

**Question 4**

**(25 marks)**

- (a) The complex numbers  $z_1, z_2$  and  $z_3$  are such that  $\frac{2}{z_1} = \frac{1}{z_2} + \frac{1}{z_3}$ ,  $z_2 = 2 + 3i$  and  $z_3 = 3 - 2i$ , where  $i^2 = -1$ . Write  $z_1$  in the form  $a + bi$ , where  $a, b \in \mathbb{Z}$ .

- (b) Let  $\omega$  be a complex number such that  $\omega^n = 1$ ,  $\omega \neq 1$ , and  $S = 1 + \omega + \omega^2 + \dots + \omega^{n-1}$ . Use the formula for the sum of a finite geometric series to write the value of  $S$  in its simplest form.