

<b>13</b>	<b>12 b</b>	<p>The region bounded by the graph <math>y = 3 \sin \frac{x}{2}</math> and the <math>x</math>-axis between <math>x = 0</math> and <math>x = \frac{3\pi}{2}</math> is rotated about the <math>x</math>-axis to form a solid.</p> <p>Find the exact volume of the solid.</p>		<b>3</b>
		$V = \pi \int_a^b y^2 dx$ $= \pi \int_0^{\frac{3\pi}{2}} (3 \sin \frac{x}{2})^2 dx$ $= 9\pi \int_0^{\frac{3\pi}{2}} \sin^2 \frac{x}{2} dx$ $= 9\pi \int_0^{\frac{3\pi}{2}} \frac{1}{2} [1 - \cos x] dx$ $= \frac{9\pi}{2} \int_0^{\frac{3\pi}{2}} 1 - \cos x dx$	$= \frac{9\pi}{2} [x - \sin x]_0^{\frac{3\pi}{2}}$ $= \frac{9\pi}{2} \left[ \frac{3\pi}{2} - \sin \frac{3\pi}{2} - 0 \right]$ $= \frac{9\pi}{2} \left[ \frac{3\pi}{2} + 1 \right]$ $\therefore \text{volume of } \frac{9\pi}{2} \left[ \frac{3\pi}{2} + 1 \right] \text{ units}^3$	<div style="border: 1px solid black; padding: 2px; display: inline-block;">             State Mean:  <b>2.01/3</b> </div>

\* These solutions have been provided by [projectmaths](http://projectmaths.com.au) and are not supplied or endorsed by the Board of Studies

### Board of Studies: Notes from the Marking Centre

Candidates went to the identity  $\sin^2 x = \frac{1}{2}(1 - \cos^2 x)$ , commonly used in integration, and proceeded to alter it to suit the question.

Common problems were:

- not correctly writing  $\sin^2 \frac{x}{2}$  in terms of  $\cos x$
- omitting  $\pi$
- not squaring the function
- squaring  $\frac{x}{2}$
- using  $\sin^2 \left( \frac{x}{4} \right)$
- writing the incorrect primitive
- careless substitutions and evaluations.

Source: [http://www.boardofstudies.nsw.edu.au/hsc\\_exams/](http://www.boardofstudies.nsw.edu.au/hsc_exams/)