

3. [Maximum mark: 6]

Consider the polynomial  $q(x) = 3x^3 - 11x^2 + kx + 8$ .

(a) Given that  $q(x)$  has a factor  $(x - 4)$ , find the value of  $k$ . [3]

(b) Hence or otherwise, factorize  $q(x)$  as a product of linear factors. [3]

4. [Maximum mark: 4]

Find the coefficient of  $x^8$  in the expansion of  $\left(x^2 - \frac{2}{x}\right)^7$ .

5. Let  $z = x + yi$ . Find the values of  $x$  and  $y$  if  $(1 - i)z = 1 - 3i$ .

(4 marks)

9. [Maximum mark: 7]

Two distinct roots for the equation  $z^4 - 10z^3 + az^2 + bz + 50 = 0$  are  $c + i$  and  $2 + id$  where  $a, b, c, d \in \mathbb{R}, d > 0$ .

(a) Write down the other two roots in terms of  $c$  and  $d$ . [1]

(b) Find the value of  $c$  and the value of  $d$ . [6]

12. [Maximum mark: 18]

Consider the polynomial  $P(z) = z^5 - 10z^2 + 15z - 6, z \in \mathbb{C}$ .

(a) Write down the sum and the product of the roots of  $P(z) = 0$ . [2]

(b) Show that  $(z - 1)$  is a factor of  $P(z)$ . [2]

The polynomial can be written in the form  $P(z) = (z - 1)^3(z^2 + bz + c)$ .

(c) Find the value of  $b$  and the value of  $c$ . [5]

(d) Hence find the complex roots of  $P(z) = 0$ . [3]