AQA – Further algebra and functions – A2 Further Mathematics P2

1. June/2021/Paper_7367/2/No.4

(a) Show that

$$(r+1)^2 - r^2 = 2r + 1$$

[1 mark]

(b) Use the method of differences to show that

$$\sum_{r=1}^{n} (2r+1) = n^2 + 2n$$

[3 marks]

(c) Verify that using the formula for $\sum_{r=1}^{n} r$ gives the same result as that given in part **(b)**.

[3 marks]

2. June/2021/Paper_7367/2/No.5

The equation

$$z^3 + 2z^2 - 5z - 3 = 0$$

has roots α, β and γ

Find a cubic equation with roots

$$\frac{1}{2}\alpha - 1, \quad \frac{1}{2}\beta - 1 \quad \text{and} \quad \frac{1}{2}\gamma - 1$$

[5 marks]

3. June/2021/Paper_7367/2/No.6

The ellipse E_1 has equation

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

E_1 is translated by the vector $\begin{bmatrix} 3 \\ 0 \end{bmatrix}$ to give the ellipse E_2

(a) Write down the equation of E_2

[1 mark]

(b) The ellipse E_3 has equation

$$\frac{x^2}{4} + (y-3)^2 = 1$$

Describe the transformation that maps E_2 to E_3

[1 mark]

(c) Each of the lines L_A and L_B is a tangent to both E_2 and E_3

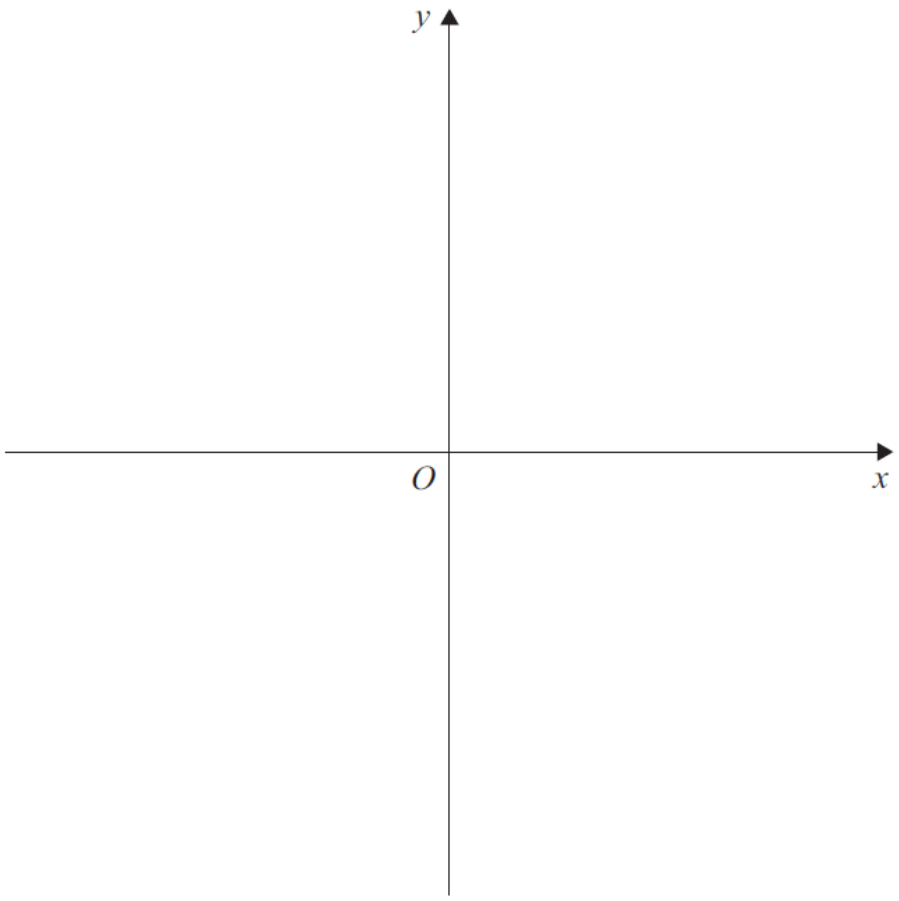
L_A is closer to the origin than L_B

E_2 and E_3 both lie between L_A and L_B

Sketch and label E_2, E_3, L_A and L_B on the axes below.

You do not need to show the values of the axis intercepts for L_A and L_B

[4 marks]



(d) Explain, without doing any calculations, why L_A has an equation of the form

$$x + y = c$$

where c is a constant.

[2 marks]