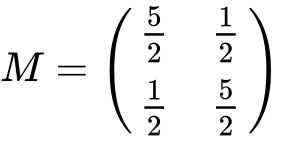
# 1.Numbers and algebra\_P\_3

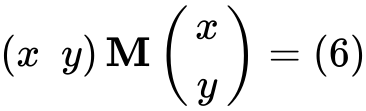
**1a.** *[8 marks]*

This question will diagonalize a matrix and apply this to the transformation of a curve.

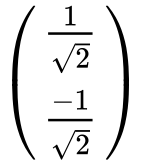
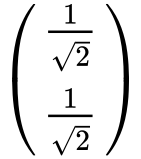
Let the matrix .

Find the eigenvalues for . For each eigenvalue find the set of associated eigenvectors.

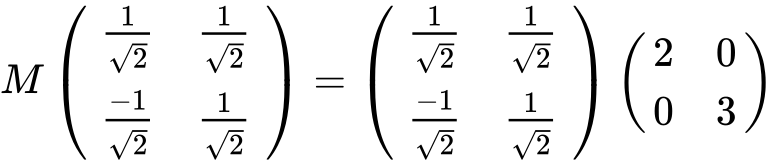
**1b.** *[2 marks]*

Show that the matrix equation  is equivalent to the Cartesian equation .

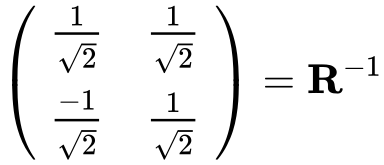
**1c.** *[2 marks]*

Show that  and  are unit eigenvectors and that they correspond to different eigenvalues.

**1d.** *[1 mark]*

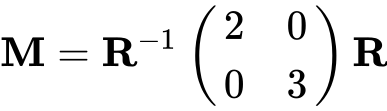
Hence, show that .

**1e.** *[2 marks]*

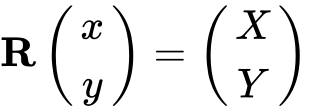
Let .

Find matrix **R**.

**1f.** *[1 mark]*

Show that .

**1g.** *[3 marks]*

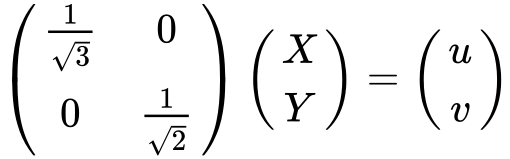
Let .

Verify that .

**1h.** *[2 marks]*

Hence, find the Cartesian equation satisfied by  and .

**1i.** *[2 marks]*

Let .

Find the Cartesian equation satisfied by  and  and state the geometric shape that this curve represents.

**1j.** *[2 marks]*

State geometrically what transformation the matrix  represents.

**1k.** *[2 marks]*

Hence state the geometrical shape represented by

the curve in  and  in part (e) (ii), giving a reason.

**1l.** *[1 mark]*

the curve in  and  in part (b).

**1m.** *[2 marks]*

Write down the equations of two lines of symmetry for the curve in  and  in part (b).