d. Pedro draws a circle, with centre at point E , passing through point C . [5 marks]
Part of the circle is shown in the diagram.

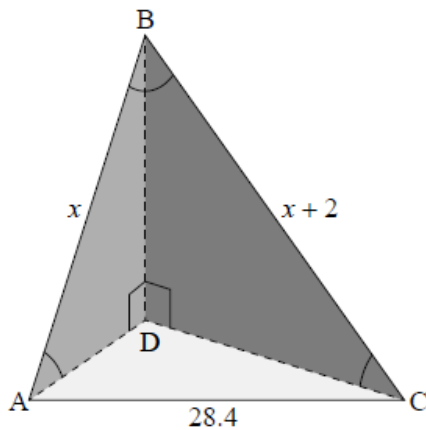
diagram not to scale



Show that point A lies outside this circle. Justify your reasoning.

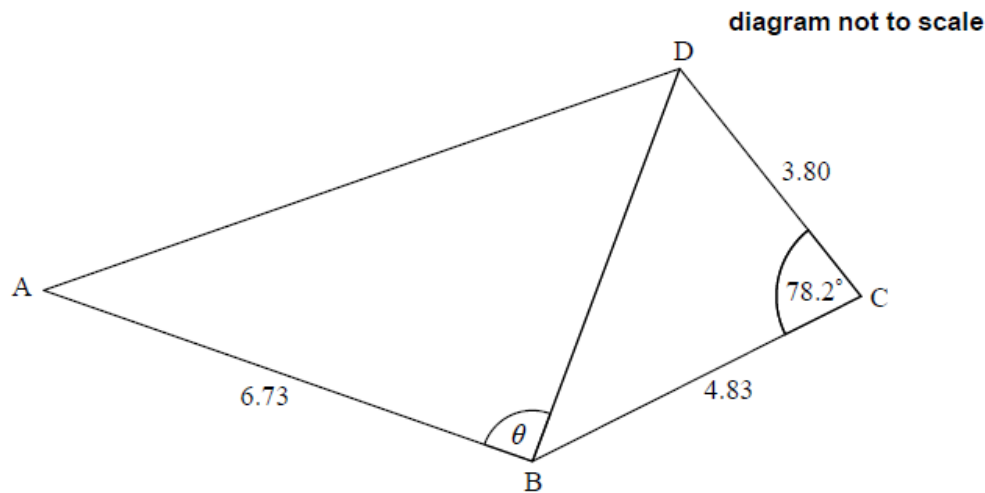
6. The diagram below shows a triangular-based pyramid with base ADC . [6 marks]
Edge BD is perpendicular to the edges AD and CD .

diagram not to scale



$AC = 28.4$ cm, $AB = x$ cm, $BC = x + 2$ cm, $\widehat{ABC} = 0.667$, $\widehat{BAD} = 0.611$
Calculate AD

The following diagram shows the quadrilateral ABCD.



$AB = 6.73$ cm, $BC = 4.83$ cm, $\hat{C} = 78.2^\circ$ and $CD = 3.80$ cm.

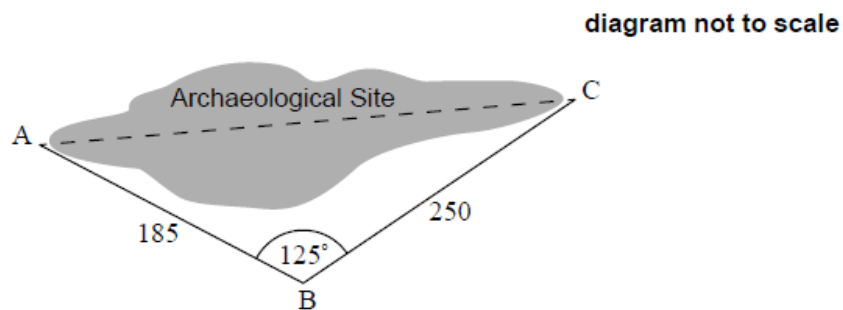
7a. Find BD.

[3 marks]

7b. The area of triangle ABD is 18.5 cm². Find the possible values of θ .

[4 marks]

An archaeological site is to be made accessible for viewing by the public. To do this, archaeologists built two straight paths from point A to point B and from point B to point C as shown in the following diagram. The length of path AB is 185 m, the length of path BC is 250 m, and angle $\hat{A}BC$ is 125° .

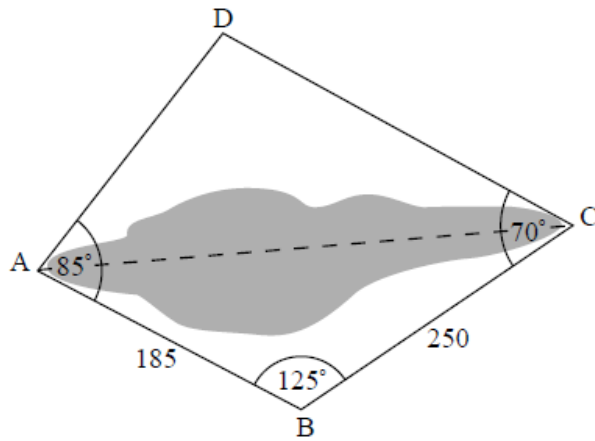


8a. Find the distance from A to C.

[3 marks]

The archaeologists plan to build two more straight paths, AD and DC. For the paths to go around the site, angle $\hat{B}AD$ is to be made equal to 85° and angle \hat{BCD} is to be made equal to 70° as shown in the following diagram.

diagram not to scale



8b. Find the size of angle $\hat{B}AC$. [3 marks]

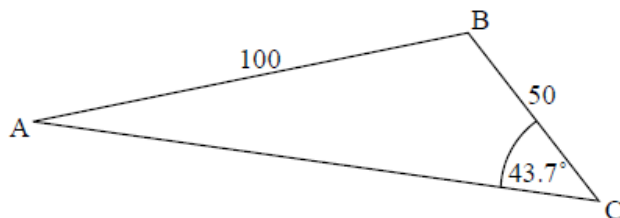
8c. Find the size of angle \hat{CAD} . [1 mark]

8d. Find the size of angle \hat{ACD} . [2 marks]

8e. The length of path AD is 287 m. [4 marks]
Find the area of the region ABCD.

A flat horizontal area, ABC, is such that $AB = 100$ m, $BC = 50$ m and angle $\hat{ACB} = 43.7^\circ$ as shown in the diagram.

diagram not to scale



9a. Show that the size of angle $\hat{B}AC$ is 20.2° , correct to 3 significant figures. [3 marks]

9b. Calculate the area of triangle ABC. [4 marks]

9c. Find the length of AC.

[3 marks]

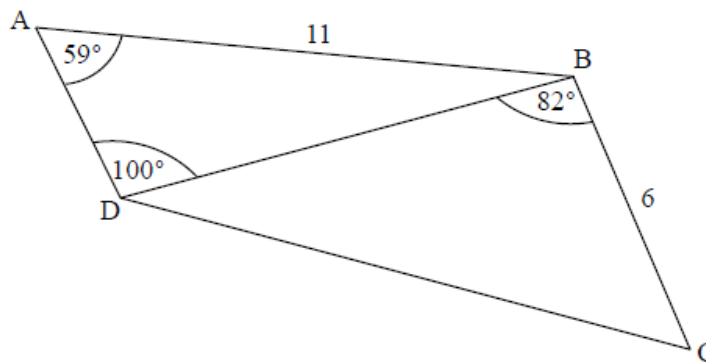
9d. A vertical pole, TB, is constructed at point B and has height 25 m.

[5 marks]

Calculate the angle of elevation of T from, M, the midpoint of the side AC.

The following diagram shows quadrilateral ABCD.

diagram not to scale



$AB = 11 \text{ cm}$, $BC = 6 \text{ cm}$, $\hat{B}A D = 100^\circ$, and $\hat{C}B D = 82^\circ$

10a. Find DB.

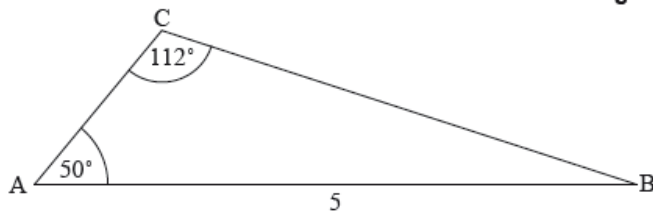
[3 marks]

10b. Find DC.

[3 marks]

The following diagram shows a triangle ABC.

diagram not to scale



$AB = 5 \text{ cm}$, $\hat{C}A B = 50^\circ$ and $\hat{A}C B = 112^\circ$

11a. Find BC.

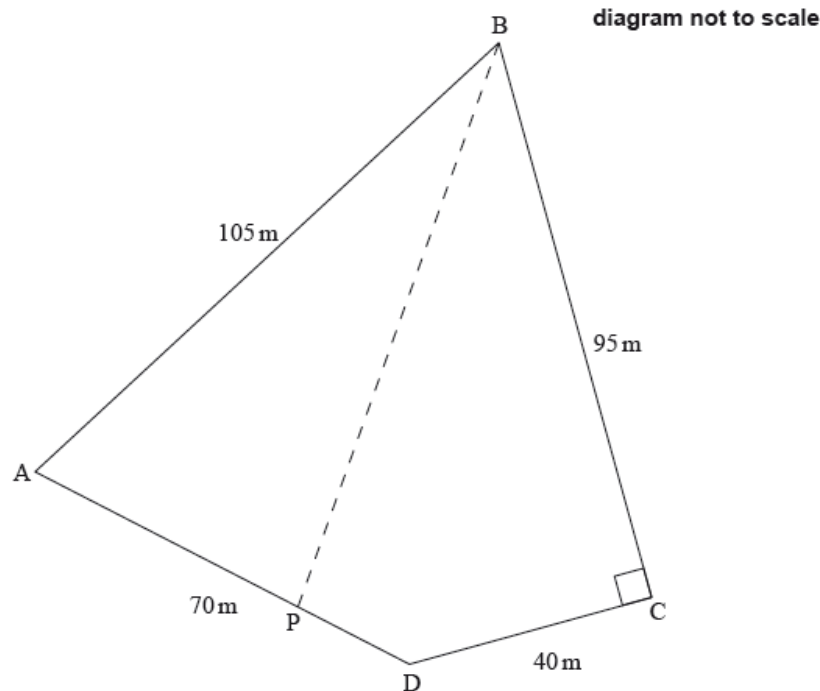
[3 marks]

11b. Find the area of triangle ABC.

[3 marks]

A farmer owns a plot of land in the shape of a quadrilateral ABCD.

$AB = 105\text{m}$, $BC = 95\text{m}$, $CD = 40\text{m}$, $DA = 70\text{m}$ and angle $DCB = 90^\circ$.



The farmer wants to divide the land into two equal areas. He builds a fence in a straight line from point B to point P on AD, so that the area of PAB is equal to the area of PBCD.

Calculate

12a. the length of BD; [2 marks]

12b. the size of angle DAB; [3 marks]

12c. the area of triangle ABD; [3 marks]

12d. the area of quadrilateral ABCD; [2 marks]

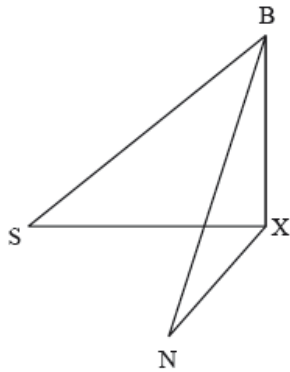
12e. the length of AP; [3 marks]

12f. the length of the fence, BP. [3 marks]

13. In triangle ABC, $AB = 5$, $BC = 14$ and $AC = 11$. [5 marks]

Find all the interior angles of the triangle. Give your answers in degrees to one decimal place.

14. Barry is at the top of a cliff, standing 80 m above sea level, and observes [6 marks] two yachts in the sea.
 "Seaview" (S) is at an angle of depression of 25° .
 "Nauti Buoy" (N) is at an angle of depression of 35° .
 The following three dimensional diagram shows Barry and the two yachts at S and N .
 X lies at the foot of the cliff and angle $SXN = 70^\circ$.



Find, to 3 significant figures, the distance between the two yachts.

- 15a. Find the set of values of k that satisfy the inequality $k^2 - k - 12 < 0$. [2 marks]

- 15b. The triangle ABC is shown in the following diagram. Given that $\cos B < \frac{1}{4}$, find the range of possible values for AB . [4 marks]

