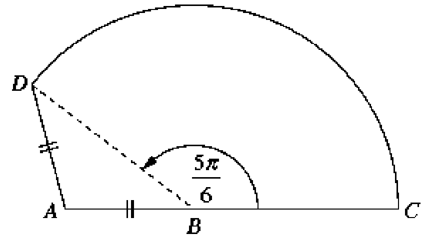
06	**4a**	In the diagram, *ABCD* represents a garden. The sector *BCD* has centre *B* and $\angle DBC = \frac{5\pi}{6}$. The points *A*, *B* and *C* lie on a straight line and $AB = AD = 3$ metres. Copy or trace the diagram into your writing booklet. (i) Show that $\angle DAB = \frac{2\pi}{3}$. (ii) Find the length of *BD*. (iii) Find the area of the garden *ABCD*. 	**1** **2** **2**

(i) $\angle ABD = \pi - \frac{5\pi}{6}$ [ie. 180° – 150° = 30°]

$= \frac{\pi}{6}$ (straight $\angle$)

$\angle DAB = \pi - (\frac{\pi}{6} + \frac{\pi}{6})$ [ie. 180° – (30° + 30°) = 120°]

$= \frac{2\pi}{3}$

(ii) Using cosine rule:

$BD^2 = 3^2 + 3^2 - 2 \times 3 \times 3 \times \cos \frac{2\pi}{3}$

$= 27$

$BD = 3\sqrt{3}$ $\therefore$ length BD is $3\sqrt{3}$ metres

(iii) Area ABCD = Area of triangle + area of sector

$= \frac{1}{2}ab\sin C + \frac{1}{2}r^2\theta$

$= \frac{1}{2} \times 3 \times 3 \times \sin \frac{2\pi}{3} + \frac{1}{2} \times 3\sqrt{3} \times 3\sqrt{3} \times \frac{5\pi}{6}$

$= \frac{1}{2} \times 3 \times 3 \times \frac{\sqrt{3}}{2} + \frac{1}{2} \times 3\sqrt{3} \times 3\sqrt{3} \times \frac{5\pi}{6}$

$= \frac{9\sqrt{3}}{4} + \frac{45\pi}{4}$

$= 39.24003167 \ldots$

$= 39.24$ (2 dec pl) $\therefore$ area is 39.24 m^2

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by the Board of Studies

Board of Studies: Notes from the Marking Centre

(i) In better responses, candidates gave reasons for the three geometrical steps and used the diagram to illustrate their thought process by marking in the angles. Most candidates worked with radians, though some chose to convert to degrees first before proceeding with their solutions. Candidates using a mixture of radians and degrees in the same equation did not gain the mark.

(ii) Candidates who used the correct cosine rule and substituted correctly usually scored full marks. The sine rule was also used by candidates with the same degree of success. Dividing the isosceles triangle into right-angle triangles for calculation of *BD* was another method used. Loss of marks usually resulted from incorrect use of calculators, a wrong angle, or incorrect cosine rule or sine rule.

(iii) Candidates who knew their formulae were generally successful in obtaining the correct answer. The most common errors were not knowing the sector area formula, and leaving out the $\frac{1}{2}$ in the sector area formula or the formula for the area of the triangle. Another error was the use of 150 instead of $\frac{5\pi}{6}$ in the sector area formula. Some candidates were unable to simplify or work with surds and fractions, resulting in calculation errors in their responses.

Source: http://www.boardofstudies.nsw.edu.au/hsc_exams/