

## Maths problems Set 0.0 (general)

August 2015

1. If  $x = 1$  is a root of the polynomial  $x^3 - 2x^2 - 5x + 6$ , find the other roots.
2. If  $a = 3 + 2i$  and  $b = 1 - 5i$  are complex numbers what is the value of  $\Im(a/b)$  (where  $\Im$  denotes the imaginary part)?
3. If  $z = 1 + i$ , what is the value of  $z^{\frac{1}{3}}$  (i.e. the cube root of  $z$ )?
4. There are two vectors  $\mathbf{a} = 2\hat{i} + \hat{j} + \hat{k}$  and  $\mathbf{b} = \hat{i} - \hat{j} - \hat{k}$ , where  $\hat{i}$ ,  $\hat{j}$  and  $\hat{k}$  are orthogonal unit vectors. Find the value of  $|\mathbf{a} \times \mathbf{b}|$ .
5. Evaluate the following integral:

$$\int_0^1 x e^{-2x} dx$$

6. Given the boundary condition  $x = 0; y = 0$ , find the solution of the differential equation

$$\frac{dy}{dx} = Ay - B$$

7. Expand  $\nabla \cdot [(\mathbf{A} \cdot \mathbf{B})(\mathbf{A} \times \mathbf{B})]$
8. Find the general solution to the following equation:

$$\frac{d^2y}{dx^2} + \lambda^2 y = 0$$