1 On the same set of axes, sketch the graphs of $y = f(x)$ and $y = \dfrac{1}{f(x)}$ given that $f(x) = 4 - x^2$. Locate the points of intersection between the two graphs.

2 A point $P(x, y)$ moves so that it is equidistant from the points $A(1, 1)$ and $B(0, 3)$. Sketch the locus of points and find its cartesian equation.

3 Give the cartesian equation of the locus of points $P(x, y)$ given that P is 5 units from the point with coordinates $(-2, 3)$.

4 **a** Find the centre and radius of the circle whose equation is

$$x^2 - 2x + y^2 + 4y + 1 = 0.$$

b Find the equation of the ellipse if the above circle is dilated by a factor 2 from the x-axis followed by a dilation of factor 3 from the y-axis. What are the coordinates of its centre?

5 Sketch the graph of each of the following ellipses. State the centre of each and label axial intercepts.

a $\dfrac{x^2}{4} + \dfrac{y^2}{9} = 1$

b $\dfrac{(x-1)^2}{4} + \dfrac{y^2}{9} = 1$

6 Find the locus of a point $P(x, y)$ as it moves such that the sum of its distance from the points $A(0,1)$ and $B(0,-1)$ is 4 units.

7 Sketch the graph of each of the following hyperbolas. State the centre of each and label axial intercepts.

a $x^2 - \dfrac{y^2}{4} = 1$

b $(y-2)^2 - \dfrac{x^2}{4} = 1$

8 A curve is parameterised by the equations

$$x = \frac{1+t}{1-t} \text{ and } y = \frac{1}{1+t}.$$

Find and sketch its cartesian equation.

9 An ellipse has parametric equations:

$$x = -2 + 3\cos t \text{ and } y = -3 + 2\sin t\ .$$

Find the cartesian equation of the ellipse.

10 Convert the cartesian coordinates $\left(-\sqrt{3}, 1\right)$ into polar coordinates.

11 Convert the polar coordinates $\left(-2, \frac{\pi}{6}\right)$ into cartesian coordinates.

12 Show that the ellipse with cartesian equation $x^2 + 4y^2 = 1$ has polar equation,

$$r^2 = \frac{1}{1+3\sin^2\theta}$$

13 Sketch the curve whose polar equation is $r = 1 + \sin\theta$, and find its Cartesian equation.