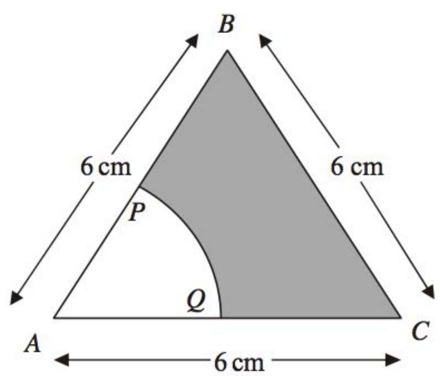
1. (**T3.5 - R**) (**CI**) The population (in thousands) of a species of butterfly in a nature sanctuary is modelled by the function:

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

where t is the time in weeks after scientists first started making population estimates. *(Cirrito 10.5, p.361)*

   a. What is the initial population?
   b. What are the largest and smallest populations?
   c. When does the population exceed 4,000 butterflies for the first time?

2. (**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.

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

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, p.351)*

   a. Solve $\sqrt{2}\cos(x) + 1 = 0$ for $-360° \le x \le 360°$
   b. Solve $\sin^2(\theta) - 1 = 0$ for $0 \le \theta \le 4\pi$

4. (**SP5.1, SP5.2, SP5.3 - R**) (**CA**) A survey is carried out to find the waiting times for 100 customers at a supermarket. The results are summarized in the table below: *(Oxford 8.5, p171; Cirrito 13.5, p482)*

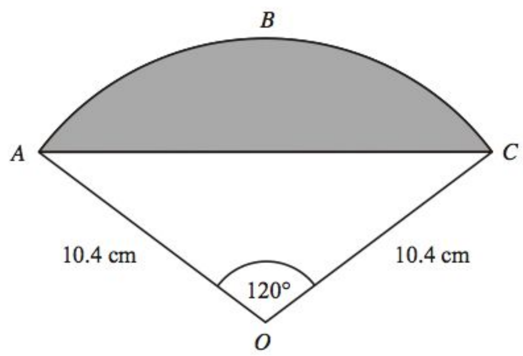
Waiting Time (sec)	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100	100 - 120	120 - 140	140 - 160
Number of customers	5	15	33	21	11	7	5	2

   a. Calculate an estimate for the mean waiting time
   b. Estimate the value of the standard deviation as well as the variance of the waiting time.
   c. Draw a cumulative frequency graph (CFG) using graph paper
   d. Use the CFG to estimate the interquartile range.

5. (**A1.1 - E**) (**CI**) Three successive terms of a sequence are $2k + 2$, $5k + 1$ and $10k + 2$. Find the value(s) of k if: *(Cirrito, 8.2, p252)*

   a. the sequence is arithmetic;
   b. the sequence is geometric.

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°. *(Cirrito 9.4, p287; Cirrito 9.7, p309)*



   a. Calculate the length of the arc ABC of the sector. Give your answer correct to 3 significant figures.

   b. Calculate the area of the shaded segment ABC. Give your answer correct to 3 significant figures.

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

   i. $\frac{9}{2} + 3 + 2 + \frac{4}{3} + \ldots\ldots$
   ii. $240 - 60 + 15 - 3.75 + \ldots\ldots$

   b. For each series,

   i. Find the common ratio, r.
   ii. Use your calculator to find S_{10}, S_{15} and S_{20}. Record the complete value (no rounding)

   c. Do you notice any patterns? Why do you think this is happening?

   d. Now use your calculator to evaluate S_{50}. Do you think your calculator is correct? Why or why not?

   e. For each series, predict the sum of an infinite number of terms.

8. (**A1.2 - N, F2.7 - E**) (**CI**) Solve $\log_3(x - 2) + \log_3(x + 4) = 3$ for x. Use your TI-84 to graph and verify. Explain why there is only one solution for x. *(Cirrito 7.4, p221)*