

# **L6 Further Mathematics Mock**

## **Paper 2 (Teacher Y)**

**January 2019**

**2018-2019**

**Duration: 1 hour 15 minutes**

**Total number of marks: 60**

*Write your answers on file paper.*

**You are permitted to use a scientific or graphical calculator in this paper.**

**Final answers should be given to a degree of accuracy appropriate to the context.**

**Relevant information from the formula booklet is included prior to each section of questions.**

**The acceleration due to gravity is denoted by  $g \text{ m s}^{-2}$ . Unless otherwise instructed, when a numerical value is needed, use  $g = 9.8$ .**

1.

The complex number  $z$  has modulus  $2\sqrt{3}$  and argument  $-\frac{1}{3}\pi$ . Giving your answers in the form  $x+iy$ , where  $x$  and  $y$  are exact real numbers, and showing clearly how you obtain them, find

(i)  $z$ , [2]

(ii)  $\frac{1}{(z^* - 5i)^2}$ . [5]

2.

The cubic equation  $2x^3 + 3x + 3 = 0$  has roots  $\alpha$ ,  $\beta$  and  $\gamma$ .

(i) Use the substitution  $x = u + 2$  to find a cubic equation in  $u$ . [3]

(ii) Hence find the value of  $\frac{1}{\alpha-2} + \frac{1}{\beta-2} + \frac{1}{\gamma-2}$ . [4]

3.

In an Argand diagram the points  $A$  and  $B$  represent the complex numbers  $5 + 4i$  and  $1 + 2i$  respectively.

(i) Given that  $A$  and  $B$  are the ends of a diameter of a circle  $C$ , find the equation of  $C$  in complex number form. [4]

The perpendicular bisector of  $AB$  is denoted by  $l$ .

(ii) Sketch  $C$  and  $l$  on a single Argand diagram. [2]

(iii) Find the complex numbers represented by the points of intersection of  $C$  and  $l$ . [3]

4.

(i) Use an algebraic method to find the square roots of the complex number  $5 + 12i$ . You must show sufficient working to justify your answers. [5]

(ii) Hence solve the quadratic equation  $x^2 - 4x - 1 - 12i = 0$ . [5]

5.

The roots of the equation  $x^3 - kx^2 - 2 = 0$  are  $\alpha$ ,  $\beta$  and  $\gamma$ , where  $\alpha$  is real and  $\beta$  and  $\gamma$  are complex.

(i) Show that  $k = \alpha - \frac{2}{\alpha^2}$ . [2]

(ii) Given that  $\beta = u + iv$ , where  $u$  and  $v$  are real, find  $u$  in terms of  $\alpha$ . [4]

(iii) Find  $v^2$  in terms of  $\alpha$ . [4]

6.

A group of 8 people, including Kathy, David and Harpreet, are planning a theatre trip.

(i) Four of the group are chosen at random, without regard to order, to carry the refreshments. Find the probability that these 4 people include Kathy and David but not Harpreet. [3]

(ii) The 8 people sit in a row. Kathy and David sit next to each other and Harpreet sits at the left-hand end of the row. How many different arrangements of the 8 people are possible? [3]

(iii) The 8 people stand in a line to queue for the exit. Kathy and David stand next to each other and Harpreet stands next to them. How many different arrangements of the 8 people are possible? [3]