

Ex 10 C

1 a. $\sin \theta = 0.1$
 $\theta = 5.7, 174.3$

h. $\theta = \tan^{-1}(-0.32)$
 $= -17.7, 162.3, 342.3$

m. $2\theta + 60 = \sin^{-1}(0.3584)$
 $= 21.0, 159.0, 381, 519, 741$

b. $\theta = \sin^{-1}(-0.84)$
 $= -57.1$
 $= 302.9, 237.1$

i. $\theta = \tan^{-1}(0.11)$
 $= 6.3, 186.3$

$\theta = -19.5, 49.5, 160.5, 229.5, 340.5$

c. $\theta = \sin^{-1}(0.951)$
 $= 72.0, 108.0$

j. $180 + \theta = \sin^{-1}(0.4)$
 $= 23.6, 156.4$
 $\theta_1 = 23.6 - 180 = -156.4 = 203.6$
 $\theta_2 = 156.4 - 180 + 360 = 336.4$

n. $30 - \theta = \sin^{-1}(0.5)$
 $= 30, 150$
 $\theta = 0, 240, 360$

d. $\theta = \cos^{-1}(0.8)$
 $= 36.9, 323.1$

k. $90 - \theta = \cos^{-1}(-0.57)$
 $= 124.8, 235.2$

o. $3\theta - 120 = \cos^{-1}(0)$
 $= 90^\circ, 270^\circ$
 $\theta = 70, 130$

e. $\theta = \cos^{-1}(-0.84)$
 $= 147.1, 212.9$

$\theta_1 = 90 - 124.8 + 360 = 325.2$
 $\theta_2 = 90 - 235.2 + 360 = 214.8$

f. $\theta = \cos^{-1}\left(\frac{\sqrt{2}}{3}\right)$
 $= 35.3^\circ = 324.7$

l. $90 - \theta = \tan^{-1}(-3)$
 $= -71.6, 108.4, 288.4$

$\theta_1 = 90 + 71.6 = 161.6$

g. $\theta = \tan^{-1}(4)$
 $= 76.0 = 256.0$

$\theta_2 = 90 - 108.4 + 360 = 341.6$

$\theta_3 = 90 - 288.4 + 360 = 161.6$

2a. $\theta = \sin^{-1}(0.8)$
 $= 53.1, 126.9$

e. $\theta = \cos^{-1}(-0.12)$
 $= 96.9, -96.9$

g. $\frac{4 \sin \theta}{\cos \theta} = \frac{5 \cos \theta}{\cos \theta}$
 $4 \tan \theta = 5$
 $\theta = \tan^{-1}\left(\frac{5}{4}\right)$
 $= 51.3, -128.7$

i. $2 \sin \theta = \tan \theta$
 $2 \sin \theta = \frac{\sin \theta}{\cos \theta}$

$2 = \frac{1}{\cos \theta}$

$2 \cos \theta = 1$

$\cos \theta = \frac{1}{2}$

$\theta = 60, -60, 0, -180, 180$

b. $\theta = \cos^{-1}(0.25)$
 $= 75.5, -75.5$

f. $4 \tan \theta = -3$
 $\tan \theta = -\frac{3}{4}$
 $\theta = \tan^{-1}(-0.75)$
 $= -36.9, 143.1$

h. $2 \sin^2 \theta = 1$
 $\sin^2 \theta = \frac{1}{2}$
 $\sin \theta = \pm \sqrt{\frac{1}{2}}$

① $\sin \theta = +\sqrt{\frac{1}{2}}$
 $\theta = 45, 135$

② $\sin \theta = -\sqrt{\frac{1}{2}}$
 $\theta = -45, 225, -135$

c. $\theta = \tan^{-1}(2)$
 $= 63.4, -116.6$

d. $\theta = \sin^{-1}(-0.67)$
 $= -42.1, -137.9$

$$3a \quad \cos 2\theta = \frac{1}{3}$$

$$2\theta = 70.5 \quad (Q1, 4)$$

Q1:

$$2\theta = 70.5 \pm k \cdot 360$$

$$\theta = 35.3 \pm k \cdot 180$$

$$\theta = 35.3, 215.3 //$$

Q4

$$2\theta = (360 - 70.5) \pm 360 \cdot k$$

$$\theta = 144.8 \pm k \cdot 180$$

$$= 144.8, 324.8 //$$

$$\therefore \theta = 35.3, 144.8, 215.3, 324.8 //$$

$$b \quad \tan 3\theta = 2$$

$$3\theta = 63.4 \quad (Q1, 3)$$

Q1:

$$3\theta = 63.4 \pm 360 \cdot k$$

$$\theta = 21.1 \pm 120k$$

$$= 21.1, 141.1, 261.1 //$$

Q3:

$$3\theta = (180 + 63.4) \pm 360k$$

$$\theta = 81.1 \pm 120k$$

$$= 81.1, 201.1, 321.1 //$$

$$\therefore \theta = 21.1, 81.1, 141.1, 201.1, 261.1, 321.1 //$$

$$c. \quad \sin 2\theta = -0.6$$

$$2\theta = -36.9 \pm k \cdot 360$$

$$\theta = -18.45 \pm k \cdot 180$$

$$= 161.6, 341.6 //$$

$$2\theta = 180 - (-36.9) \pm k \cdot 360$$

$$2\theta = 216.9 \pm k \cdot 360$$

$$\theta = 108.4 \pm k \cdot 180$$

$$\theta = 108.4, 288.4 //$$

$$\therefore \theta = 108.4, 161.55, 288.5, 341.6 //$$

$$d \quad \cos 4\theta = -\frac{1}{4} \quad 0 < 4\theta \leq 1440$$

$$4\theta = 104.48 \pm k \cdot 360$$

$$\theta = 26.1 \pm k \cdot 90$$

$$\theta = 26.1, 116.1, 206.1, 296.1$$

$$4\theta = -104.48 \pm k \cdot 360$$

$$\theta = -26.12 \pm k \cdot 90$$

$$\theta = 63.9, 153.9, 243.9, 333.9$$

$$\therefore \theta = 26.1, 63.9, 116.1, 153.9, 206.1, 243.9, 296.1, 333.9 //$$

$$e \quad \tan 2\theta = 0.4$$

$$2\theta = 21.8 \pm k \cdot 180$$

$$\theta = 10.9 \pm k \cdot 90$$

$$\theta = 10.9, 100.9, 190.9, 280.9 //$$

$$f. \quad \sin 3\theta = -0.42$$

$$3\theta = -24.8 \pm k \cdot 360$$

$$\theta = -8.28 \pm k \cdot 120$$

$$= 111.72, 231.72, 351.72$$

$$3\theta = 180 - (-24.8) \pm k \cdot 360$$

$$3\theta = 204.8 \pm k \cdot 360$$

$$\theta = 68.28 \pm k \cdot 120$$

$$= 68.3, 188.3, 308.3$$

$$\therefore \theta = 68.3, 111.7, 188.3, 231.7, 308.3, 351.7 //$$

$$4 \quad -180 \leq x \leq 180$$

$$a \quad \cos 3x = \frac{2}{3}$$

$$3x = 48.2 \quad (Q1, 2)$$

$$Q1 \cdot 3x = 48.2 \pm k \cdot 360$$

$$x = 16.1 \pm k \cdot 120$$

$$x = -103.9, 16.1, 136.1$$

$$Q4 \cdot 3x = -48.2 \pm k \cdot 360$$

$$x = -16.1 \pm k \cdot 120$$

$$x = -136.1, -16.1, 103.9$$

$$\therefore x = -136.1, -103.9, -16.1, 16.1, 103.9, 136.1$$

$$b. \tan 2x = -3$$

$$2x = -71.6 \pm k \cdot 180$$

$$x = -35.8 \pm k \cdot 90$$

$$= -125.8, -35.8, 54.2, 144.2 //$$

$$c. \sin 3x = -0.2$$

$$3x = -11.54 \pm k \cdot 360$$

$$x = -3.8 \pm k \cdot 120$$

$$= -123.8, -3.8, 116.2$$

$$3x = 180 - (-11.54) \pm k \cdot 360$$

$$x = 63.85 \pm k \cdot 120$$

$$= -176.2, -56.2, 63.8$$

$$\therefore x = -176.2, -123.8, -56.2, -3.8, 63.8, 116.2 //$$

$$d \quad \cos 2x = 0.246$$

$$2x = 75.8 \quad (Q1, 4)$$

$$Q1 \cdot 2x = 75.8 \pm k \cdot 360$$

$$x = 37.9 \pm k \cdot 180$$

$$= -142.1, 37.9 //$$

$$Q4 \cdot 2x = -75.8 \pm k \cdot 360$$

$$x = -37.9 \pm k \cdot 180$$

$$= -37.9, 142.1 //$$

$$x = -142.1, -37.9, 37.9, 142.1 //$$

$$e. \tan 5x = 0.8$$

$$5x = 38.66 \pm k \cdot 180$$

$$x = 7.7 \pm k \cdot 36$$

$$= -172.3, -136.3, -100.3, -64.3,$$

$$-28.3, 7.7, 43.7, 79.7, 115.7, 151.7 //$$

$$f. \sin 2x = -0.39$$

$$2x = -23.0 \pm k \cdot 360$$

$$x = -11.5 \pm k \cdot 180$$

$$= -11.5, 168.5 //$$

$$2x = (180 + 23) \pm k \cdot 360$$

$$x = 101.5 \pm k \cdot 180$$

$$= -78.5, 101.5 //$$

$$\therefore x = -78.5, -11.5, 101.5, 168.5 //$$

$$5. \quad -180 \leq \theta \leq 180$$

$$b \quad \tan \frac{2}{3}\theta = -3$$

$$\frac{2}{3}\theta = -71.6 \pm k \cdot 180$$

$$\theta = -107.3 \pm k \cdot 270$$

$$= -107.3, 162.7 //$$

$$e. \tan \frac{3}{4}\theta = 0.5$$

$$\frac{3}{4}\theta = 26.6 \pm k \cdot 180$$

$$\theta = 35.4 \pm 240$$

$$= 35.4$$

$$d \quad \cos \frac{1}{3}\theta = \frac{1}{3}$$

$$\frac{1}{3}\theta = 70.5 \quad (Q1, 4)$$

$$Q1: \frac{1}{3}\theta = 70.5 \pm k \cdot 360$$

$$\theta = 211.6 \pm k \cdot 1080$$

$$= 211.6 = \emptyset$$

$$Q4: \frac{1}{3}\theta = -70.5 \pm k \cdot 360$$

$$\theta = -211.6 \pm k \cdot 1080$$

$$= -211.6 = \emptyset$$

$$\therefore \theta = \text{No roots in the interval}$$

$$f. \sin \frac{2}{5}\theta = -0.3$$

$$\frac{2}{5}\theta = -17.5 \pm k \cdot 360$$

$$\theta = -43.6 \pm 900k = -43.6$$

$$\frac{2}{5}\theta = (180 + 17.5) \pm k \cdot 360$$

$$\theta = 493.6 \pm 900$$

$$\therefore \theta = -43.6,$$

6 $0 < t \leq 360$

a $\sin(2t - 30) = \frac{1}{2}$
 $2t - 30 = 30 \text{ (Q1,2)}$
 $\text{Q1 } 2t - 30 = 30 \pm k \cdot 360$
 $2t = 60 \pm k \cdot 360$
 $t = 30 \pm k \cdot 180$
 $= 30, 210$

Q2. $2t - 30 = 150 \pm k \cdot 360$
 $2t = 180 \pm k \cdot 360$
 $t = 90 \pm k \cdot 180$
 $= 90, 270$
 $\therefore t = 30, 90, 210, 270$

d $\tan\left(\frac{3}{2}t - 45\right) = -\sqrt{3}$
 $\frac{3}{2}t - 45 = -60 \pm k \cdot 180$
 $\frac{3}{2}t = 45 - 60 \pm k \cdot 180$
 $\frac{3}{2}t = -15 \pm k \cdot 180$
 $t = -10 \pm k \cdot 120$
 $= 110, 230, 350 //$

e $\cos(2t - 50) = -\frac{1}{2}$
 $2t - 50 = 120 \pm 360k$
 $2t = 170 \pm 360k$
 $t = 85 \pm 180k$
 $= 85, 265$

$2t - 50 = -120 \pm k \cdot 360$
 $2t = -70 \pm k \cdot 360$
 $t = -35 \pm 180k$
 $= 145, 325$
 $\therefore t = 85, 145, 265, 325 //$

6f. $\sin\left(\frac{1}{2}t + 50\right) = 1$
 $\frac{1}{2}t + 50 = 90 \pm k \cdot 360$
 $\frac{1}{2}t = 40 \pm k \cdot 360$
 $t = 80 \pm k \cdot 720$
 $= 80 //$

g. $\cos\left(\frac{1}{5}t - 50\right) = 0$
 $\frac{1}{5}t - 50 = 90 \pm k \cdot 360$
 $\frac{1}{5}t = 140 \pm k \cdot 360$
 $t = 700 \pm k \cdot 1800$
 $\frac{1}{5}t - 50 = -90 \pm k \cdot 360$
 $\frac{1}{5}t = -40 \pm k \cdot 360$
 $t = -200 \pm k \cdot 1800$

\therefore No roots in the interval //

h. $\tan(3t - 180) = -1$
 $3t - 180 = -45 \pm k \cdot 180$
 $3t = 135 \pm k \cdot 180$
 $t = 45 \pm k \cdot 60$
 $= 45, 105, 165, 225, 285, 345 //$

i. $\sin\left(\frac{1}{4}t - 20\right) = 0$
 $\frac{1}{4}t - 20 = 0 \pm k \cdot 360$
 $\frac{1}{4}t = 20 \pm k \cdot 360$
 $t = 80 \pm k \cdot 1440$
 $= 80$

$\frac{1}{4}t - 20 = 180 \pm k \cdot 360$
 $\frac{1}{4}t = 200 \pm k \cdot 360$
 $t = 800 \pm k \cdot 1440$
 $\therefore t = \underline{80}$

7 $-180 \leq z \leq 180$

b. $\cos z (1 + \sin z) = 0$
 $\cos z = 0$ or $\sin z = -1$
 $z = \pm 90$ $z = -90$
 $\therefore z = \pm 90$

c. $(1 - \tan z) \sin z = 0$
 $\tan z = 1$ or $\sin z = 0$
 $z = 45, 225, \pm 180$
 $\therefore z = -180, 45, 180, \cancel{225}, -135, 0$

d. $\sin 2z = 0.23$
 $2z = 13.3 \pm k \cdot 360$
 $z = 6.6 \pm k \cdot 180$
 $= -173.4, 6.6$
 $2z = 180 - 13.3 \pm k \cdot 360$
 $z = 83.4 \pm k \cdot 180$
 $= -96.6, 83.4$
 $\therefore z = -173.4, -96.6, 6.6, 83.4 //$

e. $\cos(45 - z) = 0.832$
 ① $45 - z = 33.7 \pm k \cdot 360$
 $z = 11.3$
 ② $45 - z = -33.7 \pm k \cdot 360$
 $z = 78.7$
 $\therefore z = 11.3, 78.7$

f. $\tan(3z - 17) = 3$
 $3z - 17 = 71.6 \pm k \cdot 180$
 $3z = 88.6 \pm k \cdot 180$
 $z = 29.5 \pm k \cdot 60$
 $= -150.5, -90.5, -30.5, 29.5,$
 $89.5, 149.5 //$

$$8 \text{ a } \sin 2\theta = \cos 36$$

$$\sin 2\theta = \cos(90-54)$$

$$\sin 2\theta = \sin 54$$

$$2\theta = 54 \pm k \cdot 360$$

$$\theta = 27 \pm k \cdot 180$$

$$= 27, 207 //$$

$$2\theta = (180-54) \pm k \cdot 360$$

$$\theta = 63 \pm k \cdot 180$$

$$= 63, 243$$

$$\therefore \theta = 27, 63, 207, 243$$

$$b \cos 5\theta = \sin 70$$

$$\cos 5\theta = \sin(90-20)$$

$$\cos 5\theta = \cos 20$$

$$5\theta = 20 \pm k \cdot 360$$

$$\theta = 4 \pm k \cdot 72$$

$$= 4, 76, 148, 220, 292 //$$

$$5\theta = -20 \pm k \cdot 360$$

$$\theta = -4 \pm k \cdot 72$$

$$= 68, 140, 212, 284, 356,$$

$$\therefore \theta = 4, 68, 76, 140, 148, 212,$$

$$220, 284, 292, 356$$

$$c \tan 3\theta = \tan 60$$

$$3\theta = 60 \pm k \cdot 180$$

$$\theta = 20 \pm k \cdot 60$$

$$\therefore \theta = 20, 80, 140, 200, 260, 320$$

$$g \quad 0 \leq \theta \leq 180$$

$$2 \sin \theta \cos \theta = \frac{1}{2} \tan \theta \div \sin \theta$$

$$2 \cos \theta = \frac{1}{2} \frac{1}{\cos \theta}$$

$$4 \cos^2 \theta = 1$$

$$\cos^2 \theta = \frac{1}{4}$$

$$\cos \theta = \pm \frac{1}{2}$$

$$\textcircled{1} \cos \theta = \frac{1}{2}$$

$$\theta = 60 \text{ (Q1, 4)}$$

$$\text{Q1. } \theta = 60 \pm k \cdot 360$$

$$= 60$$

$$\text{Q4. } \theta = 300 \pm k \cdot 360$$

$$= 300 \text{ (> } 180^\circ)$$

$$\textcircled{2} \cos \theta = -\frac{1}{2}$$

$$\theta = 120, 240$$

$$\text{Q2. } \theta = 120$$

$$\text{Q3. } \theta = 240 \text{ (> } 180^\circ)$$

$$\sin \theta = 0, \theta = 0, 180$$

$$\therefore \theta = 0, 60, 120, 180$$

$$12 \quad d = A + B \sin kt$$

$$d = A + B \sin \frac{360}{365} t$$

$$b \quad d_{\min} = 6h, \quad d_{\max} = 18h$$

$$6 = A - B$$

$$18 = A + B$$

$$24 = 2A$$

$$A = 12, B = 6$$

$$-80 \text{ days}$$

$$d = 12 + 6 \sin 0.986 \times (-80)$$

$$= 6.11 \text{ h}$$

$$= 6h + \frac{11}{100} \times 60 \text{ minute}$$

$$= 6h + 7 \text{ minutes}$$

$$c. \quad 10 = 12 + 6 \sin \frac{360}{365} t$$

$$-2 = 6 \sin \frac{360}{365} t$$

$$\sin \frac{360}{365} t = -\frac{1}{3}$$

$$\frac{360}{365} t = 19.5 \text{ (Q3, 4)}$$

$$\text{Q3. } 0.986 t = 180 + 19.5$$

$$t = 202.3 \text{ days}$$

$$\text{Q4. } 0.986 t = 360 - 19.5$$

$$t = 345.3 \text{ days}$$