({{question\_number}}) Fig. 7a shows the curve with the parametric equations

, , .

The curve meets the x-axis at O and P. Q and R are turning points on the curve. The scales on the axes are the same.

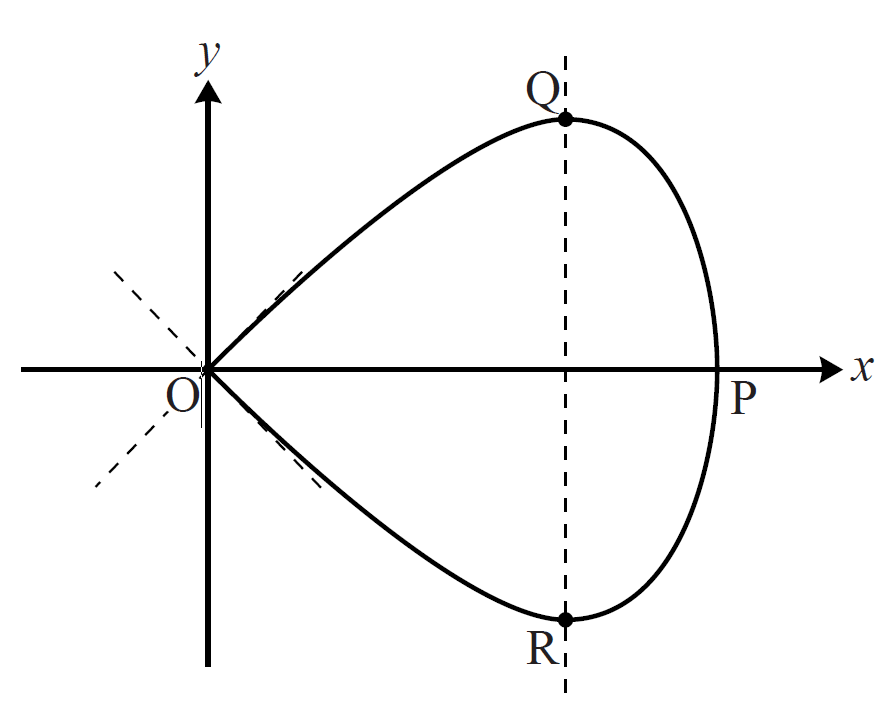


Fig. 7a

**(i)** State, with their coordinates, the points on the curve for which , and . **[3]**

**(ii)** Find in terms of . Hence find the gradient of the curve when , and verify that the two tangents to the curve at the origin meet at right angles. **[5]**

**(iii)** Find the exact coordinates of the turning point Q. **[3]**

When the curve is rotated about the x-axis, it forms a paperweight shape, as shown in Fig. 7b.

Diagram

Description automatically generated

Fig. 7b

**(iv)** Express in terms of . Hence show that the cartesian equation of the curve is . **[4]**

**(v)** Find the volume of the paperweight shape. **[4]**