Year 11 Mathematics Advanced

Topic: Trigonometry and Measure of Angles (4 of 5)
Review Questions: Radians: arc length, sectors and segments
Term 3, 2026

How to use this review set

These are real past-paper questions, grouped by question pattern. The grey label on each question shows where it is from and its marks.

- The questions are grouped by the pattern that keeps coming up in exams, a few of each in a row, running from the plainer patterns into the harder ones near the end. Work through them and you will meet every type an exam can throw at you.
- This set **is your diagnostic**. Working through it shows you exactly which patterns are solid and which need work. Attempt every question properly in your own book, and go back to your notes to help you work through tough questions if needed.
- Every question you get wrong, need help with or struggle with goes in your **Mistakes Log**, which you should be working on daily to get you exam-ready.

Contents

Radian measure and circle mensuration

1. Radian measure and converting degrees and radians
2. Arc length
3. Area of a sector
4. Area of a segment
5. Perimeter and composite mensuration

Radian measure and circle mensuration

1. Radian measure and converting degrees and radians

Q1 North Sydney Boys 2022 Trial Q11 · **1 mark**

Write 132° in radian measure.

Q2 Kambala 2024 Prelim Q2 · **1 mark**

Which of the following angles is between 30° and 60° in size?

(A) 0.3 radians

(B) 0.5 radians

(C) 0.8 radians

(D) 1.1 radians

Q3 St George Girls 2023 Prelim Q3 · **1 mark**

What is 0.5 radians in degrees, when rounded to the nearest degree?

(A) 29°

(B) 45°

(C) 50°

(D) 90°

Q4 Killara 2024 Prelim Q1 · **1 mark**

135° converted to radians is:

(A) $\frac{\pi}{4}$

(B) $\frac{3\pi}{4}$

(C) π

(D) 135π

Q5 Hurlstone 2021 Prelim Q1 · **1 mark**

In radians, which of the following is equal to 150°?

(A) $\frac{2\pi}{3}$

(B) $\frac{5\pi}{12}$

(C) $\frac{5\pi}{6}$

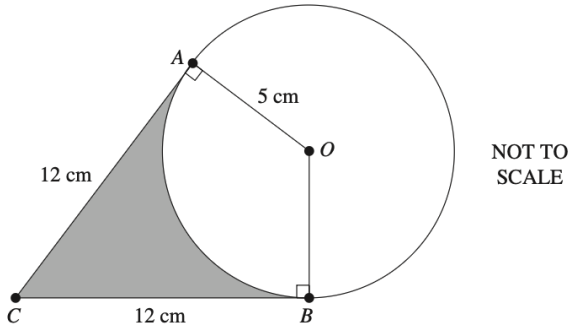
(D) $\frac{3\pi}{4}$

Q6 Penrith 2023 Prelim Q15 · **1 mark**

Express 520° in radians. Simplify fully in terms of π.

Q7 Danebank 2021 Trial Q24 · **4 marks**

The diagram shows a circle with centre O and radius 5 cm. Tangents are drawn from the points A and B, which meet at point C. The tangent lengths CA and CB are each 12 cm.



(a) Show that $\angle AOB = 2.4$ radians correct to two significant figures.

(b) Hence, find the area of the shaded region.

2. Arc length

Q8 St George Girls 2022 Trial Q9 · **1 mark**

A sector, centred at O, has a radius of 6 cm and an arc length of 5 cm. What is the area of the sector?

(A) 1.88 cm^2

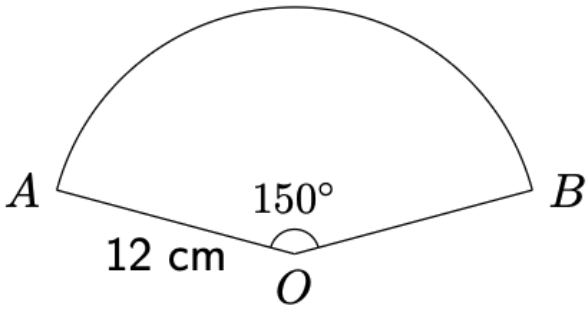
(B) 15 cm^2

(C) 21.6 cm^2

(D) 10.42 cm^2

Q9 Kambala 2023 Prelim Q5 · **1 mark**

In a circle with centre O, the arc AB subtends an angle of 150° at the centre and the radius is 12 cm. What is the length of arc AB?



(A) 10π cm

(B) 5 cm

(C) 5π cm

(D) 10 cm

Q10 Girraween 2025 Trial Q6 · **1 mark**

AOB is a sector of a circle with centre O and radius 5 cm. The sector has an area of 10π cm^2. What is the arc length of the sector in exact form?

(A) 2π cm

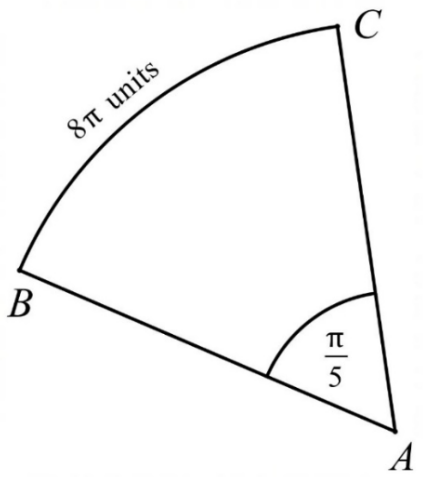
(B) 4π cm

(C) 6π cm

(D) 10π cm

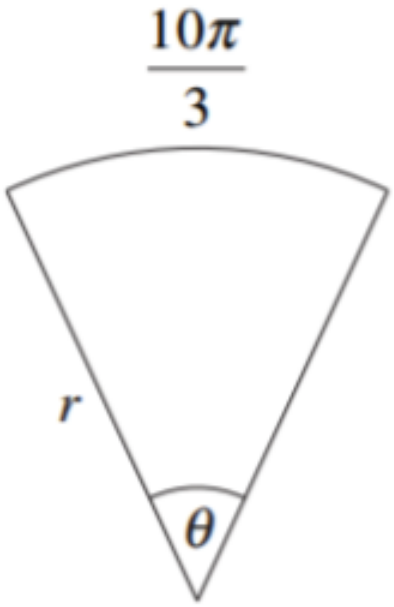
Q11 Cherrybrook Tech 2021 Prelim Q13 · **2 marks**

A sector of a circle has centre A, with $\angle BAC = \dfrac{\pi}{5}$ radians. The arc BC has a length of 8π units. Find the area of the sector, giving your answer in terms of π.



Q12 Girraween 2020 Trial Q18 · **4 marks**

A sector has radius r and angle θ, where $0 < \theta \leq 2\pi$. The arc length is $\frac{10\pi}{3}$.



(a) Find θ in terms of r, and hence show that $r \geq \frac{5}{3}$.

(b) Calculate the area of the sector when $r = 4$.

Q13 Knox 2021 Prelim Q11 · **2 marks**

The area of a sector of a circle is 4π units^2 and the arc length of this sector is $\frac{8\pi}{3}$ units. Find the radius of the circle and the angle that is subtended at the centre.

Q14 James Ruse 2025 Trial Q25 · **3 marks**

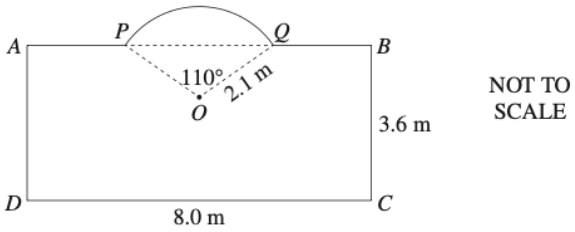
A car travels at 40 km/h on a circular curve whose radius is 500 m.

(a) Find the distance, l km, that the car travels in one minute.

(b) Calculate the size of the angle θ through which the car turns in 2 minutes. Give your answer to the nearest degree.

Q15 2023 HSC Q16 · **4 marks**

The diagram shows a shape $APQBCD$. The shape consists of a rectangle $ABCD$ with an arc PQ on side AB and with side lengths $BC = 3.6$ m and $CD = 8.0$ m. The arc PQ is an arc of a circle with centre O and radius 2.1 m and $\angle POQ = 110°$.



What is the perimeter of the shape $APQBCD$? Give your answer correct to one decimal place.

3. Area of a sector

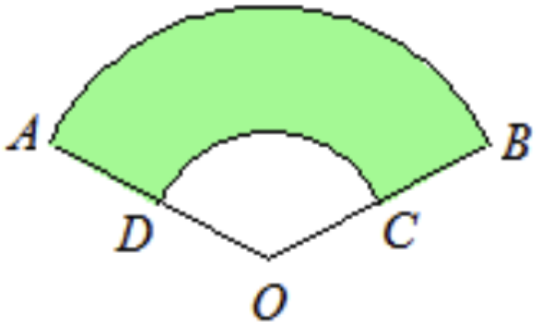
Q16 Sydney Grammar 2025 Trial Q31 · **1 mark**

In early planetary models, planets orbit the sun in circular orbits. Suppose a planet completes its orbit of radius r around the sun in time T, while moving at a constant speed v. Express v in terms of r and T by using

$$\text{constant speed} = \frac{\text{distance travelled}}{\text{time}}.$$

Q17 St George Girls 2021 Trial Q4 · **1 mark**

A car windscreen wiper traces out the area $ABCD$, where AB and CD are arcs of circles with a common centre O and radii 50 cm and 30 cm respectively. Angle AOB measures 135°.



What is the area of the shaded region $ABCD$ to the nearest square centimetre?

(A) 600 cm^2

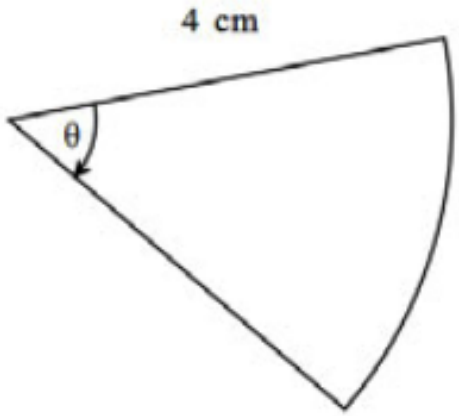
(B) 1257 cm^2

(C) 1885 cm^2

(D) 96000 cm^2

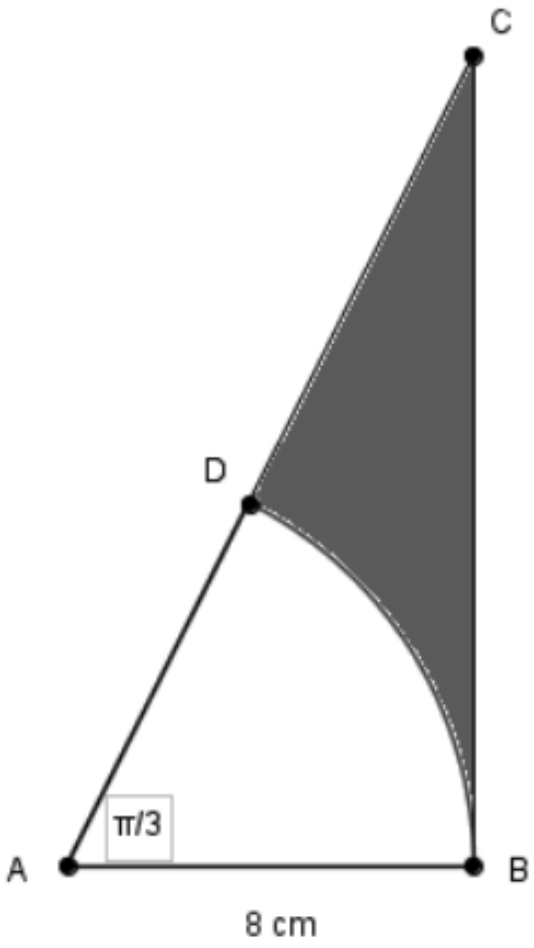
Q18 Sydney Boys 2023 Trial Q15 · **2 marks**

The radius and the area of a sector are 4 cm and 3π cm^2 respectively. Calculate the exact perimeter of the sector in terms of π.



Q19 Gosford 2022 Trial Q11 · **3 marks**

In the diagram, triangle ABC is right angled at B, with $AB = 8$ cm and $\angle BAC = \dfrac{\pi}{3}$. The circular arc BD has centre A with radius AB.



(i) Find the exact area of sector ABD.

(ii) Hence find the exact area of the shaded region BCD.

Q20 Gosford 2024 Trial Q2 · **1 mark**

An athlete runs for 500 metres around a circular track with radius 200 metres. How far, in a direct line across the field, is the athlete from her starting position?

(A) 200 m

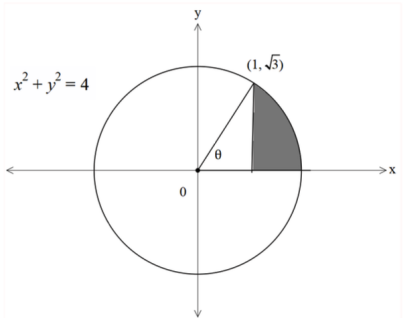
(B) 283 m

(C) 380 m

(D) 458 m

Q21 Hornsby Girls 2023 Trial Q28 · **2 marks**

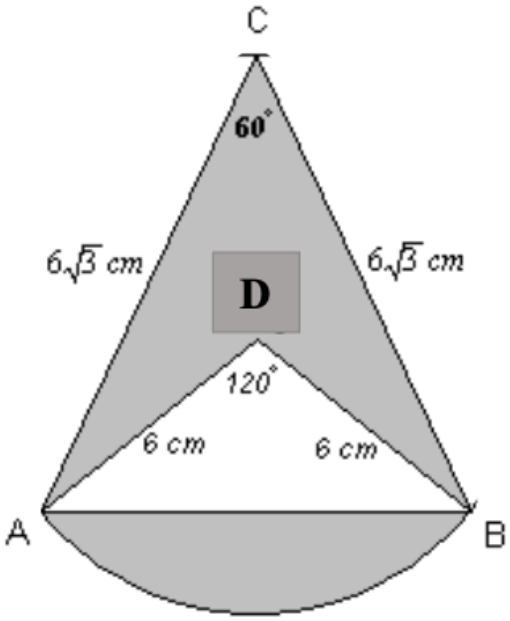
The graph of the circle $x^2 + y^2 = 4$ is shown. The interval connecting the origin O and the point $(1, \sqrt{3})$ makes an angle of θ with the positive direction of the x-axis. By considering the value of θ, find the exact area of the shaded region, as shown in the diagram.



NOT TO SCALE

Q22 SCEGGS 2022 Prelim Q21 · **3 marks**

The design drawing for a company logo is shown. Triangle ADB is inscribed in sector ABC, with $AC = CB = 6\sqrt{3}$ cm, $AD = DB = 6$ cm, $\angle ADB = 120°$ and $\angle ACB = 60°$.

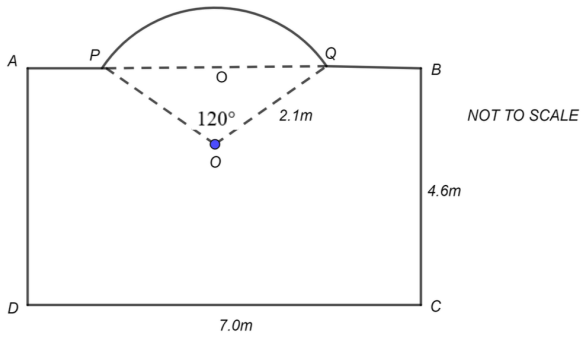


(a) Find the exact area of the sector ACB.

(b) Find the exact area of the shaded region.

Q23 Hornsby Girls 2025 Trial Q16 · **4 marks**

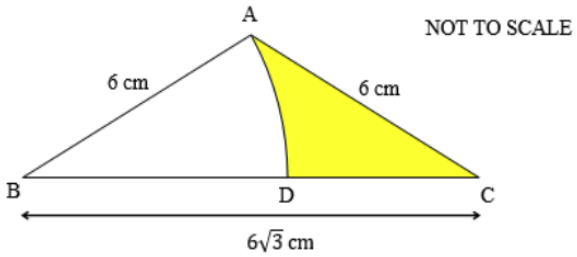
The diagram shows a shape $APQBCD$. The shape consists of a rectangle $ABCD$ with an arc PQ on the side AB, where $BC = 4.6$ m and $DC = 7.0$ m. The arc PQ is an arc of a circle with centre O and radius 2.1 m, and $\angle POQ = 120°$.



What is the area of the shape $APQBCD$? Give your answer correct to one decimal place.

Q24 St George Girls 2022 Prelim Q28 · **5 marks**

The diagram shows an isosceles triangle ABC with equal sides $AB = AC = 6$ cm and base $BC = 6\sqrt{3}$ cm. A sector ABD with centre B and radius AB is inscribed in triangle ABC.

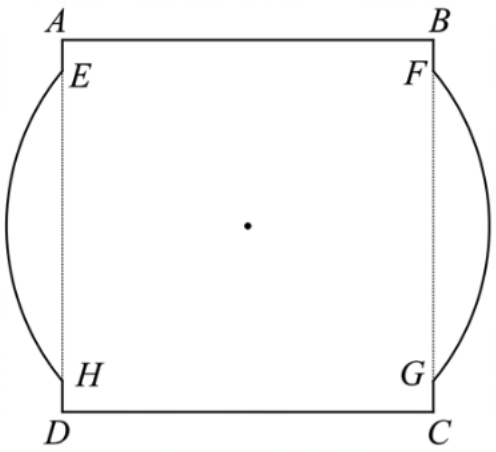


(a) Find the size of angle ABC in radians.

(b) Find the exact area of the shaded part of the triangle ABC.

Q25 Manly 2024 Trial Q27 · **3 marks**

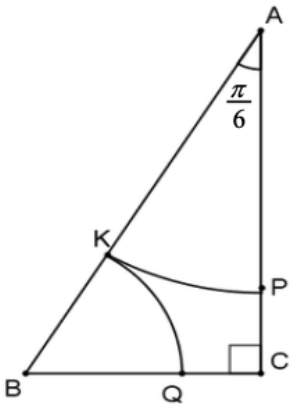
The diagram shows a shape that consists of a square with two identical arcs on opposite sides of the square. The square has a side length of 12 m and the arcs have their centre at the centre of the square. The points E, F, G and H are the endpoints of the arcs, with $AE = FB = CG = HD = 1$ m.



Calculate the area of the shape, to the nearest square metre.

Q26 Hornsby Girls 2022 Trial Q23 · **6 marks**

In the diagram, triangle ABC is right angled at C, with $\angle BAC = \dfrac{\pi}{6}$ and $AB = 5$ cm. KP is a circular arc with centre A, and KQ is a circular arc with centre B.



NOT TO SCALE

If AK has length x cm, find the value of x, correct to one decimal place, for which the areas of the sectors AKP and BKQ are equal.

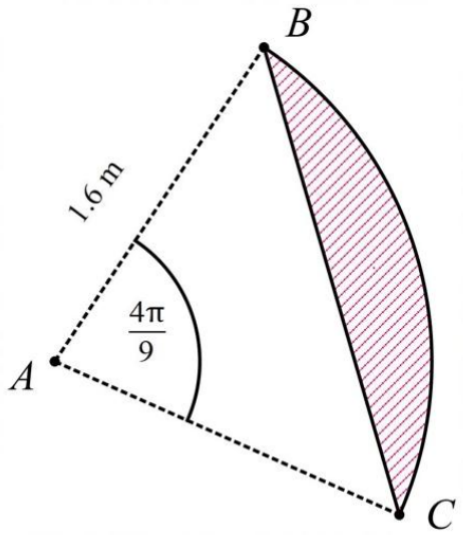
4. Area of a segment

Q27 Girraween 2021 Prelim Q2 · **2 marks**

A chord of a circle with radius 7 cm subtends an angle of 115° at the centre. Find the area of the minor segment cut off by the chord, correct to one decimal place.

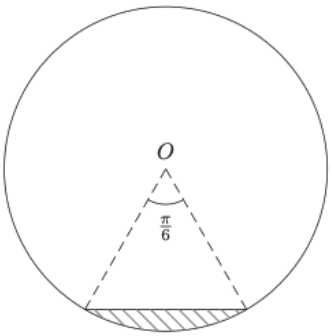
Q28 Fort St 2025 Trial Q13 · **3 marks**

The shaded segment shown is formed by an arc BC of a circle with radius 1.6 m. The arc subtends an angle of $\frac{4\pi}{9}$ radians at its centre, A. Find the area of the shaded segment, correct to three significant figures.



Q29 Normanhurst Boys 2022 Trial Q7 · **1 mark**

The area of a minor segment of a circle is 100π square metres. The chord that cuts off this segment subtends an angle of $\frac{\pi}{6}$ at the centre. Which of the following is the exact form of the radius of the circle?



NOT TO SCALE

(A) $\sqrt{\dfrac{200\pi(\pi-3)}{6}}$ m

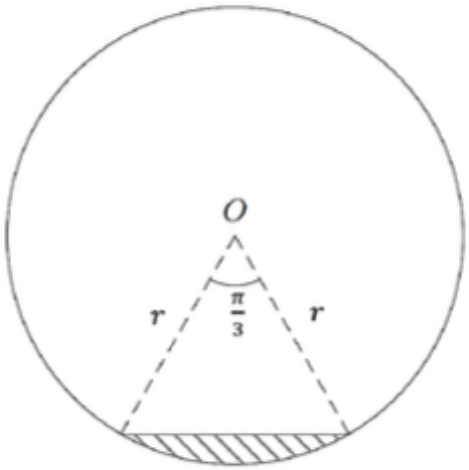
(B) $\sqrt{\dfrac{1200}{\pi-3}}$ m

(C) $\sqrt{\dfrac{200(\pi-3)}{\pi}}$ m

(D) $\sqrt{\dfrac{1200\pi}{\pi-3}}$ m

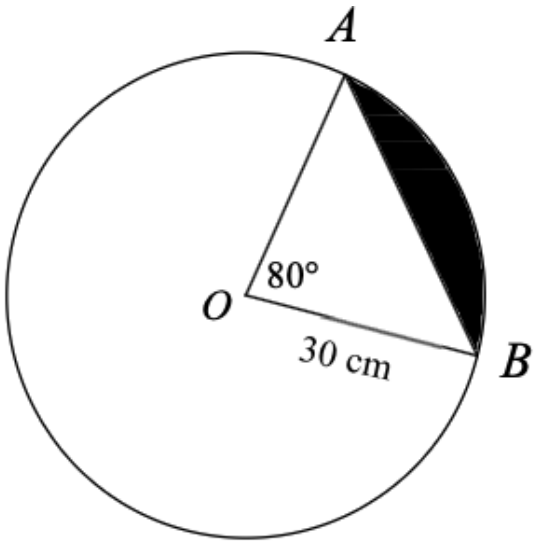
Q30 Blacktown Boys 2025 Trial Q20 · **2 marks**

The area of a minor segment of a circle is 2.5 m^2. The chord that cuts off this segment subtends an angle of $\frac{\pi}{3}$ at the centre. Find the radius of the circle, correct to two decimal places.



Q31 Shore 2023 Trial Q21 · **5 marks**

A circle has centre O and radius 30 cm. The points A and B lie on the circle such that $\angle AOB = 80°$.



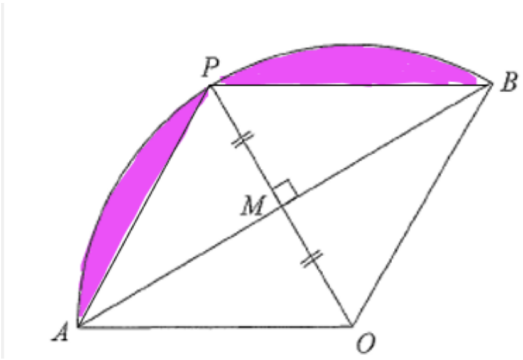
(a) Convert $80°$ to radians.

(b) Show that the area of sector AOB is equal to 628 cm^2, rounded to the nearest square centimetre.

(c) Find the perimeter of the shaded segment cut off by the chord AB, giving your answer correct to one decimal place.

Q32 Sydney Tech 2025 Trial Q23 · **3 marks**

APB is an arc of a circle with centre O and radius 8 cm, such that the chord AB bisects the radius OP at right angles. The shaded region is the segment between the chord AB and the arc APB.



(i) Show that the angle AOB is $\dfrac{2\pi}{3}$.

(ii) Find the shaded area in simplest exact form.

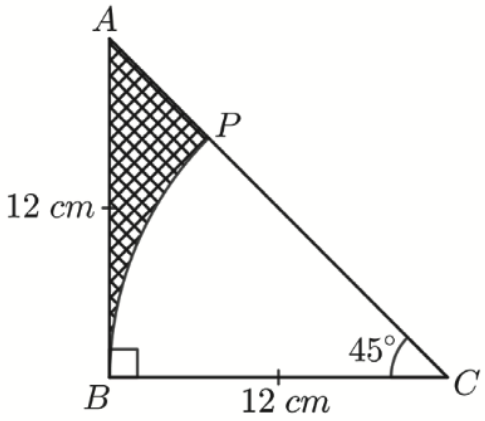
Q33 Baulkham Hills 2022 Prelim Q26 · **4 marks**

A garden bed is in the shape of a circle with a minor segment removed. The circle has centre O and radius 5 metres. The length of the straight edge AB (the chord bounding the removed segment) is $5\sqrt{3}$ metres. Find the area of the garden bed, leaving your answer as an exact value.

5. Perimeter and composite mensuration

Q34 Blacktown Boys 2022 Prelim Q22 · **4 marks**

In the diagram below, ABC is a right-angled isosceles triangle with $\angle ABC = 90°$ and $AB = BC = 12$ cm. The arc BP, with centre C and radius CB, is drawn to meet CA at P.

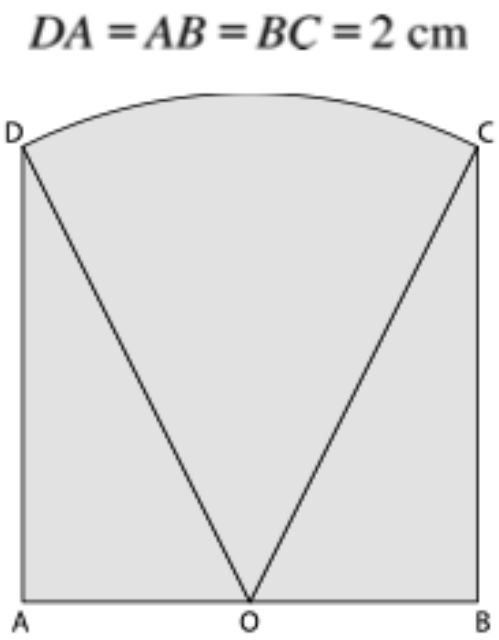


(a) Find the exact area of the shaded region ABP.

(b) Find the exact perimeter of the shaded region ABP.

Q35 Sydney Girls 2024 Trial Q11 · **5 marks**

A shape consists of three sides of the square $ABCD$ together with a sector ODC, where O is the midpoint of AB, as shown below (not to scale). The square $ABCD$ has side length 2 cm.



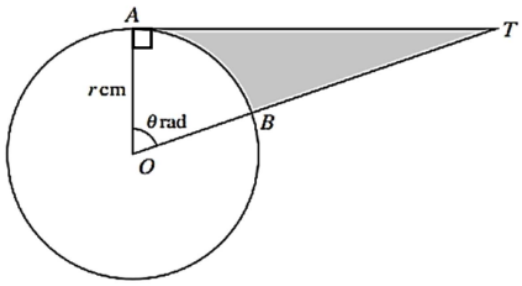
(a) Find the exact length of DO.

(b) If $\angle DOC = \theta$, show that $\cos\theta = \dfrac{3}{5}$.

(c) Hence find the perimeter of the shape $ABCD$, correct to 2 decimal places.

Q36 North Sydney Girls 2020 Trial Q22 · **5 marks**

The diagram shows a circle with centre O and radius r cm. The points A and B lie on the circle and AT is a tangent to the circle. OBT is a straight line and $\angle AOB = \theta$ radians. The shaded region is bounded by the tangent AT, the straight interval TB and the arc AB.

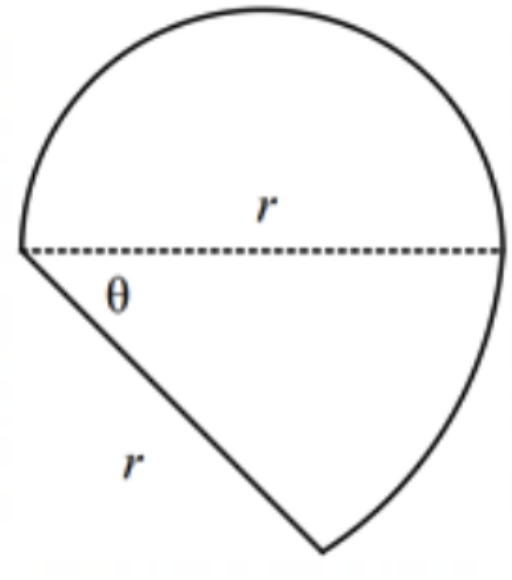


(a) Express the area of the shaded region in terms of r and θ.

(b) Given that $r = 3$ and $\theta = 1.2$, find the perimeter of the shaded region. Give your answer to 2 decimal places.

Q37 North Sydney Boys 2024 Prelim Q27 · **4 marks**

Nick constructs a swimming pool in the shape shown below. The pool design is made up of a sector, of radius r and angle θ, together with a semicircle whose diameter is equal to the radius r of the sector.



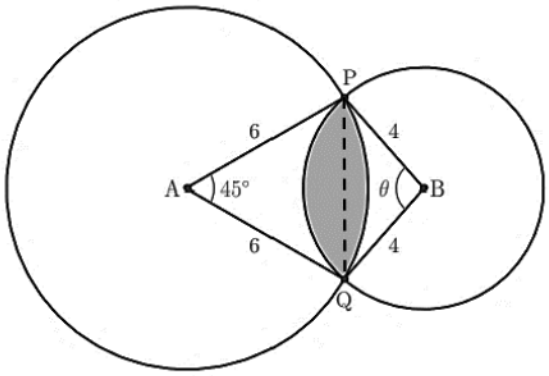
(a) Find the perimeter of the pool in terms of r and θ.

(b) Nick wants to be able to use this design in several different properties, so he decides to let the area of the pool equal 1 square unit for ease in scaling the pool sizes. Show that, if this is the case, the perimeter can be given by

$$P = \frac{2}{r} + r\left(1 + \frac{\pi}{4}\right).$$

Q38 North Sydney Girls 2023 Prelim Q27 · **4 marks**

Two circles, with centres A and B, intersect at the points P and Q. The radii of the circles are 6 cm and 4 cm respectively, and $\angle PAQ = 45°$, as shown in the diagram below. The shaded region is the overlap of the two circles.



(a) Show that $PQ = 6\sqrt{2-\sqrt{2}}$.

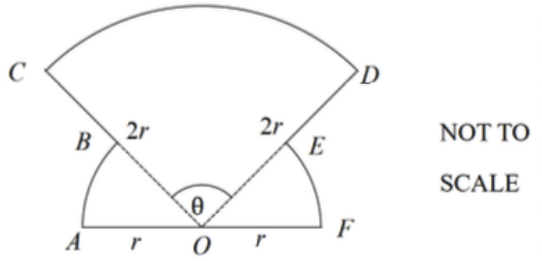
(b) Given that $\angle PBQ = 70.1°$, find the perimeter of the shaded region to the nearest centimetre.

Q39 Abbotsleigh 2024 Prelim Q29 · **5 marks**

The shape $OABCDEFO$ shown below is a design for a logo. In the design:

- OAB is a sector of a circle with centre O and radius r;
- sector OFE is congruent to sector OAB;
- ODC is a sector of a circle with centre O and radius $2r$;
- AOF is a straight line.

The size of the angle COD is θ radians.



(a) Show that $\angle AOB = \dfrac{\pi - \theta}{2}$.

(b) Show that the area of the logo is $\dfrac{1}{2}r^2(3\theta + \pi)$.

(c) Find the perimeter of the logo, giving your answer in simplest form in terms of r, θ and π.