

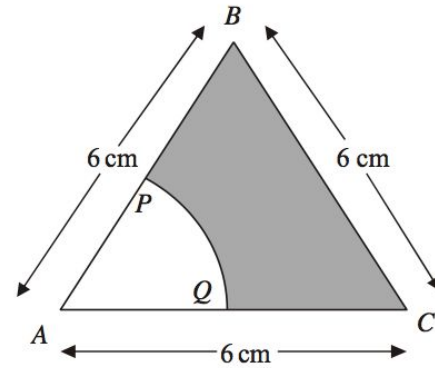
Math SL PROBLEM SET 24

Section A (Short Answer)

1. **(T3.1 - N)** (CA) The diagram shows an equilateral triangle ABC with sides of length 6 cm. *(Cirrito 9.4, p287; Cirrito 9.7, p309)*

P is the midpoint of AB.
Q is the midpoint of AC.
APQ is a sector of a circle, centre A.

- Calculate the length of the arc PQ of the sector
- Calculate the area of the shaded region. Give your answer correct to 3 significant figures.



2. **(T3.5 - R)** (CI) The population (in thousands) of a species of butterfly in a nature sanctuary is modelled by the function:

$$P(t) = 3 + 2 \sin\left(\frac{3\pi t}{8}\right), \quad 0 \leq t \leq 12$$

where t is the time in weeks after scientists first started making populations estimates.

(Cirrito 10.5, p361)

- What is the initial population?
 - What are the largest and smallest populations?
 - When does the population exceed 4,000 butterflies for the first time?
3. **(T3.5 - E)** (CI) Draw the two special right triangles as well as graphs of $y = \sin(x)$ and $y = \cos(x)$. Label the maximums, minimums and intercepts of these two graphs. *(Cirrito 10.4, p351)*

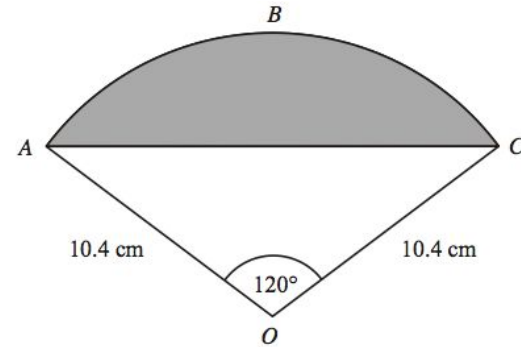
- Solve $\sqrt{2} \cos(x) + 1 = 0$ for $-360^\circ \leq x \leq 360^\circ$
- Solve $\sin^2(\theta) - 1 = 0$ for $0 \leq \theta \leq 4\pi$

4. **(A1.1 - E)** (CI) Find the value of p so that $p + 5$, $4p + 3$ and $8p - 2$ are three successive terms of an arithmetic sequence. *(Cirrito, 8.1, p241)*
5. **(A1.1 - E)** (CI) Three successive terms of a geometric sequence are $2k + 2$, $5k + 1$ and $10k + 2$. Find the value(s) of k . *(Cirrito, 8.2, p252)*

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6. **(T3.1 - N) (CA)** The diagram shows a sector OABC of a circle with centre O. Given that $OA = OC = 10.4$ cm and angle $AOC = 120^\circ$. *(Cirrito 9.4, p287; Cirrito 9.7, p309)*

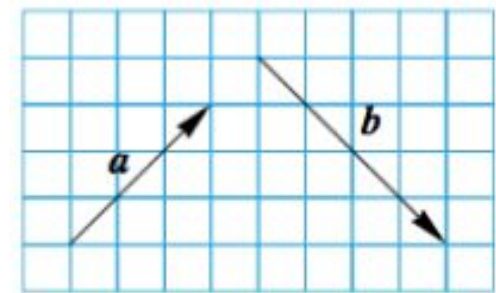
- Calculate the length of the arc ABC of the sector. Give your answer correct to 3 significant figures.
- Calculate the area of the shaded segment ABC. Give your answer correct to 3 significant figures.



Section B (Extended Response/Investigation)

7. **(V4.1 - N) (CI)** Using the vectors shown in the diagram, draw the vectors *(Cirrito 12.3, p415)*

- $a - b$
- $b - 2a$
- $2b - 3a$
- $\frac{1}{2}(b + 2a)$



8. **(A1.1 - E) (CA)** Here are two more geometric series: *(Cirrito 8.2.4, p263)*

- $\frac{9}{2} + 3 + 2 + \frac{4}{3} + \dots$
- $240 - 60 + 15 - 3.75 + \dots$

- For each series,
 - Find the common ratio, r .
 - Use your calculator to find S_{10} , S_{15} and S_{20} . Record the complete value (no rounding)
- Do you notice any patterns? Why do you think this is happening?
- Now use your calculator to evaluate S_{50} . Do you think your calculator is correct? Why or why not?
- For each series, predict the sum of an infinite number of terms.