1. Write in the form a + bi:

$$\frac{5}{(1-i)(2-i)(3-i)}$$

- 2. Solve $z^2 2z + 2 = 0$.
- 3. Sketch the set of points in the complex plane $\mathbb C$ satisfying

$$|z-1| = |z+i|.$$

4. (a) If $z \neq 1$ show that

$$1 + z + z^{2} + \dots + z^{n} = \frac{1 - z^{n+1}}{1 - z}.$$

(b) (Extra for experts.) Derive Lagrange's trigonometric identity

$$1 + \cos\theta + \cos 2\theta + \dots + \cos n\theta = \frac{1}{2} + \frac{\sin(n + \frac{1}{2})\theta}{2\sin\frac{\theta}{2}}.$$

- 5. Show that if $f(z) = \operatorname{Re}(z)$ then f'(z) does not exist anywhere.
- 6. Show that $f(z) = e^{-y}e^{ix}$ is an analytic function.
- 7. Find a function v(x, y) so that if u(x, y) = 2x(1 y), f(z) = u + iv is an analytic function. Such a v is called a *harmonic conjugate* of u.
- 8. Show that $\sin(iz) = i \sinh z$ and $\cos(iz) = \cosh z$.