AQA – Differentiation – A2 Mathematics P2

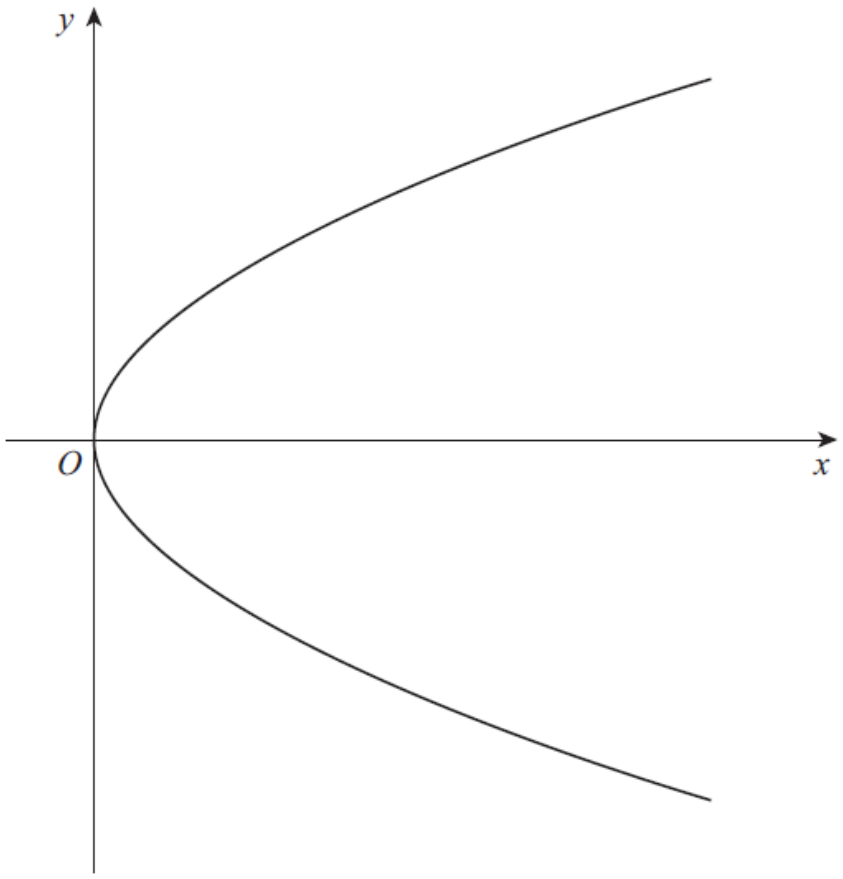
1. June/2020/Paper_2/No.8

The curve defined by the parametric equations

$$x = t^2 \text{ and } y = 2t \qquad -\sqrt{2} \leq t \leq \sqrt{2}$$

is shown in **Figure 1** below.

Figure 1



(a) Find a Cartesian equation of the curve in the form $y^2 = f(x)$

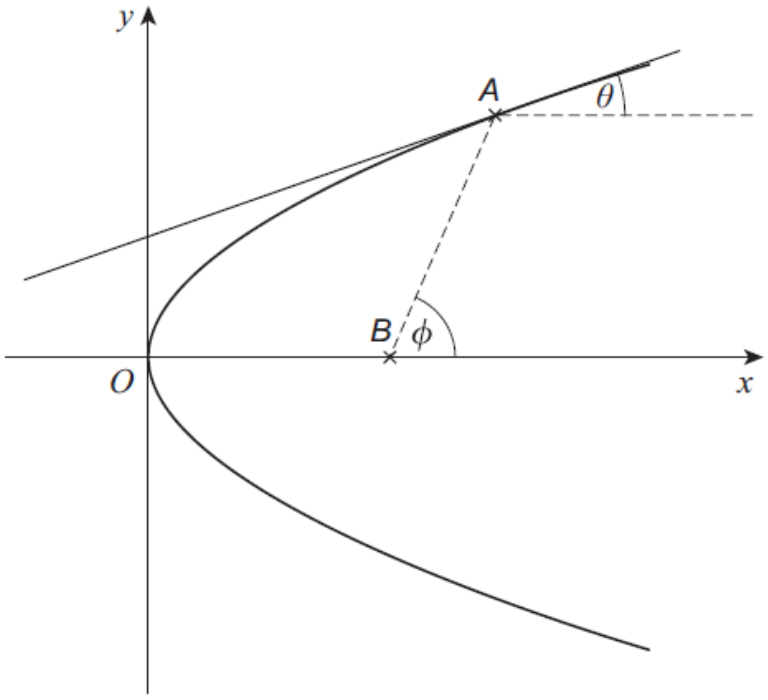
[2 marks]

(b) The point A lies on the curve where $t = a$

The tangent to the curve at A is at an angle θ to a line through A parallel to the x-axis.

The point B has coordinates (1, 0)

The line AB is at an angle ϕ to the x-axis.



(b) (i) By considering the gradient of the curve, show that

$$\tan\theta = \frac{1}{a}$$

[3 marks]

(b) (ii) Find $\tan\phi$ in terms of a.

[2 marks]

(b) (iii) Show that $\tan 2\theta = \tan\phi$

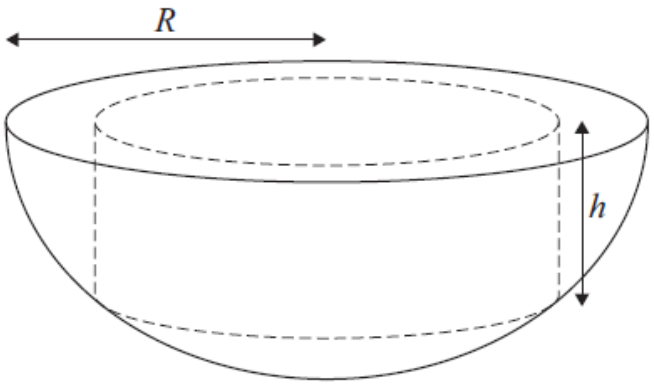
[3 marks]

2. June/2020/Paper_2/No.9

A cylinder is to be cut out of the circular face of a solid hemisphere.

The cylinder and the hemisphere have the same axis of symmetry.

The cylinder has height h and the hemisphere has a radius of R.



(a) Show that the volume, V, of the cylinder is given by

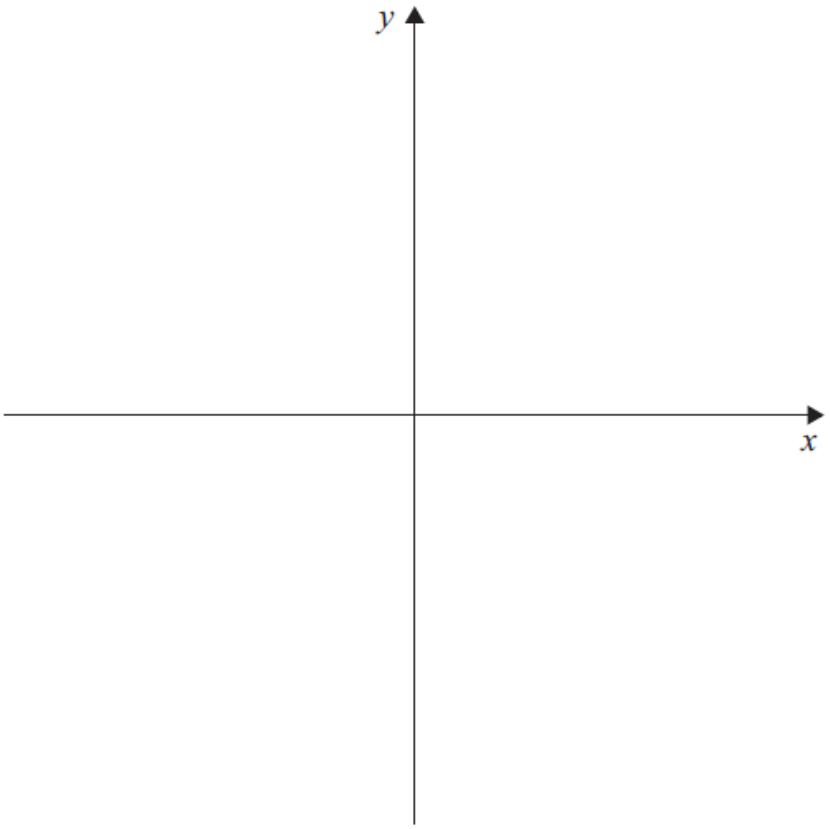
$$V = \pi R^2 h - \pi h^3$$

[3 marks

3. June/2019/Paper_2/No.7

(a) Sketch the graph of any cubic function that has **both** three distinct real roots **and** a positive coefficient of x^3

[2 marks]



(b) The function $f(x)$ is defined by

$$f(x) = x^3 + 3px^2 + q$$

where p and q are constants and $p > 0$

(b) (i) Show that there is a turning point where the curve crosses the y-axis.

[3 marks]

(b) (ii) The equation $f(x) = 0$ has three distinct real roots.

By considering the positions of the turning points find, in terms of p, the range of possible values of q.

[5 marks]