IB MATHS AA HL · UNIT 3

Radians: exam practice

10 questions · 39 marks · worked solutions and markschemes

Name _____ Date _____ Score / 39

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/hlaa/radians-exam-practice

1. **2 marks · Paper 1 style · no calculator**

Convert $225°$ to radians and $\frac{7\pi}{12}$ to degrees.

Convert both. **[2]**

2. **2 marks · Paper 1 style · no calculator**

A wheel turns through $750°$.

Write this angle in radians, as an exact multiple of π. **[2]**

3. **3 marks · Paper 1 style · no calculator**

The minute hand of a clock is 12 cm long.

Find the exact distance moved by the tip of the minute hand in 20 minutes. **[3]**

4. **3 marks · Paper 1 style · no calculator**

A sector of radius r and angle 0.8 radians has area $40\ \text{cm}^2$.

Find r and the arc length. **[3]**

5. **4 marks · Paper 1 style · no calculator**

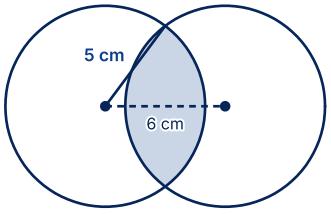
The area of a sector is $15\ \text{cm}^2$ and its arc length is 5 cm.

Find the radius and the angle of the sector. **[4]**

6. **5 marks · Paper 2 style · calculator**

Two circles of radius 5 cm have centres 6 cm apart. The common region of the two circles is shaded.

Find the area of the shaded region. **[5]**



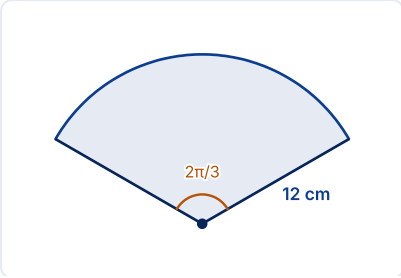
Radius 5 cm, centres 6 cm apart

7. **4 marks · Paper 1 style · no calculator**

A sector of a circle has radius 12 cm and angle $\frac{2\pi}{3}$.

(a) Find the exact arc length. **[2]**

(b) Find the exact area of the sector. **[2]**



Radius 12 cm, angle 2π/3

8. **4 marks · Paper 2 style · calculator**

A sector has perimeter 30 cm and radius 8 cm.

(a) Find the angle of the sector in radians. **[2]**

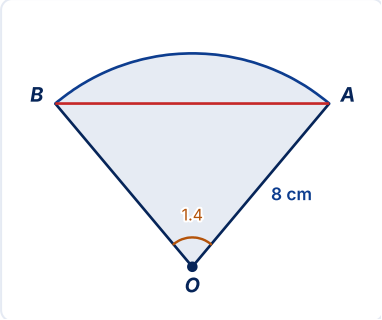
(b) Find the area of the sector. **[2]**

9. **6 marks · Paper 2 style · calculator**

A chord AB subtends an angle of 1.4 radians at the centre O of a circle of radius 8 cm.

(a) Find the area of the minor segment cut off by AB. **[3]**

(b) Find the perimeter of the minor segment. **[3]**



Radius 8 cm, angle 1.4 radians

10. **6 marks · Paper 2 style · calculator**

A sector OAB of radius r cm has angle θ radians and perimeter 20 cm.

(a) Show that the area of the sector is $A = 10r - r^2$. **[3]**

(b) Find the maximum area and the value of θ that gives it. **[3]**

Answers and worked solutions

Question 1 — 2 marks

Answer: $\frac{5\pi}{4}$, $105°$

$\frac{5\pi}{4}$ **A1**

$105°$ **A1**

Question 2 — 2 marks

Answer: $\frac{25\pi}{6}$

$750 \times \frac{\pi}{180}$ **M1**

$\frac{25\pi}{6}$ **A1**

Question 3 — 3 marks

Answer: 8π cm

angle $\frac{2\pi}{3}$ **A1**

$12 \times \frac{2\pi}{3}$ **M1**

8π cm **A1**

Question 4 — 3 marks

Answer: $r = 10$ cm, arc 8 cm

$\frac{1}{2}r^2(0.8) = 40$ **M1**

$r = 10$ cm **A1**

arc $= 8$ cm **A1**

Question 5 — 4 marks

Answer: $r = 6$ cm, $\theta = \frac{5}{6}$

$\frac{1}{2}r^2\theta = 15$, $r\theta = 5$ **M1**

$\frac{1}{2}r(5) = 15$ **A1**

$r = 6$ cm **A1**

$\theta = \frac{5}{6}$ **A1**

Question 6 — 5 marks

Answer: $22.4\ \text{cm}^2$

half-angle: $\cos\alpha = \frac{3}{5}$ **M1**

$2\alpha = 1.854$ rad **A1**

one segment

$\frac{1}{2}(25)(1.854 - \sin 1.854) = 11.18$

$M1$**A1**

$22.4\ \text{cm}^2$ **A1**

Question 7 — 4 marks

Answer: (a) 8π cm; (b) $48\pi\ \text{cm}^2$

(a)

$12 \times \frac{2\pi}{3}$ **M1**

8π cm **A1**

(b)

$\frac{1}{2}(144)\frac{2\pi}{3}$ **M1**

$48\pi\ \text{cm}^2$ **A1**

Question 8 — 4 marks

Answer: (a) 1.75; (b) $56\ \text{cm}^2$

(a)

$16 + 8\theta = 30$ **M1**

$\theta = 1.75$ **A1**

(b)

$\frac{1}{2}(64)(1.75)$ **M1**

$56\ \text{cm}^2$ **A1**

Question 9 — 6 marks

Answer: (a) $13.3\ \text{cm}^2$; (b) 21.5 cm

(a)

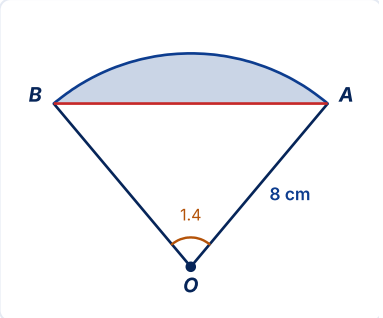
$\frac{1}{2}(64)(1.4 - \sin 1.4)$ $M1$**A1**

$13.3\ \text{cm}^2$ **A1**

(b)

chord $2(8)\sin 0.7 = 10.31$ $M1$ **A1**

$11.2 + 10.31 = 21.5$ cm **A1**



Segment = sector − triangle

Question 10 — 6 marks

Answer: (b) $25\ \text{cm}^2$ when $\theta = 2$

(a)

$2r + r\theta = 20$ **A1**

$\theta = \frac{20 - 2r}{r}$ **M1**

$A = \frac{1}{2}r^2 \cdot \frac{20 - 2r}{r} = 10r - r^2$ **A1 AG**

(b)

$r = 5$ **A1**

$A = 25\ \text{cm}^2$ **A1**

$\theta = 2$ **A1**

Every solution is also on ibmathrevision.com/hlaa/radians-exam-practice
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