Volume of Revolution

Q1

(b) Find the **exact** value of the volume generated when the area bounded by the curve $y = 2e^x$, the x-axis and the lines $x = 1$ and $x = 4$ is rotated through 2π radians about the x-axis. [7]

Q2

A trophy is to be made in the shape of a rugby ball.
It can be modelled by the volume generated when the area between the curve

$$y = \sin x$$

and the x-axis, between $x = 0$ and $x = \pi$, is rotated through 2π radians about the x-axis, as shown in **Fig. 2** below.

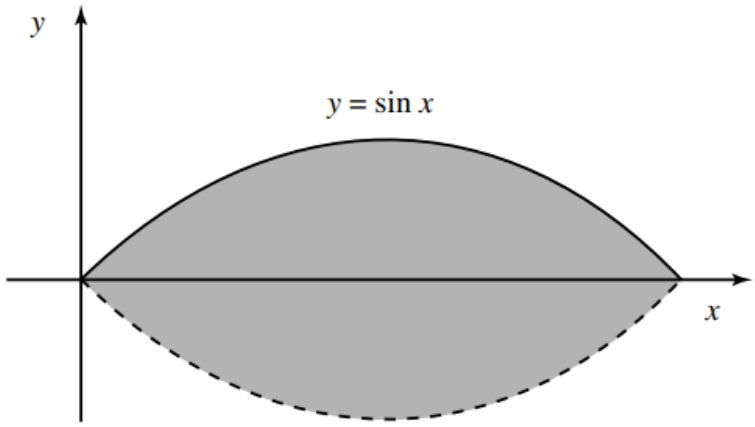

Fig. 2

Find the **exact** volume of the trophy. [9]

Q3

A paperweight can be modelled by the volume generated when the area between the curve $y = \cos x$, the lines $x = \frac{\pi}{6}$ and $x = \frac{\pi}{3}$ and the x-axis is rotated through 2π radians about the x-axis.

Find the volume of the paperweight. [10]

Q4

A bowl is formed by rotating through 2π radians about the x-axis, the arc of the curve

$$y = \sqrt{5x}$$

between $x = 0$ and $x = a$, where a is a positive constant.
The bowl is full of water.
Find the volume of water in the bowl. [6]

Q5

The designers of a bowl use an area rotated through 2π radians around the x-axis as the basis for their design.
The area used is between the curve $y = 4\sqrt{x+2}$, the x-axis and the lines $x = 0$ and $x = a$, as shown in **Fig. 1** below.

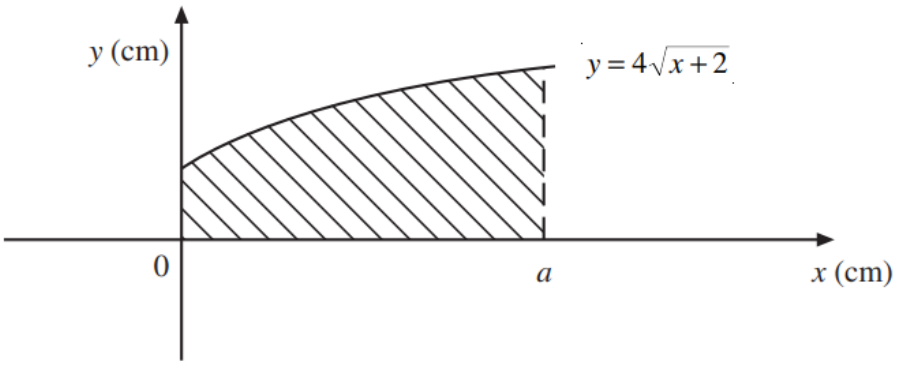

Fig. 1

(i) Find an expression for the capacity of the bowl in terms of a. [7]

The specification requires the capacity of the bowl to be 1000 cm^3

(ii) Find the value of a correct to one decimal place. [7]