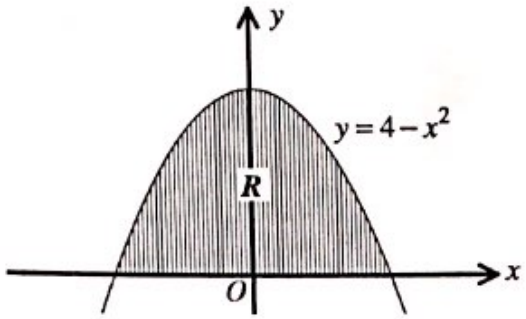
**Question 1 (**)**




The figure above shows the graph of the curve with equation

$$y = 4 - x^2 .$$

The shaded region $R$, is bounded by the curve and the $x$ axis. The region $R$ is rotated through $2\pi$ radians about the $x$ axis to form a solid of revolution.

Show that the volume of the solid is $\frac{a\pi}{b}$. State a, b

**Question 2 (***)**

The curve $C$ has equation

$$y = \sqrt{x} + \frac{4}{\sqrt{x}}, \quad x > 0 .$$

The region bounded by $C$, the $x$ axis and the lines $x = 1$, $x = 4$ is rotated through $360°$ about the $x$ axis.

Show that the volume of the solid formed is $\frac{\pi}{a}(b + c\ln 2)$

State a, b, c

**Question 3 (***)**

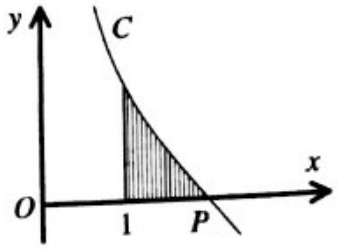
The curve $C$ has equation

$$y = x^2 - 3x .$$

The region bounded by $C$ and the $x$ axis is rotated through $2\pi$ radians in the $x$ axis.

Find the exact volume of the solid formed.

**Question 4 (***+)**




The figure above shows part of the curve $C$ with equation

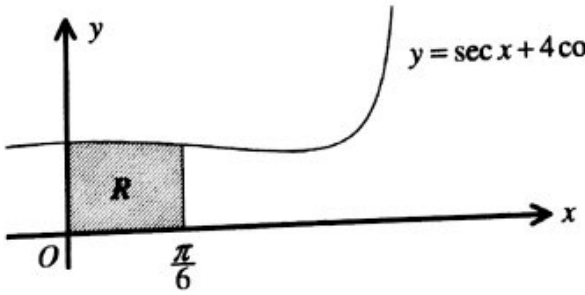
$$y=\frac{2}{x}-\frac{x^2}{4},\ x>0.$$

The curve crosses the $x$ axis at the point $P$.

The shaded region bounded by the curve, the straight line with equation $x=1$ and the $x$ axis is rotated by $360°$ about the $x$ axis to form a solid of revolution.

Show that the volume of the solid is $\frac{a\pi}{b}$ State a, b

**Question 5 (****)**




The figure above shows part of the curve with equation

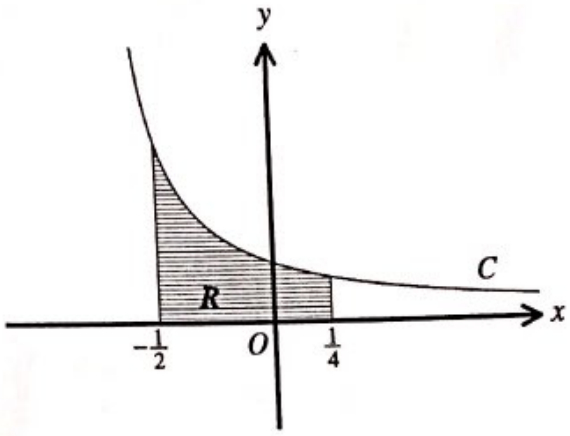
$$y=\sec x+4\cos x.$$

The shaded region, labelled $R$, bounded by the curve, the coordinate axes and the straight line with equation $x=\frac{\pi}{6}$ is rotated by $2\pi$ radians in the $x$ axis to form a solid of revolution.

Show that the solid has a volume of $\frac{\pi}{a}(b\pi+c\sqrt{3})$

State a, b, c

**Question 6 (****)**




The figure above shows part the graph of the curve $C$, with equation

$$y=\frac{3}{2(4x+3)},\ x\neq-\frac{3}{4}.$$

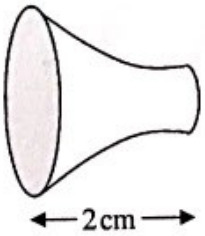
The shaded region $R$, is bounded by the curve, the $x$ axis and the straight lines with equations $x=-\frac{1}{2}$ and $x=\frac{1}{4}$.

a) Find the exact area of $R$.

This region $R$ is rotated through $360°$ about the $x$ axis to form a solid of revolution.

b) Show that the volume of the solid generated is $\frac{a\pi}{b}$. State $a, b$

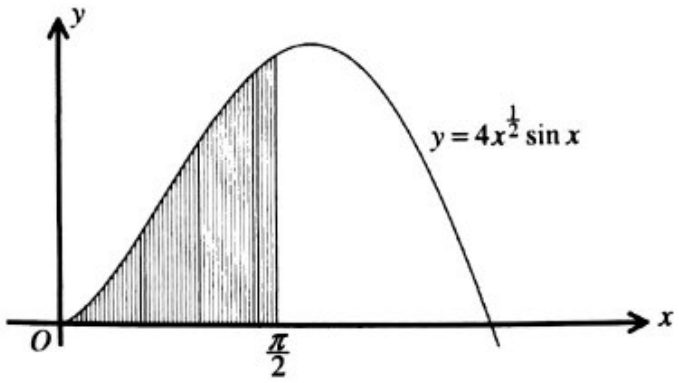
The solid generated in part (b) is used to model a small handle for a drawer.




The solid generated in part (b) and the drawer handle are mathematically similar.

c) Given that the length of the handle is 2cm, find the exact volume of the handle.

**Question 7 (****)**




The figure above shows the graph of the curve with equation

$$y = 4x^{\frac{1}{2}} \sin x .$$

**a)** Find the value of $\int_0^{\frac{\pi}{2}} 8x \cos 2x \ dx$.

The shaded region bounded by the curve, the $x$ axis and the straight line with equation $x = \frac{\pi}{2}$ is rotated by $2\pi$ radians in the $x$ axis to form a solid of revolution.

**b)** Show that the volume of the solid is $\pi(\pi^2 + a)$ State a

**Question 8 (*****)**

The finite region $R$ is by the coordinate axes and the curve with equation

$$y = \arccos x , \ -1 \le x \le 1 .$$

The region $R$ is rotated by $2\pi$ radians in the $x$ axis forming a solid of revolution.

Determine the exact volume of this solid.

**Question 9 (*****) Volumes of revolution**

A curve has equation

$$y^2 = \ln|3x - 12| , \ x \in \mathbb{R} , \ x \neq 4 .$$

The finite region bounded by the curve, the $x$ axis and the straight line with equation $y = 1$, is revolved by $2\pi$ radians in the $x$ axis.

Find the exact volume of the solid formed.

(1) $a = 512$

$b = 15$

(2) $a = 2$

$b = 63$

$c = 64$

(3) $\frac{81\pi}{10}$

(4) $a = 71$

$b = 80$

(5) $a = 3$

$b = 8$

$c = 7$

(6) a) $\frac{3}{4}\ln 2$

b) $a = 27$

$b = 64$

c) $8\pi$

(7) a) $-4$

b) $4$

(8) $\pi^2 - 2\pi$

(9) $\frac{2}{3}\pi(e-1)$