1. **[ACJC MYE 18]**

   Without using a calculator, find the roots of the equation

   $$z^2(5-5i) - 2z + (1+i) = 0,$$

   giving your answers in cartesian form $a + bi$. [3]

2. **[ACJC MYE 18]**

   The complex number w has modulus r and argument θ, where $-\pi < \theta \leq \pi$ and w^* denotes the conjugate of w.

   (a) State the modulus and argument of $\dfrac{w^2}{w^*}$. [2]

   (b) Given that $w^2 = rw^*$, find the possible exact values of θ. [2]

3. **[ACJC CA2 18]**

   One root of the equation $w^3 - 9w^2 + 20w - 37 - b^2 = 0$, where b is real and positive, is $w = 1 + bi$.

   By expressing $w^3 - 9w^2 + 20w - 37 - b^2$ as a product of a linear and a quadratic factor, find the value of b and the other roots. [4]

4. **[ACJC CA2 18]**

   Given that $\left(\dfrac{(2-2i)^2}{-\sqrt{3}+ki}\right)^* = 4e^{i\theta}$, where k is a positive real number and $-\pi < \theta \leq \pi$,

   (a) show that $k = 1$. [2]

   (b) Hence find the exact value of θ. [2]

5. **[AJC 18 MYE]**
   Do not use a calculator in answering this question.

   The complex numbers p and q satisfy the following simultaneous equations

   $$p + (2+i)q = 5 + i$$
   $$ip - 2q = 4.$$

   Find p and q in the form $x + yi$, where x and y are real. [4]

6. **[RVHS MYE 18 (modified)]**

   Find the three smallest positive real number n such that $\left(1 + i\sqrt{3}\right)^n$ is purely imaginary. [3]

7. **[CJC MYE 18]**

   It is given that

   $$z^3 + 2z^2 + \left(k - 8\sqrt{2}i\right)z + 8 - 4\sqrt{2}ki = 0,$$

   where k is a real constant, has a real root.

   (a) show that -2 is the real root and find the value of k. [4]

   (b) Hence find the other roots, giving your answers in exact cartesian form $a + bi$. [6]

8. **[NYJC MYE 18]**

The complex numbers $3+2i$, z and $4-6i$ are the first three terms of a geometric progression.

Find, in cartesian form $a+bi$, where $a, b \in \mathbb{R}$,

(a) two possible complex numbers z, [2]

(b) two possible values for the common ratio r, [1]

(c) the 13th term of the progression for which the real part of the common ratio, r, found in (b) is negative. [2]

Answers

1. $-0.2+0.4i$ or $0.4-0.2i$.
2. (a) 3θ.
   (b) $-\frac{2\pi}{3}, 0, \frac{2\pi}{3}$.
3. $b=\sqrt{5}$.
   $w=7, 1+i\sqrt{5}$ or $1-i\sqrt{5}$.
4. $-\frac{2\pi}{3}$.
5. $p=6-6i, q=1+3i$.
6. $1.5, 4.5, 7.5$.
7. (a) $k=4$.
   (b) $-2-2\sqrt{2}i$ and $-2+2\sqrt{2}i$.
8. (a) $z=5-i$ or $-5+i$.
   (b) $r=1-i$ or $-1+i$.
   (c) $-192-128i$.

Question:	1	2	3	4	5	6	7	8	Total
Marks	3	4	4	4	4	3	10	5	37
Score:									