1. Find the complex number \( z \) such that \( (2 - 3i)z + 4 = -i \).

\[
(2 - 3i)z + 4 = -i, \quad (2 - 3i)z = -4 - i, \quad z = \frac{-4 - i}{2 - 3i}
\]

\[
z = \frac{(-4 - i)(2 + 3i)}{2^2 + 3^2} = \frac{-5 - 14i}{13} = \frac{-5}{13} - \frac{14}{13}i.
\]

2. Find all complex numbers \( z \) such that \( z^5 = 1 \).

\[
z_0 = e^{\frac{0\pi i}{5}} = 1, \quad z_1 = e^{\frac{2\pi i}{5}}, \quad z_2 = e^{\frac{4\pi i}{5}}, \quad z_3 = e^{\frac{6\pi i}{5}}, \quad z_4 = e^{\frac{8\pi i}{5}}.
\]

3. Compute the absolute value \( |1 - 6i| \).

\[
|1 - 6i| = \sqrt{1^2 + 6^2} = \sqrt{37}.
\]

4. Multiply \( (3 - 2i)(1 + i) \).

\[
(3 - 2i)(1 + i) = 3 + 2 - 2i + 3i = 5 + i.
\]

5. Write down the number \( 1 + \sqrt{3}i \) in the form \( re^{i\theta} \).

\[
r = \sqrt{1^2 + \sqrt{3}^2} = \sqrt{1 + 3} = \sqrt{4} = 2, \quad cos(\theta) = \frac{1}{r} = \frac{1}{2}, \quad sin(\theta) = \frac{\sqrt{3}}{r} = \frac{\sqrt{3}}{2}.
\]

\[
\theta = \frac{\pi}{3}, \quad 1 + \sqrt{3}i = 2e^{\frac{\pi}{3}i}.
\]

6. Find all complex numbers \( z \) such that \( z^2 - z + 2 = 0 \).

\[
z = \frac{1 \pm \sqrt{1 - 8}}{2} = \frac{1 \pm \sqrt{-7}}{2} = \frac{1 \pm i\sqrt{7}}{2}.
\]

7. \( y'' + y' - 6y = 0 \).

This is a homogeneous second order differential equation with constant coefficients. The corresponding characteristic equation is

\[
p^2 + p - 6 = 0,
\]

which has two solutions \( p = -3 \) and \( p = 2 \). Hence the general solution is

\[
y = Ae^{-3x} + Be^{2x}.
\]
8. $y'' + 8y = 0$.

This is a homogeneous second order differential equation with constant coefficients. The corresponding characteristic equation is

$$p^2 + 8 = 0,$$

which has two solutions $p = 2\sqrt{2}i$ and $p = -2\sqrt{2}i$. Hence the general solution is

$$y = Ae^{2\sqrt{2}ix} + Be^{-2\sqrt{2}ix}.$$

9. $y'' + 2y' + 3y = 0$.

This is a homogeneous second order differential equation with constant coefficients. The corresponding characteristic equation is

$$p^2 + 2p + 3 = 0,$$

which has two solutions $p = -1 - \sqrt{2}i$ and $p = -1 + \sqrt{2}i$. Hence the general solution is

$$y = Ae^{(-1-\sqrt{2}i)x} + Be^{(-1+\sqrt{2}i)x}.$$