L6 Further Mathematics Mock

Paper 2 (Teacher Y)

January 2022

2021-2022

Duration: 70 minutes

Total number of marks: 55

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.

1.

Use an algebraic method to find the square roots of the complex number $16 + 30i$. [6]

2.

Solve the equation $2z - 5iz^* = 12$

[4 marks]

3.

The roots of the equation

$$x^3 - 2x^2 + 4x - 5 = 0$$

are p, q and r.

Without solving the equation, find the value of

(i) $\frac{2}{p} + \frac{2}{q} + \frac{2}{r}$

(ii) $(p - 4)(q - 4)(r - 4)$

(iii) $p^3 + q^3 + r^3$

(8)

4.

A circle C in the complex plane has equation $|z - 2 - 5i| = a$

The point z_1 on C has the least argument of any point on C, and $\arg(z_1) = \frac{\pi}{4}$

Prove that $a = \frac{3\sqrt{2}}{2}$

[6 marks]

5.

$$f(z) = z^4 + az^3 + bz^2 + cz + d$$

where a, b, c and d are real constants.

Given that $-1 + 2i$ and $3 - i$ are two roots of the equation $f(z) = 0$

(a) show all the roots of $f(z) = 0$ on a single Argand diagram,

(4)

(b) find the values of a, b, c and d.

(5)

6.

The cubic equation

$$2x^3 + 6x^2 - 3x + 12 = 0$$

has roots α, β and γ.

Without solving the equation, find the cubic equation whose roots are $(\alpha + 3)$, $(\beta + 3)$ and $(\gamma + 3)$, giving your answer in the form $pw^3 + qw^2 + rw + s = 0$, where p, q, r and s are integers to be found.

(5)

7.

The menu below shows all the dishes available at a certain restaurant.

Rice dishes	Main dishes	Vegetable dishes
Boiled rice	Chicken	Mushrooms
Fried rice	Beef	Cauliflower
Pilau rice	Lamb	Spinach
Keema rice	Mixed grill	Lentils
	Prawn	Potatoes
	Vegetarian	

A group of friends decide that they will share a total of 2 different rice dishes, 3 different main dishes and 4 different vegetable dishes from this menu. Given these restrictions,

(i) find the number of possible combinations of dishes that they can choose to share, **[3]**

(ii) assuming that all choices are equally likely, find the probability that they choose boiled rice. **[2]**

The friends decide to add a further restriction as follows. If they choose boiled rice, they will not choose potatoes.

(iii) Find the number of possible combinations of dishes that they can now choose. **[3]**

8.

(i) 5 of the 7 letters A, B, C, D, E, F, G are arranged in a random order in a straight line.

(a) How many different arrangements of 5 letters are possible? **[2]**

(b) How many of these arrangements end with a vowel (A or E)? **[3]**

(ii) A group of 5 people is to be chosen from a list of 7 people.

(a) How many different groups of 5 people can be chosen? **[1]**

(b) The list of 7 people includes Jill and Jo. A group of 5 people is chosen at random from the list. Given that either Jill and Jo are both chosen or neither of them is chosen, find the probability that both of them are chosen. **[3]**