# Name: _____

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# GCSE (1 – 9)

# The Cosine Rule

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## Instructions

- Use **black** ink or ball-point pen.
- Answer all questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
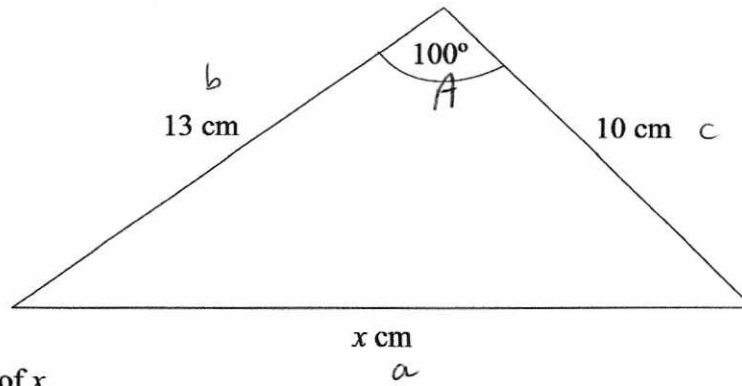- You must **show all your working out.**

## Information

- The marks for each question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end

**1**



100° A

b
13 cm

10 cm c

x cm
a

Work out the value of $x$.
Give your answer to 1 decimal place.

$$a^2 = b^2 + c^2 - 2bc \cos A$$
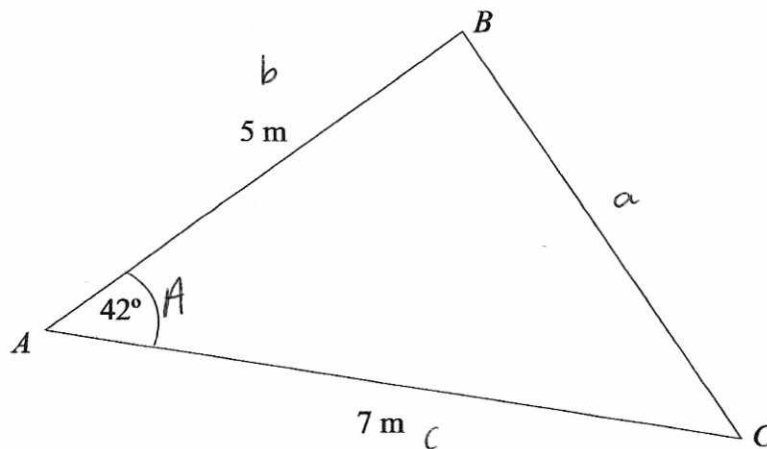$$x^2 = (13)^2 + (10)^2 - 2(13)(10) \cos (100)$$
$$x^2 = 314.1485...$$
$$x = \sqrt{Ans}$$
$$= \underline{17.7} \quad (1dp)$$

..........17.7..........

**(Total for question 1 is 3 marks)**

**2**



B

b
5 m

a

42° A

A

7 m c

C

Work out the length of BC.
Give your answer to 3 significant figures.

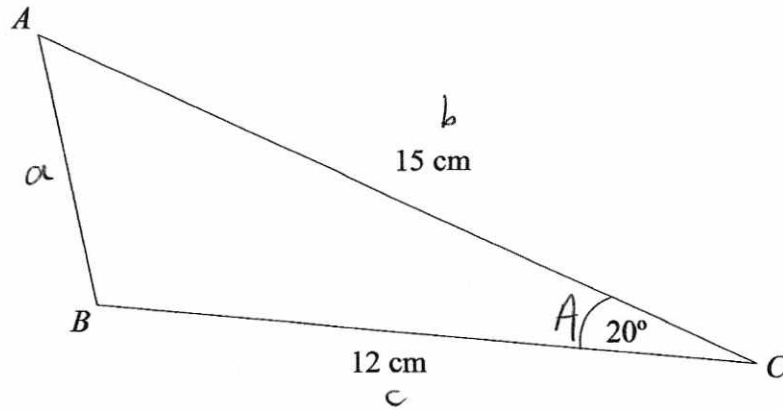$$a^2 = (5)^2 + (7)^2 - 2(5)(7) \cos (42)$$
$$a^2 = 21.97986...$$
$$a = \sqrt{Ans}$$
$$= 4.69 \quad (3sf)$$

..........4.69..........m

**(Total for question 2 is 3 marks)**

**3**

A

b
15 cm

α

B

12 cm
c

A 20°

C

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

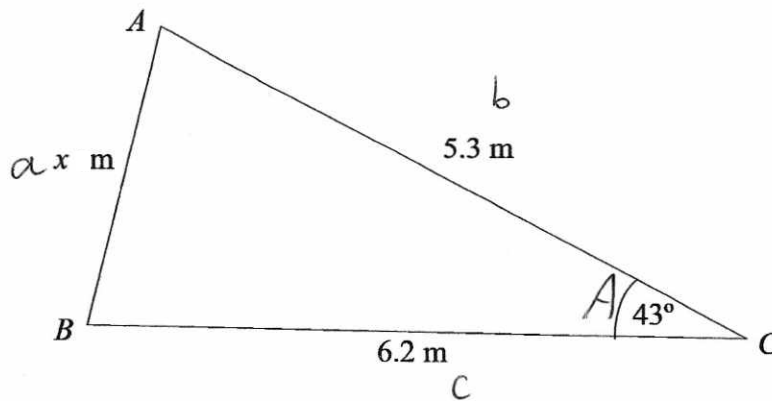$$a^2 = (15)^2 + (12)^2 - 2(15)(12)\cos(20)$$
$$a^2 = 30.7106\ldots$$
$$a^2 = \sqrt{Ans}$$
$$a = 5.5 \;(1dp)$$

....................5.5...............cm

**(Total for question 3 is 3 marks)**

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**4**

A

b
5.3 m

α x  m

B

6.2 m
c

A 43°

C

Work out the value of x.
Give your answer to 3 significant figures.

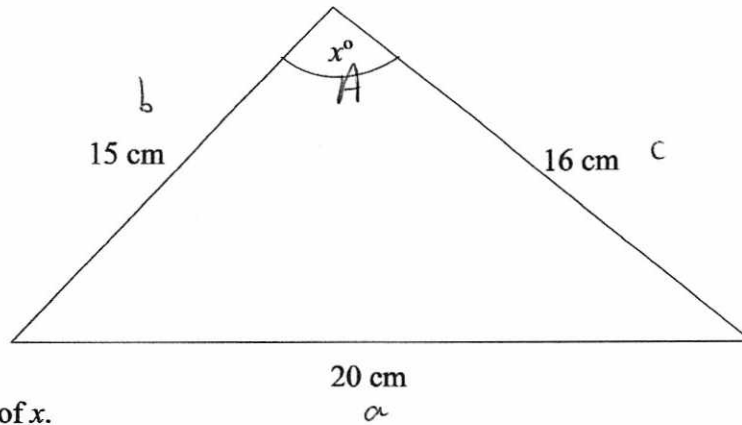$$x^2 = (5.3)^2 + (6.2)^2 - 2(5.3)(6.2)\cos(43)$$
$$x^2 = 18.4654\ldots$$
$$x = \sqrt{Ans}$$
$$x = 4.30 \;(3sf)$$

....................4.30...............

**(Total for question 4 is 3 marks)**

**5**



15 cm  $b$

16 cm  $c$

$x°$  A

20 cm  $a$

Work out the value of $x$.
Give your answer to 3 significant figures.

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

$$\cos x = \frac{(15)^2 + (16)^2 - (20)^2}{2(15)(16)}$$
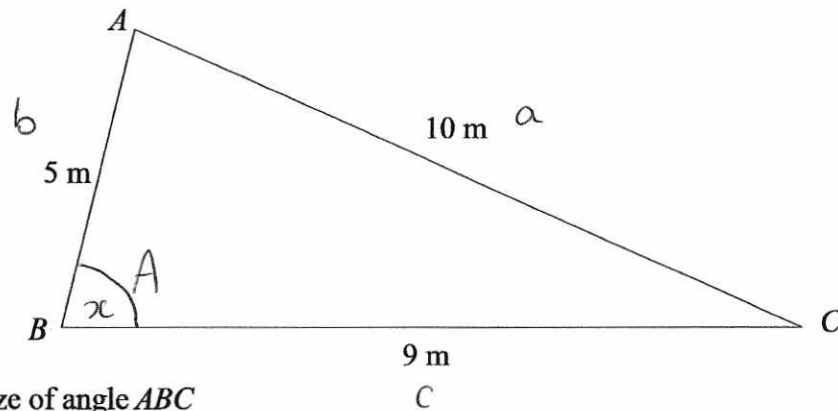
$$\cos x = \frac{27}{160}$$

$$x = \cos^{-1}(Ans)$$

$$= 80.3 \ (3sf)$$

**80.3**

**(Total for question 5 is 3 marks)**

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**6**



$A$

$b$

5 m

$B$  $x$  A

9 m  $C$

10 m  $a$

$C$

Work out the size of angle $ABC$
Give your answer to the nearest degree.

$$\cos x = \frac{(5)^2 + (9)^2 - (10)^2}{2(5)(9)}$$
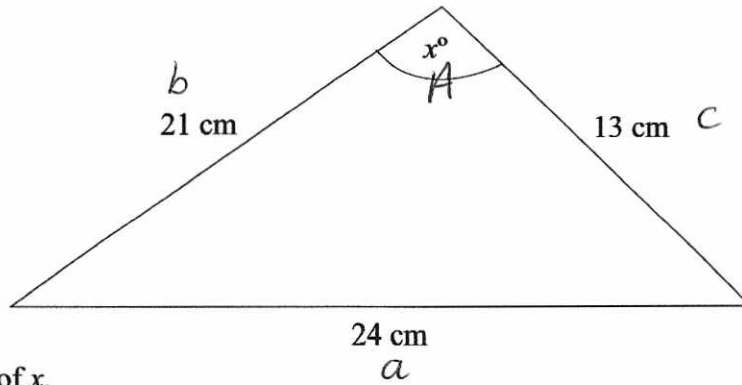
$$\cos x = \frac{1}{15}$$

$$x = \cos^{-1}(Ans)$$

$$= 86 \ (nearest \ degree)$$

**86** °

**(Total for question 6 is 3 marks)**

**7**



$b$
21 cm

$x°$
$A$

13 cm  $C$

24 cm
$a$

Work out the value of $x$.
Give your answer to 1 decimal place.

$$\cos x = \frac{(21)^2 + (13)^2 - (24)^2}{2(21)(13)}$$

$$\cos x = \frac{17}{273}$$
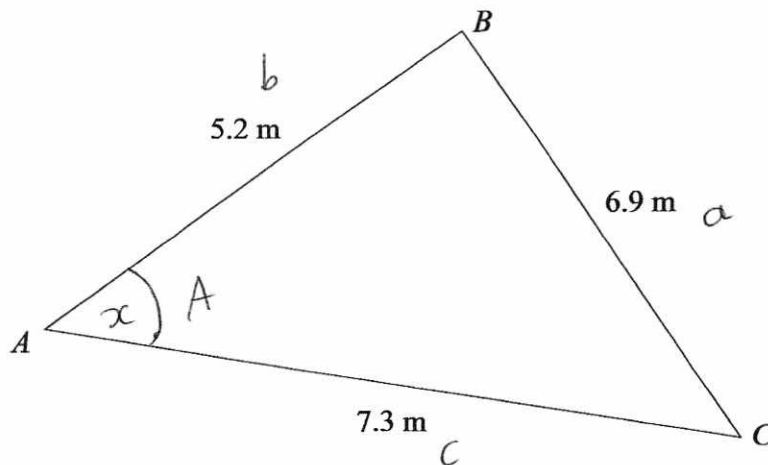
$$x = \cos^{-1}(\text{Ans})$$

$$= 86.4 \quad (1dp)$$

.....86.4.....

**(Total for question 7 is 3 marks)**

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**8**



$B$

$b$
5.2 m

6.9 m  $a$

$x$  $A$

$A$

7.3 m
$c$

$C$

Work out the size of angle BAC.
Give your answer to 3 significant figures.

$$\cos x = \frac{(5.2)^2 + (7.3)^2 - (6.9)^2}{2(5.2)(7.3)}$$
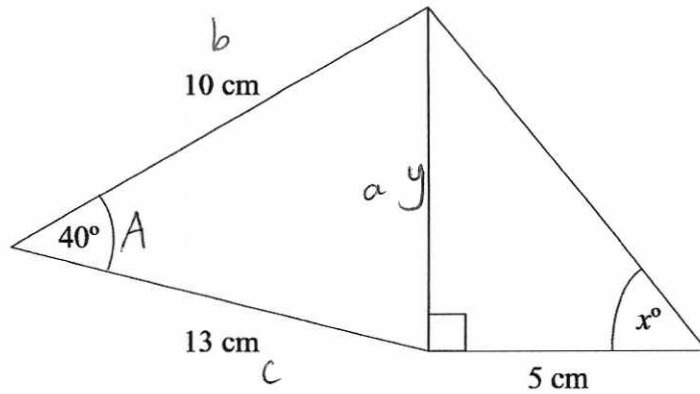
$$\cos x = \frac{409}{949}$$

$$x = \cos^{-1}(\text{Ans})$$

$$= 64.5 \quad (3sf)$$

.....64.5..... °

**(Total for question 8 is 3 marks)**

**9**

b
10 cm

a y

40° A

13 cm
C

x°

5 cm
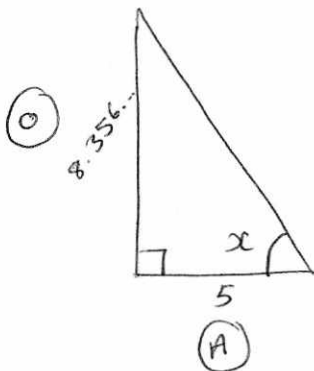
Work out the value of $x$.
Give your answer to 1 decimal place.

$$y^2 = (10)^2 + (13)^2 - 2(10)(13)\cos(40)$$
$$y^2 = 69.828\ldots$$
$$y = \sqrt{Ans}$$
$$y = 8.35634159\,1$$

O

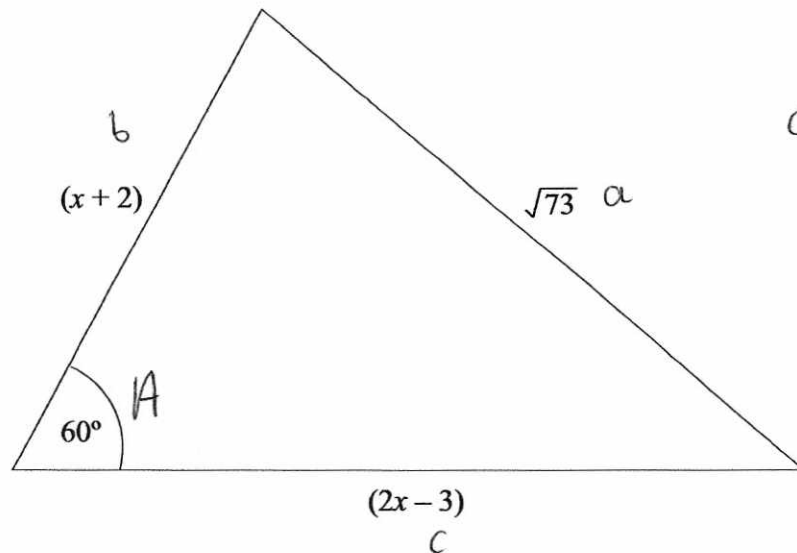8.356...

x

5

A

$$\tan x = \frac{Ans}{5}$$

$$x = \tan^{-1}\left(\frac{Ans}{5}\right)$$

$$= 59.1° \quad (1dp)$$

59.1

**(Total for question 9 is 5 marks)**

**10**

$b$

$(x + 2)$

$\sqrt{73}$ $a$

$\cos 60 = \frac{1}{2}$

$A$

60°

$(2x - 3)$

$C$

Work out the value of $x$.

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

$$73 = (x+2)^2 + (2x-3)^2 - 2(x+2)(2x-3)\cos(60)$$

$$73 = (x+2)(x+2) + (2x-3)(2x-3) - (x+2)(2x-3)$$

$$73 = x^2 + 2x + 2x + 4 + 4x^2 - 6x - 6x + 9 - (2x^2 - 3x + 4x - 6)$$

$$73 = 5x^2 - 8x + 13 - (2x^2 + x - 6)$$

$$73 = 3x^2 - 9x + 19$$

$$0 = 3x^2 - 9x - 54$$

$$0 = x^2 - 3x - 18$$
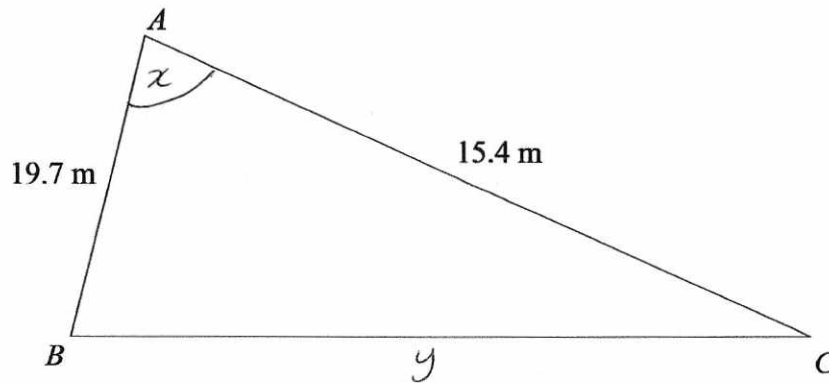
$$0 = (x - 6)(x + 3)$$

$$x = 6 \qquad x = -3$$

$x$ cannot $= -3$ as the lengths would be negative.

$$\underline{\underline{x = 6}}$$

6

**(Total for question 10 is 5 marks)**

**11**



19.7 m

15.4 m

*A*

*x*

*B*

*y*

*C*

The area of the triangle is 100m²
Calculate the perimeter of triangle *ABC*.
Give your answer to 3 significant figures.

$$\frac{1}{2} \, a \, b \, \sin C = 100$$

$$\frac{1}{2}(19.7)(15.4) \sin x = 100$$

$$151.69 \sin x = 100$$

$$\sin x = \frac{100}{151.69}$$

$$x = \sin^{-1}\left(\frac{100}{151.69}\right)$$

$$= 41.24187853$$

$$y^2 = (19.7)^2 + (15.4)^2 - 2(19.7)(15.4)\cos(41.24187...)$$

$$y^2 = 169.0069753$$

$$y = \sqrt{Ans}$$

$$= 13.0 \quad (3sf)$$

$$Perimeter = 19.7 + 15.4 + 13.0$$

$$= 48.1 \, m$$

......48.1......m

**(Total for question 11 is 5 marks)**