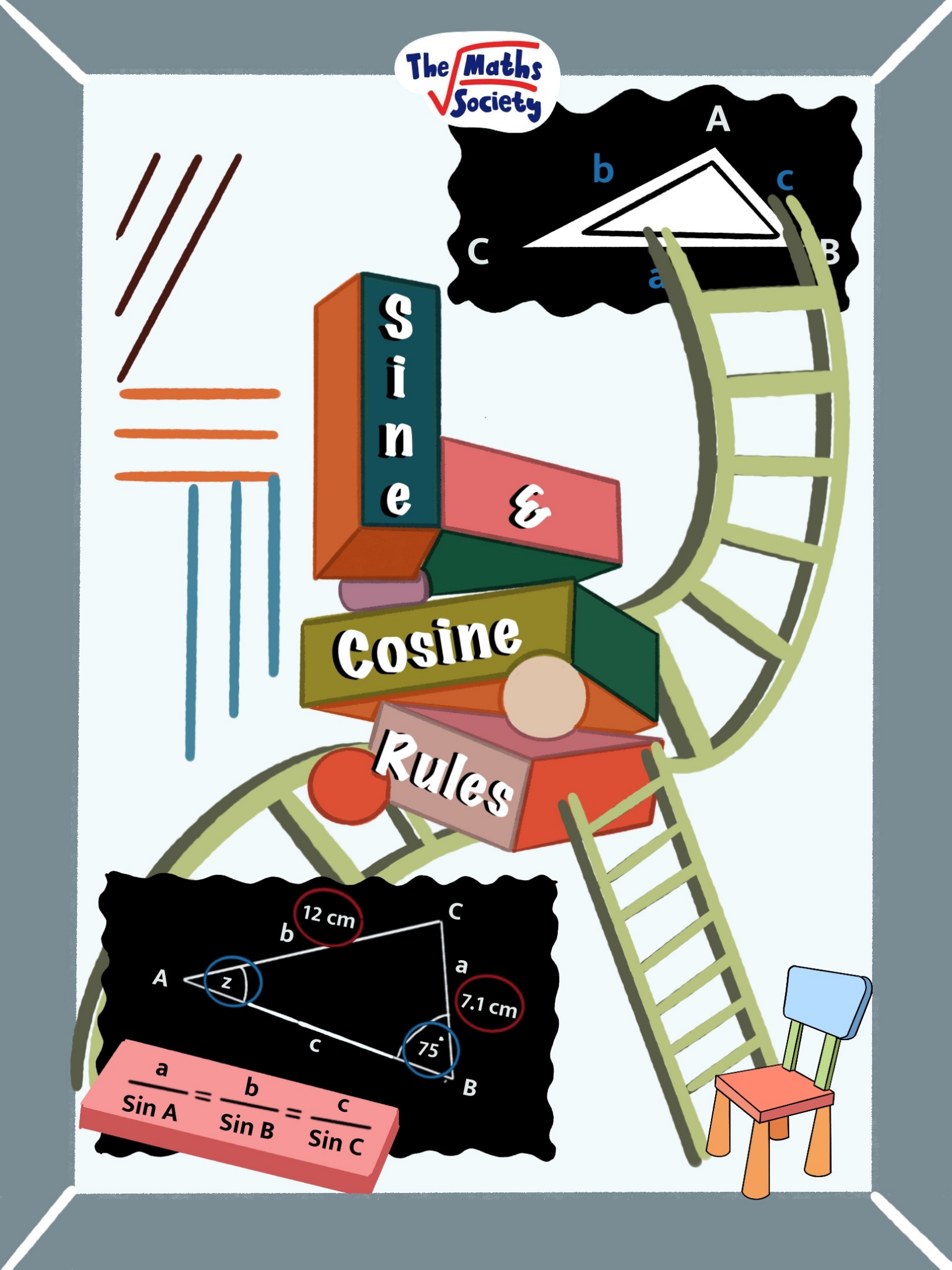
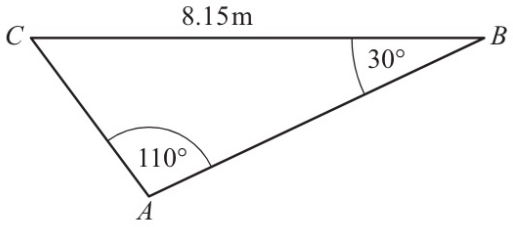

The Maths Society
A
b
c
C
B
a
Sine
&
Cosine
Rules
12 cm
b
C
a
A
z
7.1 cm
c
75°
B
a / Sin A = b / Sin B = c / Sin C

Question 1



NOT TO SCALE

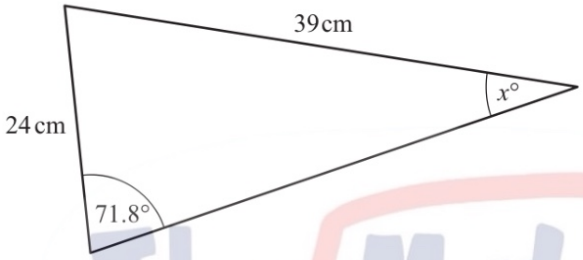
Calculate AC. [3]

$$\frac{8.15}{\sin 110^\circ} = \frac{x}{\sin 30}$$

$$x = \frac{8.15 \times \sin 30}{\sin 110}$$

$$= 4.34\text{m}$$

Question 2



NOT TO SCALE

Find the value of x. [3]

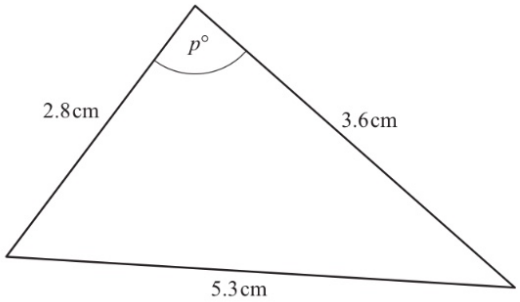
$$\frac{39}{\sin 71.8} = \frac{24}{\sin x}$$

$$\sin x = \frac{24 \times \sin 71.8}{39}$$

$$x = \sin^{-1}\left(\frac{24 \times \sin 71.8}{39}\right)$$

$$= 35.77\text{cm}$$

Question 3



NOT TO SCALE

Find the value of p. [4]

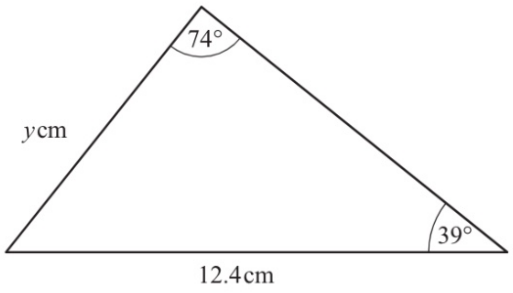
$$\cos\theta = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos p = \frac{2.8^2 + 3.6^2 - 5.3^2}{2(2.8)(3.6)}$$

$$\cos p = \frac{-81}{224}$$

$$p = \cos^{-1}\left(\frac{-81}{224}\right) = 111.2^\circ$$

Question 4



NOT TO SCALE

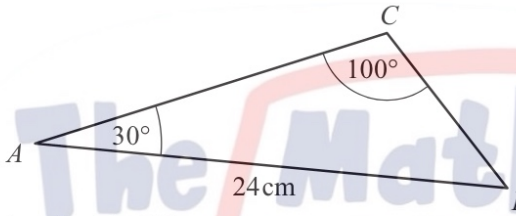
Calculate the value of y. [3]

$$\frac{12.4}{\sin 74} = \frac{y}{\sin 39}$$

$$y = \frac{12.4 \times \sin 39}{\sin 74}$$

$$= 8.1\text{cm}$$

Question 5



NOT TO SCALE

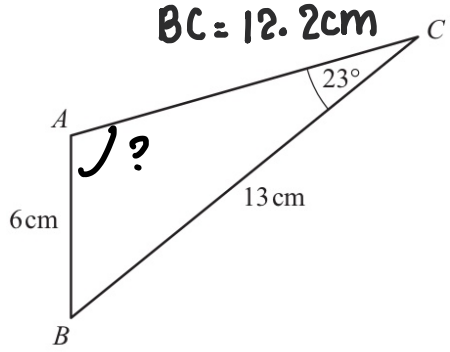
Use the sine rule to calculate BC. [3]

$$\frac{24}{\sin 100} = \frac{BC}{\sin 30}$$

$$BC = \frac{24 \times \sin 30}{\sin 100}$$

$$BC = 12.2\text{cm}$$

Question 6



NOT TO SCALE

In triangle ABC, $AB = 6$ cm, $BC = 13$ cm and angle $ACB = 23°$.
Calculate angle BAC, which is obtuse. [4]

$$\frac{6}{\sin 23} = \frac{13}{\sin A}$$

$$\sin A = \frac{13 \times \sin 23}{6}$$

$$A = \sin^{-1}\left(\frac{13 \times \sin 23}{6}\right)$$

$$= 57.8°$$

Question 1

$\cos\theta = \frac{b^2 + c^2 - a^2}{2(b)(c)}$

A triangle has sides of length 2 cm, 8 cm and 9 cm.

$a = 2$
$b = 8$
$c = 9$

Calculate the value of the largest angle in this triangle. [4]

$\cos A = \frac{8^2 + 9^2 - 2^2}{2(8)(9)}$

$A = 11.7°$

$\cos B = \frac{2^2 + 9^2 - 8^2}{2(2)(9)}$

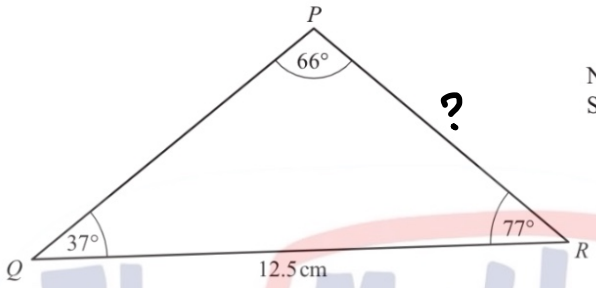
$B = 54.3$

$\cos C = \frac{8^2 + 2^2 - 9^2}{2(8)(2)}$

$= 114.0$

∴ largest triangle (C)

Question 2



NOT TO SCALE

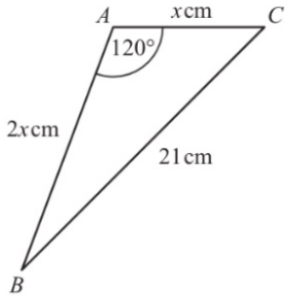
Calculate PR. [3]

$\frac{12.5}{\sin 66} = \frac{PR}{\sin 37°}$

$PR = \frac{12.5 \times \sin 66}{\sin 37}$

$= 19.0$ cm

Question 3



NOT TO SCALE

In triangle ABC, $AB = 2x$ cm, $AC = x$ cm, $BC = 21$ cm and angle $BAC = 120°$.
Calculate the value of x. [3]

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

$\cos 120 = \frac{(2x)^2 + (x)^2 - 21^2}{2(2x)(x)}$

$-\frac{1}{2} = \frac{4x^2 + x^2 - 441}{4x^2}$

$-2x^2 = 5x^2 - 441$

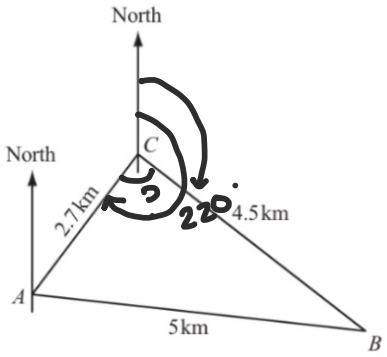
$441 = 7x^2$

$63 = x^2$

$x = \sqrt{63}$

$= 3\sqrt{7} = 7.9$ cm

Question 4



NOT TO SCALE

The diagram shows 3 ships A, B and C at sea.

$AB = 5$ km, $BC = 4.5$ km and $AC = 2.7$ km.

(a) Calculate angle ACB.
Show all your working. [4]

$$\cos C = \frac{b^2 + a^2 - c^2}{2ba}$$

$$\cos C = \frac{2.7^2 + 4.5^2 - 5^2}{2(2.7)(4.5)}$$

$$\cos C = \frac{127}{1215}$$

$$C = \cos^{-1}\left(\frac{127}{1215}\right)$$

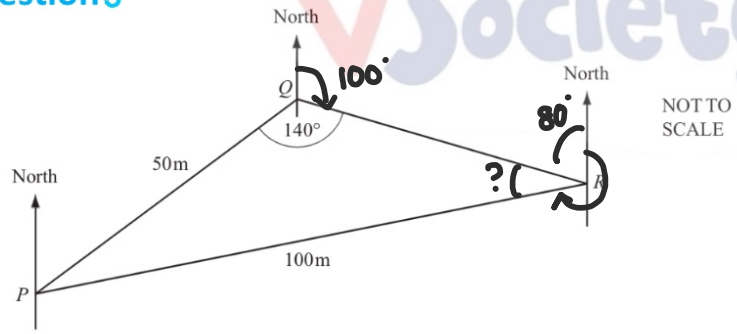
$$= 84^\circ$$

(b) The bearing of A from C is 220°.

Calculate the bearing of B from C. [1]

$$220^\circ - 84^\circ = 136^\circ$$

Question 5



NOT TO SCALE

The diagram shows three points P, Q and R on horizontal ground.

$PQ = 50$ m, $PR = 100$ m and angle $PQR = 140°$.

(a) Calculate angle PRQ. [3]

$$\frac{\sin R}{50} = \frac{\sin 140}{100}$$

$$\sin R = \frac{50 \times \sin 140}{100}$$

$$R = \sin^{-1}\left(\frac{50 \times \sin 140}{100}\right)$$

$$= 18.7^\circ$$

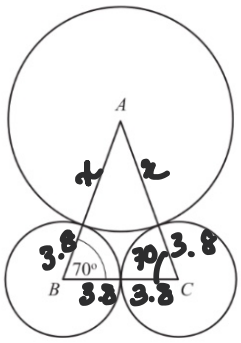
(b) The bearing of R from Q is 100°.

Find the bearing of P from R. [2]

$$180^\circ - 100^\circ = 80^\circ$$

$$360^\circ - 80^\circ - 18.7^\circ = 261.3^\circ$$

Question 6



NOT TO SCALE

The diagram shows three touching circles.
A is the centre of a circle of radius x centimetres.
B and C are the centres of circles of radius 3.8 centimetres. Angle $ABC = 70°$.
Find the value of x. [3]

$180° - 70° - 70° = 40°$

$BC = 3.8 + 3.8 = 7.6\text{cm}$

$$\frac{7.6}{\sin 40} = \frac{x}{\sin 70}$$

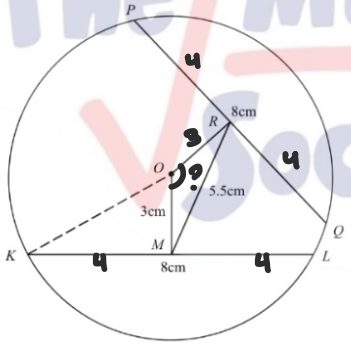
$$x = \frac{7.6 \times \sin 70}{\sin 40}$$

$x = 11.11$

$= 11.11 - 3.8 = 7.31\text{ cm}$

Question 7

NOT TO SCALE



In the circle, centre O, the chords KL and PQ are each of length 8 cm.
M is the mid-point of KL and R is the mid-point of PQ. $OM = 3$ cm.

(a) Calculate the length of OK.

$OK^2 = 3^2 + 4^2$

$OK = \sqrt{9 + 16}$

$= 5\text{ cm}$

[2]

(b) RM has a length of 5.5 cm. Calculate angle ROM.

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

$5.5^2 = 8^2 + 3^2 - 2 \times 8 \times 3 \times \cos O$

$5.5^2 - 8^2 - 3^2 = -18 \cos O$

$\cos O = \frac{5.5^2 - 18}{-18}$

$= -\frac{49}{72}$

$O = \cos^{-1}\left(\frac{-49}{72}\right) = 132.9°$

[3]