

# IB Maths: AA HL

## Further Trigonometry

### Topic Questions

These practice questions can be used by students and teachers and is Suitable for IB Maths AA HL Topic Questions

Course	IB Maths
Section	3. Geometry & Trigonometry
Topic	3.4 Further Trigonometry
Difficulty	Medium

**Level: IB Maths**

**Subject: IB Maths AA HL**

**Board: IB Maths**

**Topic: Further Trigonometry**

## Question 1

Complete the table.

Degrees	Radians	sin	cos	tan
	$\frac{\pi}{6}$		$\frac{\sqrt{3}}{2}$	
$45^\circ$			$\frac{1}{\sqrt{2}}$	
$60^\circ$	$\frac{\pi}{3}$			
	$\frac{2\pi}{3}$	$\frac{\sqrt{3}}{2}$		
$270^\circ$				

[5 marks]

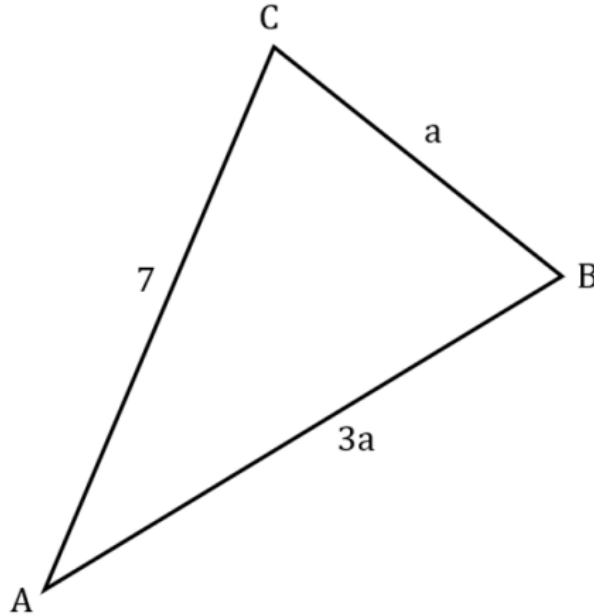
## Question 2

Given that  $\sin \theta = \frac{3}{5}$ , where  $\frac{\pi}{2} < \theta < \pi$ , find the possible values of  $\cos \theta$  and  $\tan \theta$ .

[3 marks]

### Question 3

The following triangle shows triangle ABC, with  $AB = 3a$ ,  $BC = a$  and  $AC = 7$ .

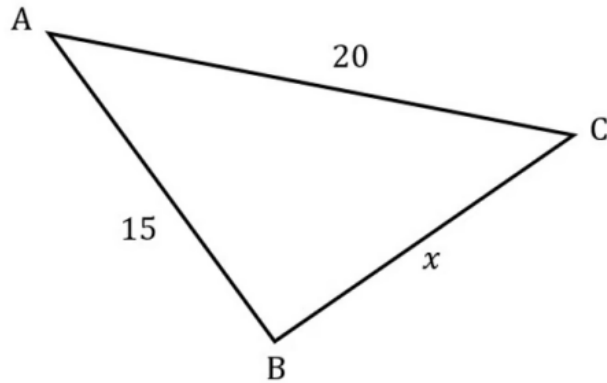


Given that  $\cos \widehat{ABC} = \frac{1}{2}$ , find the area of the triangle. Give your answer in the form  $\frac{p\sqrt{3}}{r}$  where  $p, q \in \mathbb{R}$ .

[7 marks]

### Question 4

The following triangle shows triangle ABC, with  $AB = 15$ ,  $AC = 20$ ,  $BC = x$ .



(a) Given that  $\cos \widehat{BAC} = \frac{2}{3}$ , find the value of  $\sin \widehat{BAC}$ .

[3 marks]

(b) Find the exact area of triangle ABC.

[3 marks]

(c) By finding the value of  $x$ , show that triangle ABC is isosceles.

[3 marks]

### Question 5

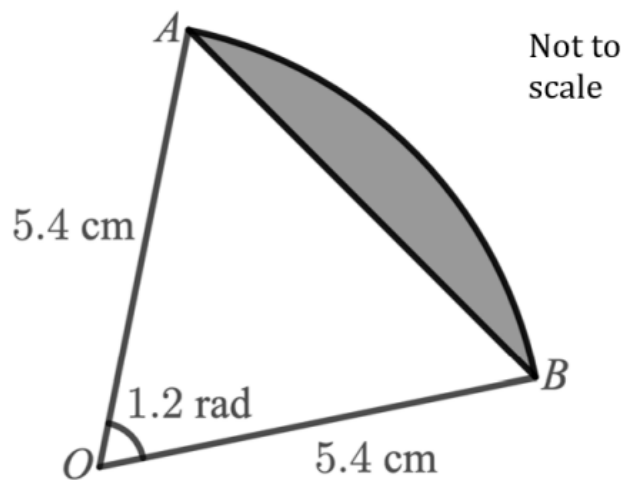
A sector of a circle,  $OPQ$ , is such that it has radius 3.4 cm and the angle at its centre,  $O$ , is  $\frac{3\pi}{4}$  radians.

- (i) Find the length of the arc  $PQ$ .
- (ii) Find the area of the sector  $OPQ$ .

[4 marks]

### Question 6

The diagram below shows the sector of a circle  $OAB$ .



- (a) (i) Find the area of the sector  $OAB$ , giving your answer to 3 significant figures.
- (ii) Find the area of the triangle  $OAB$ , giving your answer to 3 significant figures.
- (iii) Find the area of the shaded segment, giving your answer to 3 significant figures.

[5 marks]

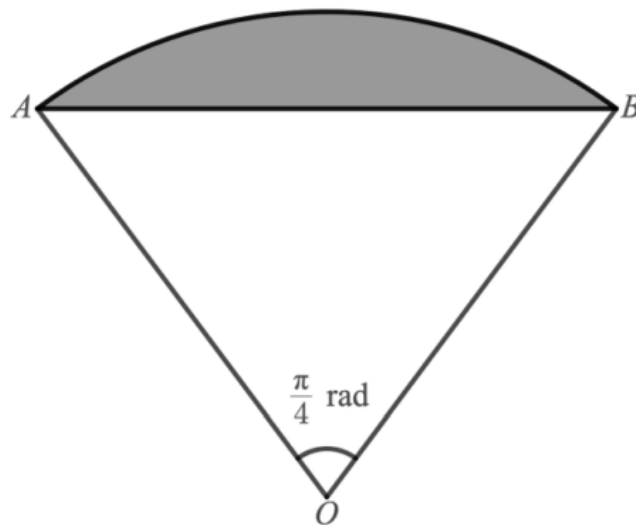
(b) (i) Find the length of the arc  $AB$ .

(ii) Find the perimeter of the sector  $OAB$ .

[3 marks]

### Question 7

The canopy of a parachute and the outermost connecting cords form a sector of a circle as shown in the diagram below, with the parachutist modelled as a particle at point  $O$ .



Not to  
scale

The area of the sector  $OAB$  is  $\frac{81\pi}{200}$  m<sup>2</sup>.

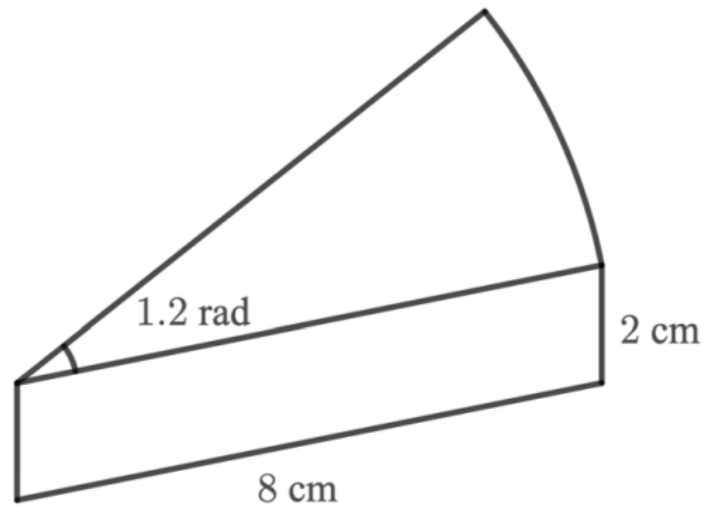
Find the length of one of the connecting cords on the parachute.

[3 marks]

### Question 8

A plastic puzzle piece is in the form of a prism with a cross-section that is the sector of a circle, as shown in the diagram below. The radius of the sector is 8 cm, and the angle at the centre is 1.2 radians.

The height of the puzzle piece is 2 cm.



Not to  
scale

- (i) Work out the area of the cross-section.
- (ii) Hence, or otherwise, work out the volume of the puzzle piece.

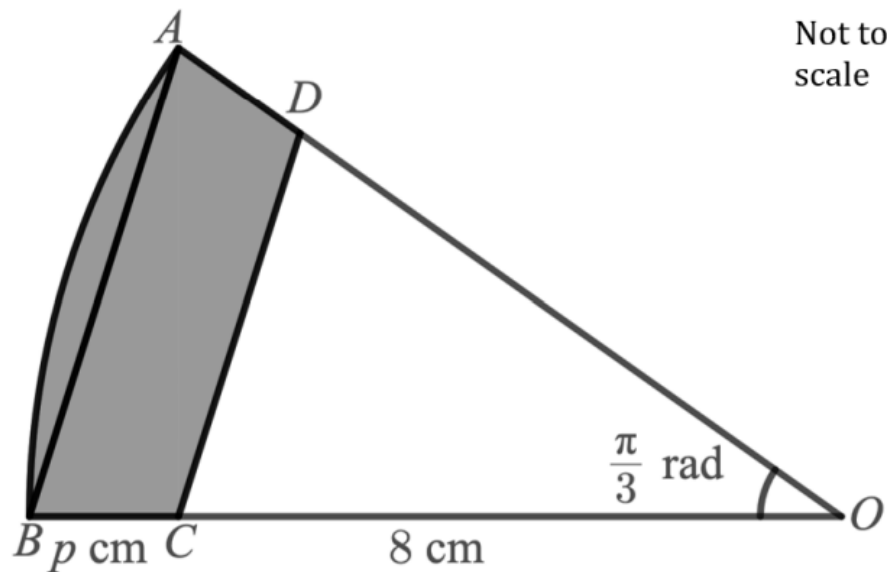
[3 marks]

### Question 9

The circle sector  $OAB$  is shown in the diagram below.

The angle at the centre is  $\frac{\pi}{3}$  radians, and the line segments  $OC$  and  $BC$  have lengths of 8 cm and  $p$  cm respectively.

Additionally,  $CD$  is parallel to  $AB$ , so that  $AD = BC$  and  $OD = OC$ .



(a) Show that the area of the sector  $OAB$  is  $\frac{\pi}{6}(p + 8)^2 \text{ cm}^2$ .

[2 marks]

(b) Show that the area of the triangle  $OCD$  is  $16\sqrt{3} \text{ cm}^2$ .

[2 marks]



(c) Given that the area of the shaded shape  $ABCD$  is  $\left(\frac{50\pi}{3} - 16\sqrt{3}\right) \text{ cm}^2$ , find the value of  $p$ .

[4 marks]

### Question 10

Solve the equation  $2 \sin x = \frac{1}{\sin x}$  for  $0^\circ \leq x \leq 360^\circ$ .

[5 marks]

### Question 11

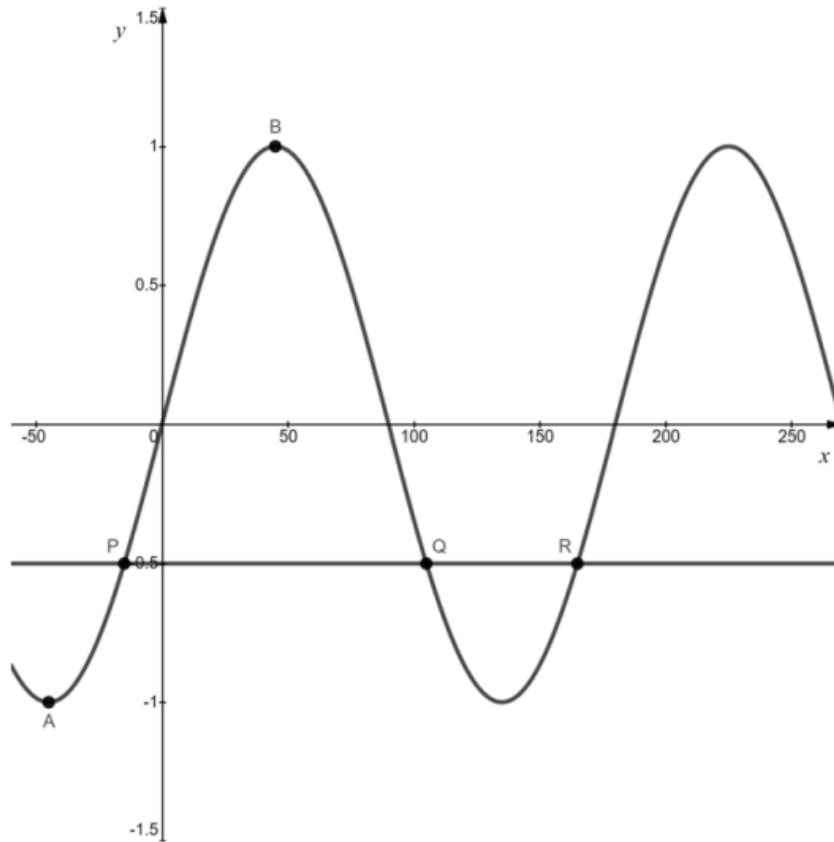
A right-angled triangle has hypotenuse 8cm. One of its other sides is 5cm.

Find exact values for  $\sin \theta$ ,  $\cos \theta$  and  $\tan \theta$ , where  $\theta$  is the smallest angle in the triangle.

[6 marks]

### Question 12

The graph below shows the curve with equation  $y = \sin 2x$  in the interval  $-60^\circ \leq x \leq 270^\circ$ .



- (a) Point  $A$  has coordinates  $(-45^\circ, -1)$  and is the minimum point closest to the origin.  
Point  $B$  is the maximum point closest to the origin. State the coordinates of  $B$ .

[1 mark]

(b) A straight line with equation  $y = -\frac{1}{2}$  meets the graph of  $y = \sin 2x$  at the three points  $P$ ,  $Q$  and  $R$ , as shown in the diagram.

Given that point  $P$  has coordinates  $(-15^\circ, -\frac{1}{2})$ , use graph symmetries to determine the coordinates of  $Q$  and  $R$ .

[2 marks]

### Question 13

(i) Sketch the graph of  $y = \cos(\theta + 30^\circ)$  in the interval  $-180^\circ \leq \theta \leq 360^\circ$ .

(ii) Write down all the values where  $\cos(\theta + 30^\circ) = 0$  in the given interval.

[4 marks]