3.4 Further Trigonometry

Question Paper

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

Time allowed: 80

Score: /60

Percentage: /100

Question 1

Complete the table.

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

[5 marks]

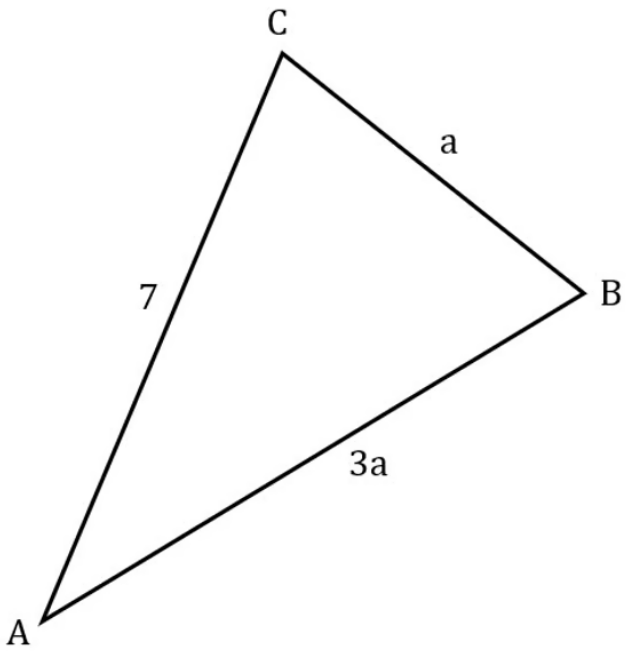
Question 2

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 $AC = 7$.

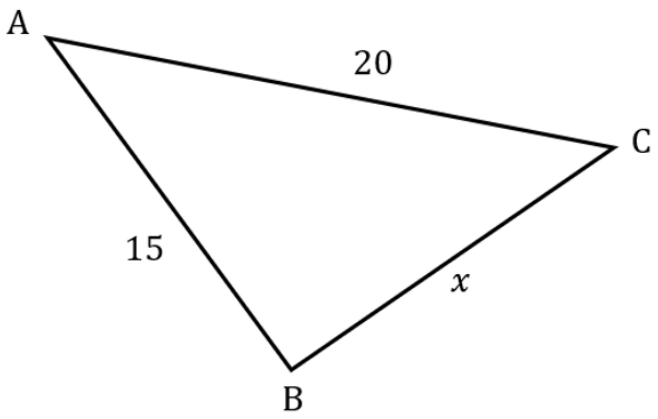


Given that $\cos A\widehat{B}C = \frac{1}{2}$, find the area of the triangle. Give your answer in the form $\frac{p\sqrt{3}}{r}$ where $p, q \in \mathbb{R}$.

[7 marks]

Question 4a

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



(a) Given that $\cos B\hat{A}C = \frac{2}{3}$, find the value of $\sin B\hat{A}C$.

[3 marks]

Question 4b

(b) Find the exact area of triangle ABC.

[3 marks]

Question 4c

(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

Two non-congruent triangles both have sides $AB = 5.3$ cm, $BC = 6.4$ cm and $A\hat{C}B = 38°$.

(i) Show that the angle $B\hat{A}C$ for one of the triangles is 132°, to 3 significant figures.

(ii) Find the angle $A\hat{B}C$ for the other triangle.

[4 marks]

Question 7

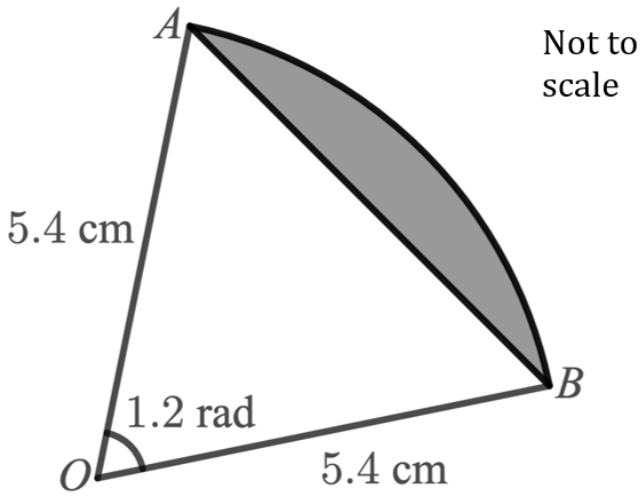
A right-angled triangle has hypotenuse 8cm. One of its other sides is 5cm.

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

[6 marks]

Question 8a

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]

Question 8b

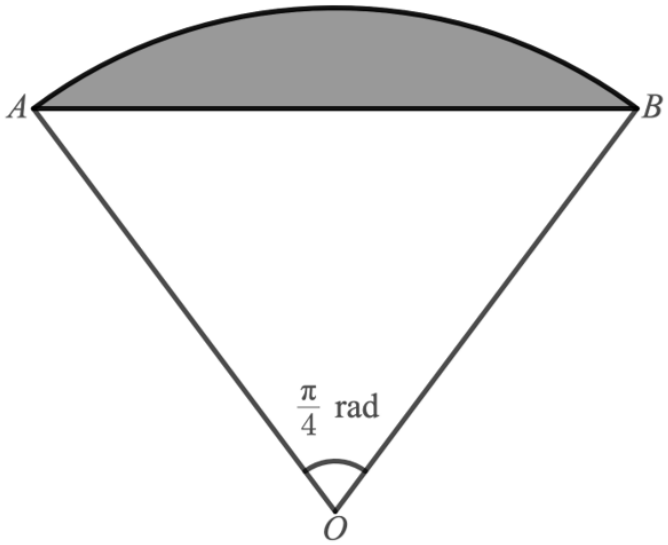
(b) (i) Find the length of the arc AB.

(ii) Find the perimeter of the sector OAB.

[3 marks]

Question 9

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

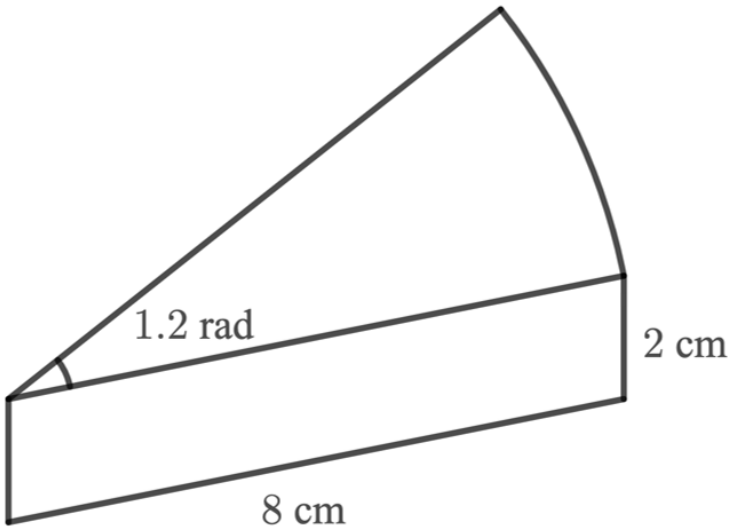
The area of the sector OAB is $\frac{81\pi}{200}$ m^2.

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

[3 marks]

Question 10

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.

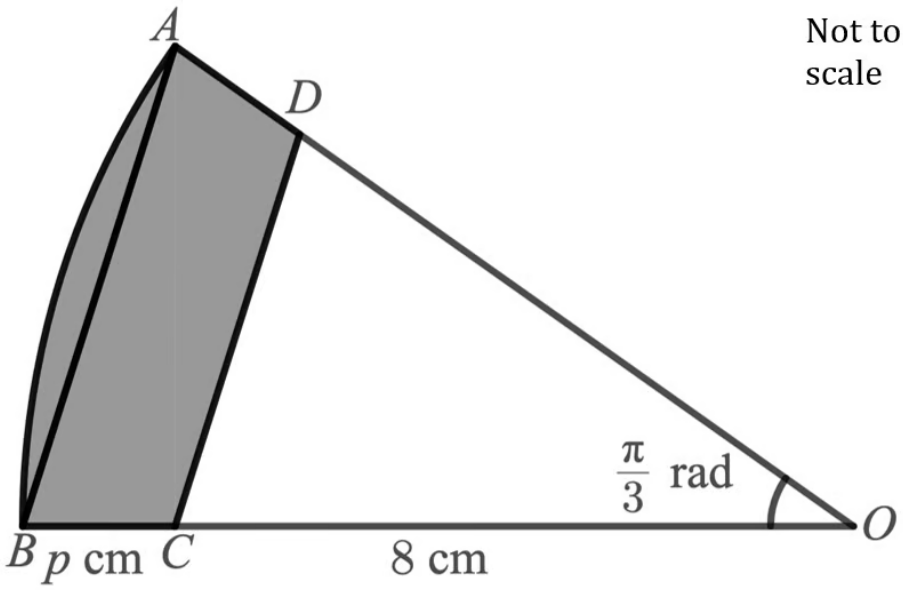
[3 marks]

Question 11a

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 $\frac{\pi}{6}(p+8)^2$ cm^2.

[2 marks]

Question 11b

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

[2 marks]

Question 11c

(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]