# Answers

## Tutorial 1

**Q1**

(i) It is not complete in mathematics to include real numbers only. Some mathematical problems cannot be solved by using real numbers only. Complex numbers are needed to solve them.

(ii)

| | Modulus | Argument | Complex conjugates |
|---|---|---|---|
| -j | 1 | -π/2 | j |
| -3 | 3 | π | -3 |
| 1 + j | $\sqrt{2}$ | π/4 | 1 - j |
| cos θ + j sin θ | 1 | $\theta$ | cos θ - j sin θ |

**Q2**

(a) $\frac{9}{41}+\frac{40}{41}j$

(b) $\frac{2}{13}-\frac{3}{13}j$

(c) $\frac{4}{13}$

(d) $\frac{x}{x^2+y^2}+\frac{y}{x^2+y^2}j$

**Q3**

(i)

$$z_1=\frac{\sqrt{2}}{2}-j\frac{\sqrt{2}}{2}$$

$$z_1^2=-j$$

(ii)

$$z_2=\sqrt{3}\angle arctg(-\sqrt{2})$$

$$z_2^2=3\angle arctg(2\sqrt{2})$$

(iii)

$$\frac{z_1}{z_2}=\left(\frac{1}{3}+\frac{\sqrt{2}}{6}\right)+j\left(\frac{1}{3}-\frac{\sqrt{2}}{6}\right)$$

# Tutorial 2

**Q1**

(a)

$$\frac{dy}{dx} = 6x$$

At $x = 3, \frac{dy}{dx} = 18$

(b)

(i)

$$\frac{dy}{dx} = 2xsec^2(x^2 + 1)$$

(ii)

$$\frac{dy}{dx} = 8xsec^2(2x^2 - 1)\tan(2x^2 - 1)$$

(iii)

$$\frac{dy}{dx} == \frac{e^x - sinx}{e^x + cosx}$$

**Q2**

(a)

$$\frac{dy}{dt} = -e^{-t} + e^t$$

At $t = 5$,

$$\frac{dy}{dt} = -e^{-5} + e^5$$

(b)

At $t = 0, y' = 0.$ $\quad\therefore$ (0,0)

**Q3**

(a)

$$\frac{dy}{dx} = -sinxcos(cosx)$$

(b)

$$\frac{dg}{dx} = e^{x}[\sin(cosx) - sinxcos(cosx)]$$

# Tutorial 3

## Q1

(a) $e^2 + 1$

(b) 12.78

(c) $2e^{tanx} + 2c$

## Q2

(a) $\frac{3}{2}sin2x + C$. This is the required general solution.

(b) $y = \ln(x^3 + e)$

(c) $y = xtan(\ln|Dx|)$

## Q3

(a)

(i) -sin 2$x$

(ii) $\frac{1}{8}$ sin 8$x$

(b)The amplitude is $2\sqrt{7}$, the frequency is $\frac{3}{2\pi}$ Hz, and the phase is 1.2373.