Paper 3C1

Answers for Examples Sheet 1: Complex numbers

1. Some possible answers:

$$5 = 5\ e^{j2\pi}$$
$$-3j = 3\ e^{j\frac{3\pi}{2}}$$
$$(1-j)^2 = (\sqrt{2}\ e^{\left(-j\frac{\pi}{4}\right)})^2 = 2\ e^{\left(-j\frac{\pi}{2}\right)}$$

$$\frac{\sqrt{2}+j\sqrt{2}}{1+j\sqrt{3}} = \frac{e^{\left(j\frac{\pi}{4}\right)}}{e^{\left(j\frac{\pi}{3}\right)}} = e^{\left(-j\frac{\pi}{12}\right)}$$

2. $z_1 = -0.5 + j\ 0$, $z_2 = 0 + j$, $z_3 = 1 - j$

3. $z_4 = 2 - j$, $z_5 = 2$.

$$\begin{cases} \text{We have :} & z_5 - z_4 = 2 - (2-j) = j \\ \text{and} & z_3 - z_4 = 1 - j - (2-j) = -1 \\ \text{or} & \exp(-j\frac{\pi}{2})(z_3 - z_4) = (-j)(-1) = j \\ \text{hence} & z_5 - z_4 = \exp(-j\frac{\pi}{2})\ (z_3 - z_4) \end{cases} \tag{1}$$

   z_5 is the result of the rotation of z_3 (centre z_4 and angle $\frac{\pi}{4}$).

4. A complex number and its conjugate are symmetric with respect to the abscissa (horizontal) axis.

5. The perpendicular bisector of the segment defined by the points z_4 and z_2 is the solution to the equation.

6. See solutions fig. 1.

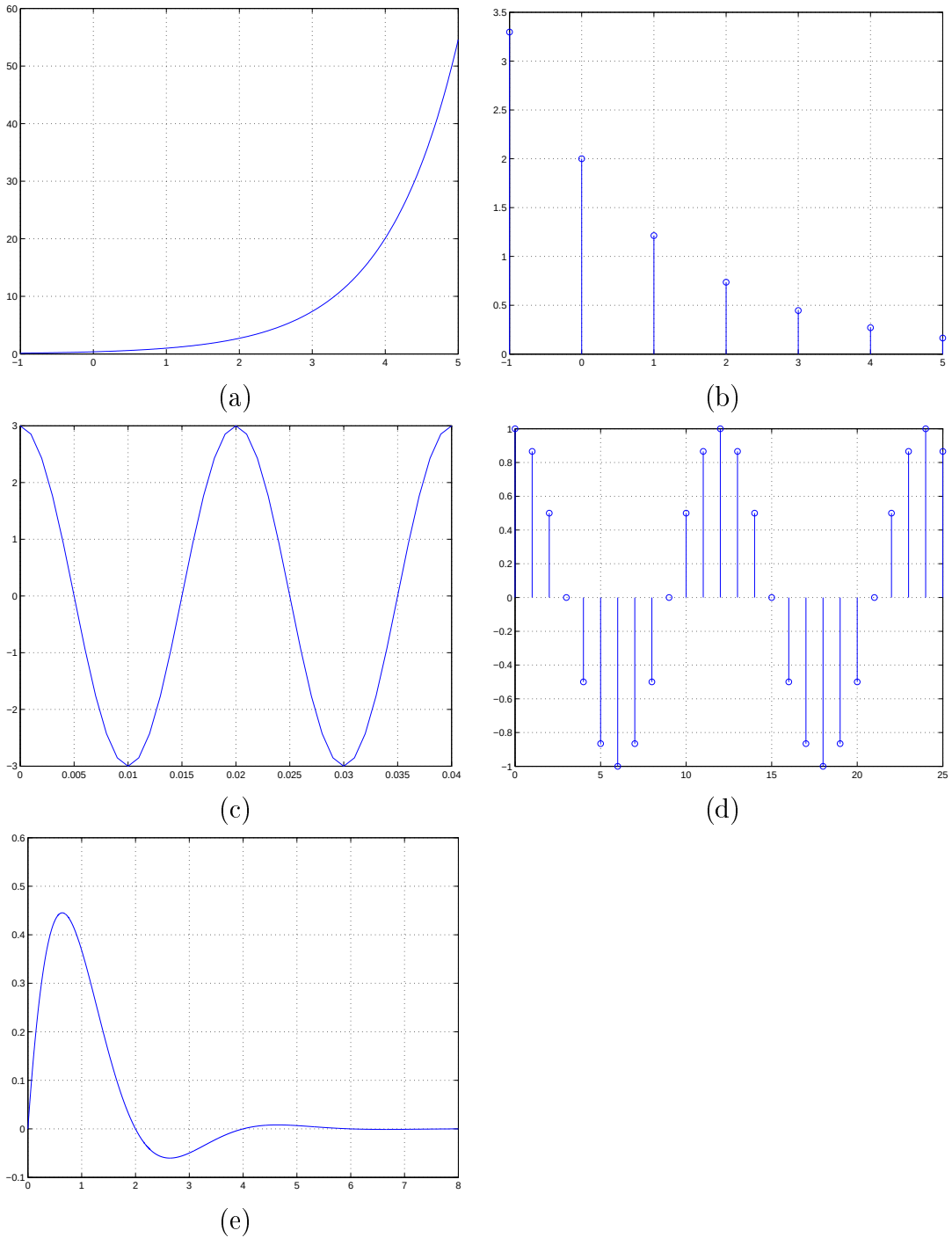

Figure 1: Solutions of question 6.