Railway Engineering Mathematics
Tutorial Sheet 19

1. Given the following complex numbers in Cartesian form:

$$z_1 = 2 + j4, \qquad z_2 = 3 - j, \qquad z_3 = -7 + j5, \qquad z_4 = 9 - j6$$

Calculate:

(a) $z_1 + z_2$

(b) $z_1 - z_2$

(c) $z_2 - z_1$

(d) $z_3 + z_4$

(e) $z_3 z_1$

(f) $z_2 z_4$

(g) $\bar{z_3}$

(h) $\dfrac{z_4}{z_2}$

(i) $\dfrac{z_1}{z_3}$

(j) $z_4 \bar{z_4}$

(k) $\mathrm{Re}\big(z_1 z_3\big)$

(l) $\mathrm{Im}\big(z_1 \bar{z_1}\big)$

2. Determine the roots of the following polynomial functions:

(a) $y = x^2 + 14x + 58$

(b) $y = 4x^2 - 12x + 10$

(c) $y = x^2 + 3x + 12$

3. In the hydrogen atom, the angular momentum p of the de Broglie wave is given by:

$$p\Psi = -\left(\frac{jh}{2\pi}\right)\left(\pm jm\Psi\right)$$

Determine a simplified expression for p.