EXAM PAPERS PRACTICE

GCSE OCR Math J560
Sine/Cos Rules &
Area of a Triangle

Answers

"We will help you to achieve A Star "

EXAM PAPERS PRACTICE

Answer 1

(b) Work out the length of the side *AB*.
Give your answer correct to 3 significant figures.

COSINE RULE

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$x^2 = 6^2 + 7^2 - 2 \times 6 \times 7 \times \cos 60$$

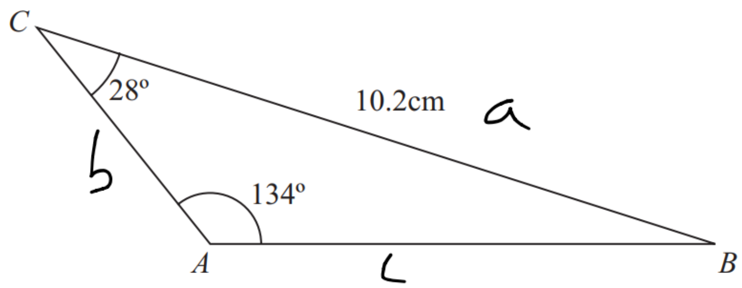
$\sqrt{\ }$ $$x = \sqrt{(6^2 + 7^2 - 2 \times 6 \times 7 \times \cos 60)}$$

$$= \underline{\underline{6.56\text{ cm}}}$$

Answer 2

The diagram shows triangle *ABC*.

Diagram **NOT** accurately drawn



Angle $BCA = 28°$
Angle $CAB = 134°$
$BC = 10.2$ cm.

Calculate the length of *AB*.
Give your answer correct to 3 significant figures.

Sine rule $\frac{a}{\sin(A)} = \frac{b}{\sin(B)}$

$\frac{10.2}{\sin(134)} = \frac{b}{\sin(28)}$ $\therefore$ $b = \frac{\sin(28) \times 10.2}{\sin(134)} = 6.6546\ldots \approx \underline{6.66}$

$\underline{6.66}$ cm

Answer 3

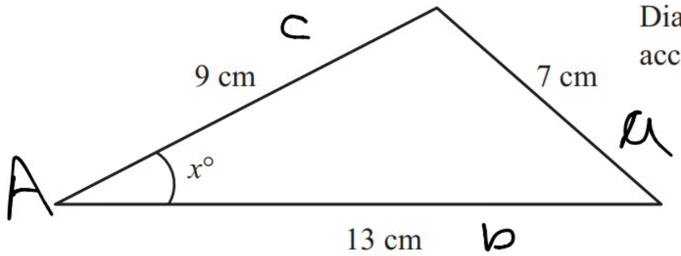


Diagram **NOT** accurately drawn

Calculate the value of x.
Give your answer correct to 1 decimal place.

cosine rule $a^2 = b^2 + c^2 - 2bc\cos(A)$

$7^2 = 9^2 + 13^2 - 2(9)(13)\cos(A)$

$234\cos(A) = 201$

$\cos A = \frac{201}{234}$ $A \approx 30.8°$

$x =$ 30.8°

Answer 4

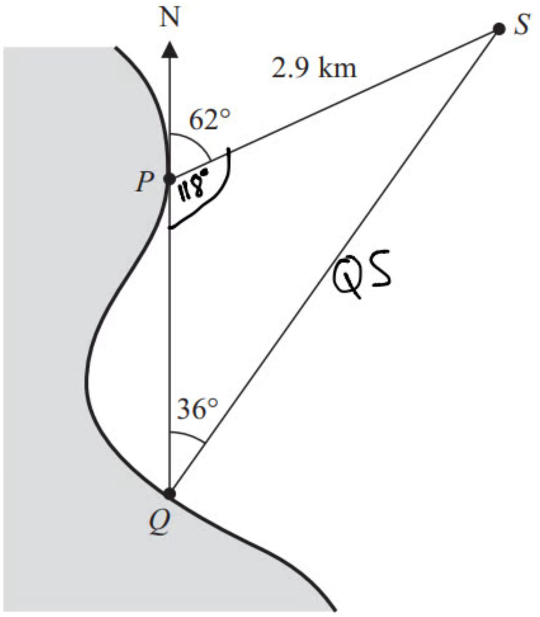


Diagram **NOT** accurately drawn

P and *Q* are two points on a coast.
P is due North of *Q*.
A ship is at the point *S*.
PS = 2.9 km.
The bearing of the ship from *P* is 062°
The bearing of the ship from *Q* is 036°

Calculate the distance *QS*.
Give your answer correct to 3 significant figures.

Angles on a straight line add to 180 degrees

$$\therefore \angle QPS = 180 - 62^\circ$$

Applying the sine rule :

$$\frac{PS}{\sin(118)} = \frac{2.9}{\sin 36}$$

$$PS = \frac{2.9}{\sin(36)} \times \sin(118) = 4.36\ldots$$
$$\approx 4.36 \text{ (3sf)}$$

4.36 km

Answer 5

The diagram shows a metal plate.

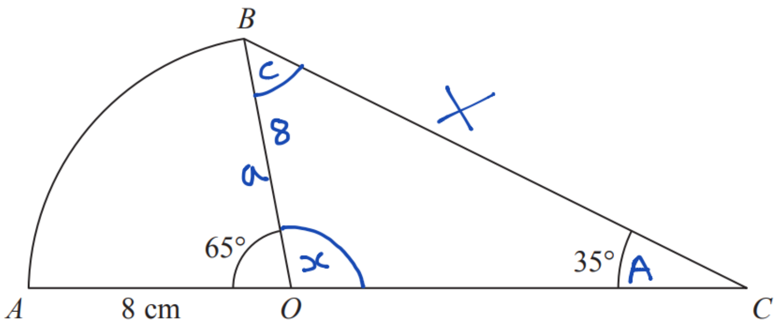


Diagram **NOT** accurately drawn

The metal plate is made from a sector OAB of a circle, centre O, and a triangle OCB.

Angle $AOB = 65°$ Angle $OCB = 35°$
$OA = OB = 8$ cm.
AOC is a straight line.

(a) Calculate the length of BC.
Give your answer correct to 3 significant figures.

Angles on a straight line sum to 180
x + 65 = 180
x = 115

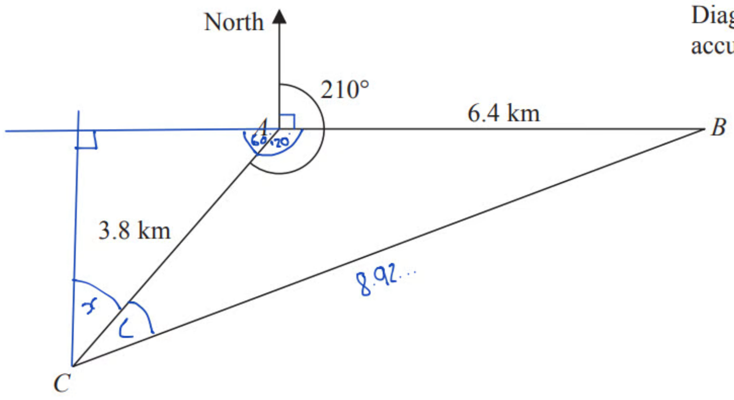
Apply sine rule

$\frac{a}{\text{Sin(A)}} = \frac{BC}{S} \rightarrow \frac{8}{\text{Sin(35)}} \times \text{Sin(115)} = BC =$

12.6 cm

Answer 6

Diagram **NOT** accurately drawn



A, *B* and *C* are 3 villages.
B is 6.4 km due east of *A*.
C is 3.8 km from *A* on a bearing of 210°

Calculate the bearing of *B* from *C*.
Give your answer correct to the nearest degree.
Show your working clearly.

Angle CAB = 210 - 90 = 120

Using the cosine rule to find the length of BC : $BC^2 = AC^2 + AB^2 - 2\ AC\ AB \cos(CAB)$

$BC = \sqrt{3.8^2 + 6.4^2 - 2(6.4)(3.8)(\cos(120))} = \sqrt{79.72} = 8.92\ldots$

Using the sine rule to find ACB :

$\dfrac{\text{Sin}(c)}{6.4} = \dfrac{\sin(\text{ACB})}{8.92\ldots}$

$C = \arcsin\left(\dfrac{\sin(120) \times 6.4}{8.92\ldots}\right) = 38.4$ degrees

The bearing of b from c is x + the angle c

X = 90-60 = 30 for diagram

30 + 38.4 = 68.4

68 °

Answer 7

The diagram shows triangle *LMN*.

NON RIGHT ANGLED TRIANGLE

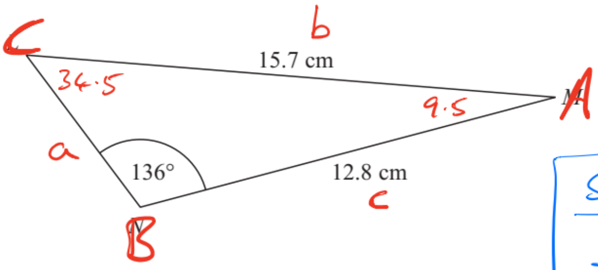


Diagram **NOT** accurately drawn

SINE RULE

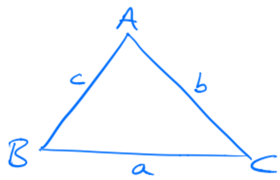
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

COSINE RULE

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

AREA

$$\text{AREA} = \tfrac{1}{2}ab\sin C$$



Calculate the length of *LN*.
Give your answer correct to 3 significant figures.

$$\frac{\sin C}{c} = \frac{\sin B}{b}$$

$$12.8 \times \frac{\sin C}{12.8} = \frac{\sin 136}{15.7} \times 12.8$$

$$\sin C = \frac{\sin 136 \times 12.8}{15.7}$$

$$C = \sin^{-1}\left(\frac{\sin 136 \times 12.8}{15.7}\right)$$

$$C = \underline{34.5^\circ}$$

$$A = 180 - 136 - 34.5 = \underline{9.504^\circ...}$$ (IN THE ANS MEMORY)

$$\frac{a}{\sin A} = \frac{b}{\sin B}$$

$$\sin 9.5 \times \frac{a}{\sin 9.5} = \frac{15.7}{\sin 136} \times \sin 9.5$$

ANS

$$a = \frac{15.7 \times \sin 9.5}{\sin 136} = \underline{3.73\text{ cm}}$$

.... cm

Answer 8

ABC is a triangle.

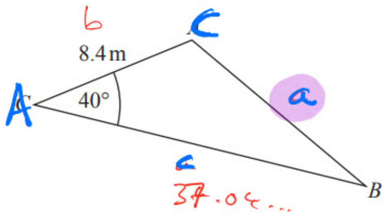


Diagram **NOT** accurately drawn

$AC = 8.4\text{ m}$
Angle $ACB = 40°$

The area of the triangle = 100 m^2.

Work out the length of AB.
Give your answer correct to 3 significant figures.
You must show all your working.

SINE RULE

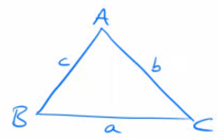
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

COSINE RULE

$$a^2 = b^2 + c^2 - 2bc \cos A$$

AREA

$$\text{AREA} = \tfrac{1}{2}ab\sin C$$



$$\text{AREA} = \tfrac{1}{2}ab\sin C$$

$$\frac{100}{\frac{1}{2}\times 8.4\times\sin 40} = \frac{\cancel{\frac{1}{2}}\times a\times \cancel{8.4}\times\cancel{\sin 40}}{\cancel{\frac{1}{2}}\times\cancel{8.4}\times\cancel{\sin 40}}$$

$$a = \frac{100}{\frac{1}{2}\times 8.4\times\sin 40}$$

$$a = 37.04\ldots$$

(IN THE Ans MEMORY)

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$BC^2 = 8.4^2 + \text{Ans}^2 - 2\times 8.4\times \text{Ans}\times\cos 40$$

$$\sqrt{}$$

$$BC = \sqrt{8.4^2 + \text{Ans}^2 - 2\times 8.4\times\text{Ans}\times\cos 40}$$

$$= 31.07\ldots$$

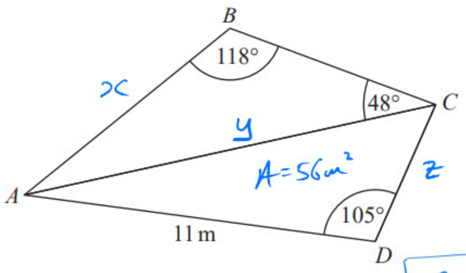
≥ 5 SO ROUND UP

$$= \underline{\underline{31.1}}\text{ m}$$

EXAM PAPERS PRACTICE

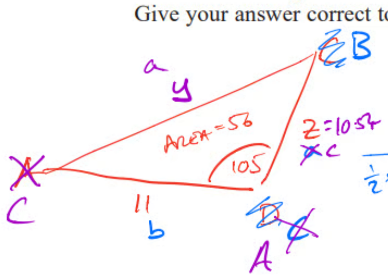
Answer 9

ABC and *ADC* are triangles.



The area of triangle *ADC* is 56 m²

Work out the length of *AB*.
Give your answer correct to 1 decimal place.



AREA = $\frac{1}{2}ab\sin C$

$$\frac{56}{\frac{1}{2}\times 11\times \sin 105} = \frac{\cancel{\frac{1}{2}}\times z\times \cancel{11\times \sin 105}}{\cancel{\frac{1}{2}\times 11\times \sin 105}}$$

$$z = \frac{56}{\frac{1}{2}\times 11\times \sin 105}$$

$$= 10.54\ldots \rightarrow \boxed{\text{Ans}}$$

SINE RULE

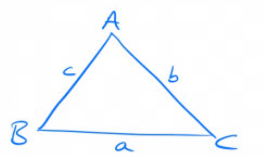
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

COSINE RULE

$$a^2 = b^2 + c^2 - 2bc\cdot\cos A$$

AREA

AREA = $\frac{1}{2}ab\sin C$



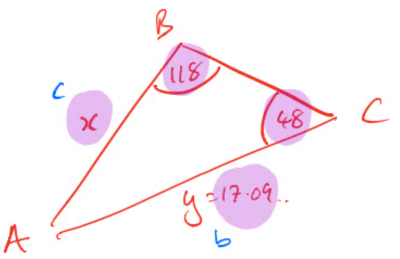
COSINE RULE

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$y^2 = 11^2 + \text{Ans}^2 - 2\times 11\times \text{Ans}\times\cos 105$$

$$y = \sqrt{11^2 + \text{Ans}^2 - 2\times 11\times \text{Ans}\times \cos 105}$$

$$= 17.09\ldots \rightarrow \boxed{\text{Ans}}$$



SINE RULE

$$\frac{c}{\sin C} = \frac{b}{\sin B}$$

$$\cancel{\sin 48}\times \frac{x}{\cancel{\sin 48}} = \frac{\text{Ans}}{\sin 118}\times \sin 48$$

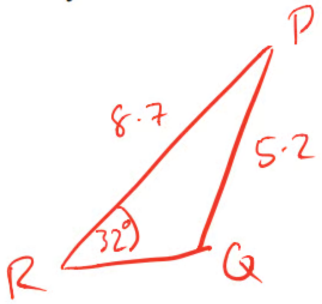
$$x = \frac{\text{Ans}\times \sin 48}{\sin 118}$$

.... m

$x = 14.3856\ldots = 14.4\text{ m}$

Answer 10

(b) If you did not know that angle PQR is an acute angle, what effect would this have on your calculation of the area of triangle RPQ?



WE WOULD HAVE TO THINK ABOUT TWO DIFFERENT TRIANGLES - SO TWO DIFFERENT AREAS

Answer 11

ABCD is a parallelogram.

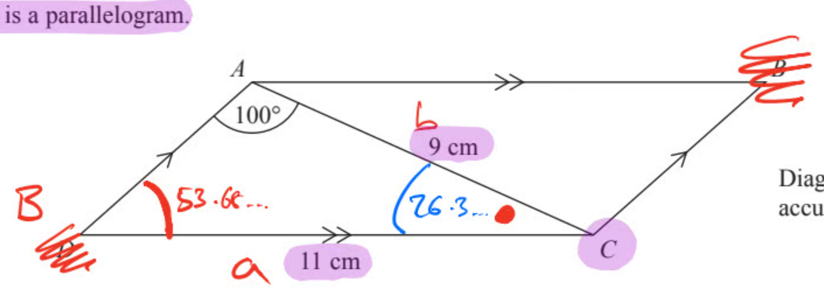


Diagram **NOT** accurately drawn

$AC = 9$ cm
$DC = 11$ cm
Angle $DAC = 100°$

Calculate the area of the parallelogram.
Give your answer correct to 3 significant figures.

SINE RULE

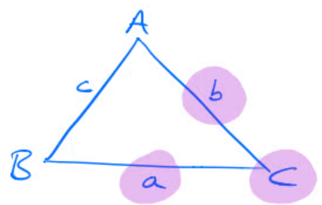
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

COSINE RULE

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

AREA

$$\text{AREA} = \tfrac{1}{2}ab\sin C$$



$$\frac{\sin B}{b} = \frac{\sin A}{a}$$

$$9 \times \frac{\sin B}{9} = \frac{\sin 100}{11} \times 9$$

$$\sin B = \frac{9\sin 100}{11}$$

$$B = \sin^{-1}\left(\frac{9\sin 100}{11}\right)$$

"SHIFT sin"

$$= 53.68\ldots$$

$\boxed{\text{ANS}}$

$$C = 180 - 100 - 53.68\ldots$$

$$= 26.317\ldots \rightarrow \boxed{\text{ANS}}$$

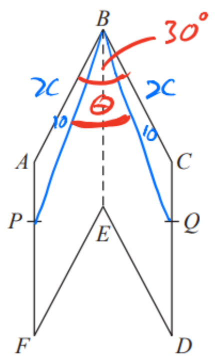
$$\text{AREA OF } \Delta = \tfrac{1}{2} \times 11 \times 9 \times \sin 26.317\ldots$$

THEN $\times 2$ FOR AREA OF PARALLELOGRAM

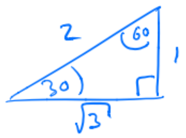
$$\boxed{43.9\text{ cm}^2}$$

Answer 12

The diagram shows a hexagon *ABCDEF*.



$$\boxed{\cos 30 = \frac{\sqrt{3}}{2}}$$



SINE RULE

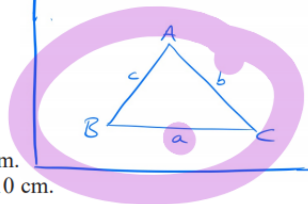
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

COSINE RULE

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

AREA

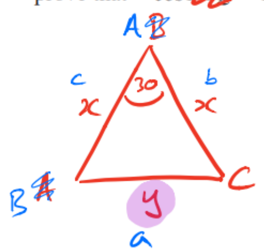
$$\text{AREA} = \tfrac{1}{2}ab\sin C$$

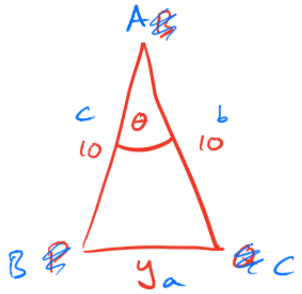


ABEF and *CBED* are congruent parallelograms where $AB = BC = x$ cm.
P is the point on *AF* and *Q* is the point on *CD* such that $BP = BQ = 10$ cm.

Given that angle $ABC = 30°$,

prove that $\cos \cancel{PBQ}\,\theta = 1 - \frac{(2-\sqrt{3})}{200}x^2$





COSINE RULE

$$y^2 = x^2 + x^2 - 2 \times x \times x \times \cos 30$$

$$y^2 = 2x^2 - \cancel{2}x^2 \times \frac{\sqrt{3}}{\cancel{2}}$$

$$y^2 = x^2(2-\sqrt{3})$$

COSINE RULE

$$y^2 = 10^2 + 10^2 - 2 \times 10 \times 10 \times \cos\theta$$

$$y^2 = 200 - 200\cos\theta$$

$$y^2 = 200(1-\cos\theta)$$

So: $\frac{x^2(2-\sqrt{3})}{200} = \frac{\cancel{200}(1-\cos\theta)}{\cancel{200}}$

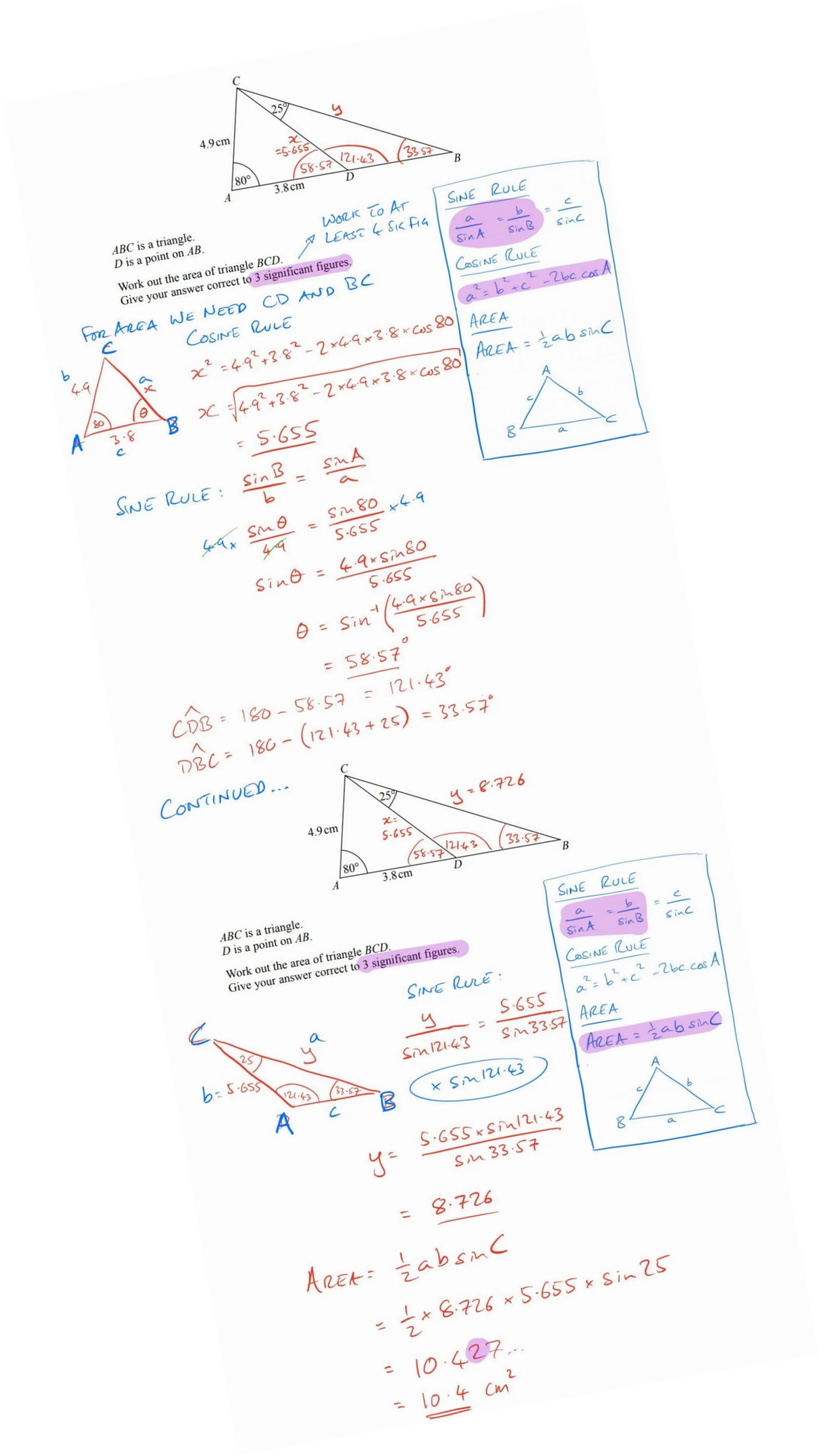
$+\cos\theta \qquad +\cos\theta$

$$\cos\theta + \frac{(2-\sqrt{3})}{200}x^2 = 1$$

$-\frac{(2-\sqrt{3})}{200}x^2 \qquad -\frac{(2-\sqrt{3})x^2}{200}$

$$\cos\theta = 1 - \frac{(2-\sqrt{3})x^2}{200}$$

Answer 13



ABC is a triangle.
D is a point on AB.

Work out the area of triangle BCD.
Give your answer correct to 3 significant figures.

WORK TO AT LEAST 4 SIG FIG

SINE RULE $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

COSINE RULE $a^2 = b^2 + c^2 - 2bc\cos A$

AREA = $\frac{1}{2}ab\sin C$

FOR AREA WE NEED CD AND BC

COSINE RULE

$x^2 = 4.9^2 + 3.8^2 - 2 \times 4.9 \times 3.8 \times \cos 80$

$x = \sqrt{4.9^2 + 3.8^2 - 2 \times 4.9 \times 3.8 \times \cos 80}$

$= 5.655$

SINE RULE: $\frac{\sin B}{b} = \frac{\sin A}{a}$

$4.9 \times \frac{\sin\theta}{4.9} = \frac{\sin 80}{5.655} \times 4.9$

$\sin\theta = \frac{4.9 \times \sin 80}{5.655}$

$\theta = \sin^{-1}\left(\frac{4.9 \times \sin 80}{5.655}\right)$

$= 58.57°$

$\hat{CDB} = 180 - 58.57 = 121.43°$

$\hat{DBC} = 180 - (121.43 + 25) = 33.57°$

CONTINUED...

SINE RULE:

$\frac{y}{\sin 121.43} = \frac{5.655}{\sin 33.57}$ $\times \sin 121.43$

$y = \frac{5.655 \times \sin 121.43}{\sin 33.57}$

$= 8.726$

AREA $= \frac{1}{2}ab\sin C$

$= \frac{1}{2} \times 8.726 \times 5.655 \times \sin 25$

$= 10.427\ldots$

$= 10.4\ \text{cm}^2$

Answer 14

The diagram shows the triangle *PQR*.

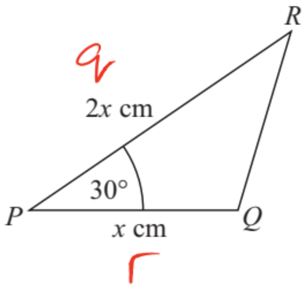
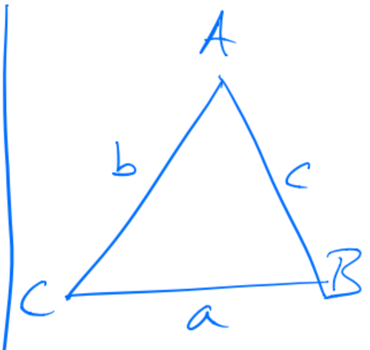


Diagram **NOT** accurately drawn

$PQ = x$ cm
$PR = 2x$ cm
Angle $QPR = 30°$

The area of triangle $PQR = A$ cm^2

Show that $x = \sqrt{2A}$



$$\text{Area} = \frac{1}{2}ab\sin C$$

$$\text{Area} = \frac{1}{2} rq \times \sin P$$

$$A = \frac{1}{2} \times x \times 2x \times \sin 30$$

$$\boxed{\sin 30 = \frac{1}{2}}$$

$$A = \cancel{\frac{1}{2}} \times \cancel{2}x^2 \times \frac{1}{2}$$

$$2 \times A = \frac{x^2}{2} \times 2$$

$$\sqrt{2A} = \sqrt{x^2}$$

$$\sqrt{2A} = x$$

Answer 15

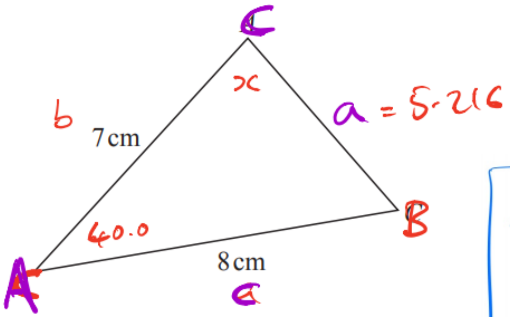


Diagram **NOT** accurately drawn

ABC is an acute-angled triangle.
$BA = 7$ cm
$BC = 8$ cm

The area of triangle ABC is 18 cm².

Work out the size of angle BAC.
Give your answer correct to 3 significant figures.
You must show all your working.

SINE RULE

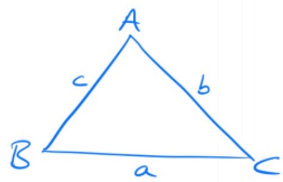
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

COSINE RULE

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

AREA

$$\text{AREA} = \tfrac{1}{2}ab\sin C$$



$$\text{AREA} = \tfrac{1}{2}ab\sin C$$

$$\frac{18}{\frac{1}{2}\times 8\times 7} = \frac{\frac{1}{2}\times 8\times 7\times \sin C}{\frac{1}{2}\times 8\times 7}$$

$$\sin C = \frac{18}{\frac{1}{2}\times 8\times 7}$$

$$C = \sin^{-1}\left(\frac{18}{\frac{1}{2}\times 8\times 7}\right)$$

$$= 40.0052\ldots \rightarrow \boxed{\text{Ans}}$$

COSINE RULE

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$a^2 = 7^2 + 8^2 - 2\times 7\times 8\times \cos\boxed{\text{Ans}}$$

$$\sqrt{}\quad a = \sqrt{7^2 + 8^2 - 2\times 7\times 8\times \cos\boxed{\text{Ans}}}$$

$$= 5.216\ldots \rightarrow \boxed{\text{Ans}}$$

$$\text{AREA} = \tfrac{1}{2}ab\sin C$$

$$\frac{18}{\frac{1}{2}\times \text{Ans}\times 7} = \frac{\frac{1}{2}\times \text{Ans}\times 7\times \sin x}{\frac{1}{2}\times \text{Ans}\times 7}$$

$$\sin x = \frac{18}{\frac{1}{2}\times \text{Ans}\times 7}$$

$$x = \sin^{-1}\left(\frac{18}{\frac{1}{2}\times \text{Ans}\times 7}\right)$$

$$= 80.4\ ^\circ$$