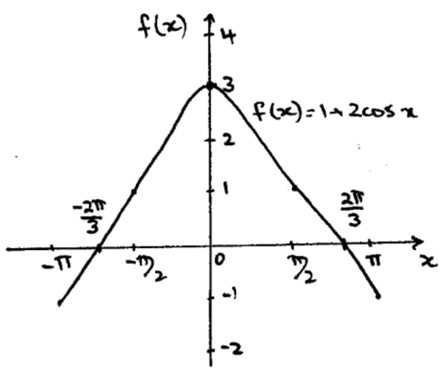
06	**7b**	A function $f(x)$ is defined by $f(x) = 1 + 2\cos x$.	
		(i) Show that the graph of $y = f(x)$ cuts the x-axis at $x = \frac{2\pi}{3}$.	**1**
		(ii) Sketch the graph of $y = f(x)$ for $-\pi \le x \le \pi$ showing where the graph cuts each of the axes.	**3**
		(iii) Find the area under the curve $y = f(x)$ between $x = -\frac{\pi}{2}$ and $x = \frac{2\pi}{3}$.	**3**

(i)

$$\begin{aligned} \text{Let } f(x) &= 0: \\ 1 + 2\cos x &= 0 \\ 2\cos x &= -1 \\ \cos x &= -\frac{1}{2} \\ x &= \frac{2\pi}{3}, \ldots \end{aligned}$$

$\therefore$ cuts x-axis at $x = \frac{2\pi}{3}$.

(ii)



(iii)

$$\begin{aligned} \text{Area} &= \int_{-\frac{\pi}{2}}^{\frac{2\pi}{3}} 1 + 2\cos x \, dx: \\ &= \left[x + 2\sin x\right]_{-\frac{\pi}{2}}^{\frac{2\pi}{3}} \\ &= \left(\frac{2\pi}{3} + 2\sin\frac{2\pi}{3} - \left(-\frac{\pi}{2} + 2\sin\left(-\frac{\pi}{2}\right)\right)\right) \\ &= \frac{2\pi}{3} + 2 \times \frac{\sqrt{3}}{2} - \left(-\frac{\pi}{2} + 2(-1)\right) \\ &= \frac{2\pi}{3} + \sqrt{3} + \frac{\pi}{2} + 2 \\ &= 2 + \sqrt{3} + \frac{7\pi}{6} \end{aligned}$$

$\therefore$ area is $\left(2 + \sqrt{3} + \frac{7\pi}{6}\right)$ units^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) Candidates were required to show that a graph cut the x-axis at a given point. They needed to realise that this task involved analytical rather than graphical methods.

(ii) The correct shape of a cosine curve was indicated by correct intercepts and correct concavity changes. Three marks were allocated for varying degrees of correctness. The majority of candidates demonstrated a familiarity with the shape of a cosine curve.

(iii) The required calculation to determine the area under the curve was usually set up correctly, and the primitive was also found correctly; however, the correct numerical expression required substituting radian measure rather than degrees. It is apparent from most responses that the table of standard integrals was correctly applied in this question.

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