4a) $-2.8 \sin\left(\frac{\pi}{6}(x-12)\right) + 16 = 16$ $\quad 0 \le x \le 2\pi$

$\sin\left(\frac{\pi}{6}(x-12)\right) = 0$

$\text{per} = \frac{2\pi}{\left(\frac{\pi}{6}\right)} = 12$

let $\theta = \frac{\pi}{6}(x-12)$

$\sin\theta = 0$

$\theta = 0$ or $\theta = \pi$

$\frac{\pi}{6}(x-12) = 0$ or $\pi = \frac{\pi}{6}(x-12)$

$x - 12 = 0$

$\boxed{x = 12}$

$6\pi = \pi(x-12)$

$6 = x - 12$

$\boxed{18 = x}$

Both too big ∴ subtract period from each

$x = 12 - 12$

$\boxed{x = 0}$

or

$x = 18 - 12$

$\boxed{x = 6}$

b) $12\cos(2(x-45^\circ))+8=10$

$0^\circ \le x \le 360^\circ$

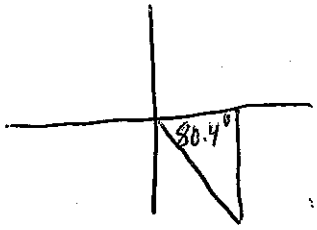
$\cos(2(x-45^\circ)) = \frac{1}{6}$

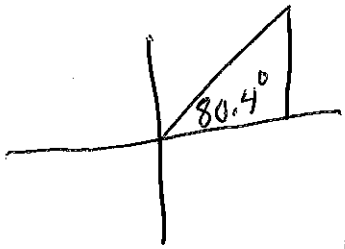
$\text{Per} = \frac{360^\circ}{2} = 180^\circ$

Let $\theta = 2(x-45^\circ)$

$\cos\theta = \frac{1}{6}$

$\theta_R = 80.4^\circ$





$\theta = 279.6^\circ$

$\theta = 80.4^\circ$

$279.6^\circ = 2(x-45^\circ)$

$139.8^\circ = (x-45^\circ)$

$\boxed{184.8^\circ = x}$

$80.4^\circ = 2(x-45^\circ)$

$\boxed{85.2^\circ = x}$

$\text{Per} = \frac{360^\circ}{2} = 180^\circ$

$X = 184.8^\circ - 180^\circ$

$\boxed{X = 4.8^\circ}$

$X = 85.2^\circ + 180^\circ$

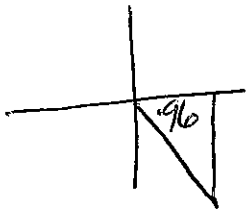
$\boxed{X = 265.2^\circ}$

c) $7\cos 3(x-6) = 4$ $\quad 0 \le x < 2\pi$

$\cos 3(x-6) = \frac{4}{7}$ $\quad$ per $= \frac{2\pi}{3}$

Let $\theta = 3(x-6)$

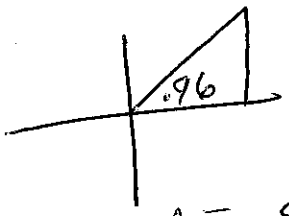
$\cos\theta = \frac{4}{7}$



$\theta = 5.3$

$3(x-6) = 5.3$

$x = 7.77$ too big



$\theta = .96$

$3(x-6) = 0.96$

$x = 6.32$ too big

per $= \frac{2\pi}{3}$

$x = 7.77 - \frac{2\pi}{3}$

$x = 5.68$

$x = 5.68 - \frac{2\pi}{3}$

$x = 3.59$

$x = 3.59 - \frac{2\pi}{3}$

$x = 1.49$

$x = 6.32 - \frac{2\pi}{3}$

$x = 4.23$

$x = 4.23 - \frac{2\pi}{3}$

$x = 2.13$

$x = 2.13 - \frac{2\pi}{3}$

$x = 0.04$

a) $6.2\sin(4(x+8^\circ))-1=4$

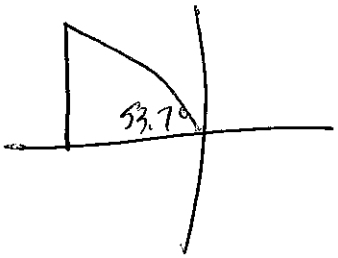
$0^\circ \le x \le 360^\circ$

$\sin(4(x+8^\circ)) = .80645$

$per = \frac{360^\circ}{4} = 90^\circ$

Let $\theta = 4(x+8^\circ)$

$\sin\theta = .80645$



$\theta = 180^\circ - 53.7^\circ$

$\theta = 126.3^\circ$

$4(x+8^\circ) = 126.3^\circ$

$x = 23.58^\circ$

$x = 23.58^\circ + 90^\circ$

$x = 113.58^\circ$

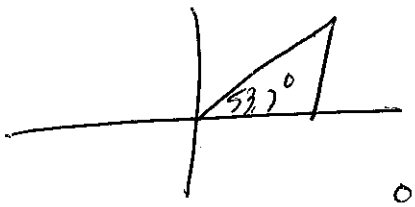
$x = 113.58^\circ + 90^\circ$

$x = 203.58^\circ$

$x = 203.58^\circ + 90^\circ$

~~$x = 293.58^\circ$~~

or



$\theta = 53.7^\circ$

$4(x+8^\circ) = 53.7^\circ$

$x = 5.43^\circ$

$x = 5.43^\circ + 90^\circ$

$x = 95.43^\circ$

$x = 95.43^\circ + 90^\circ$

$x = 185.43^\circ$

$x = 185.43^\circ + 90^\circ$

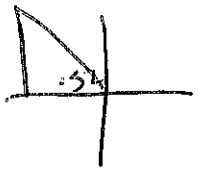
$x = 275.43^\circ$

5. a) $\sin\left(\frac{\pi}{4}(x-6)\right) = 0.5$ $\quad 0 \le x \le 2\pi$

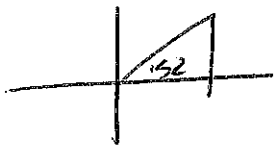
Let $\theta = \frac{\pi}{4}(x-6)$

$\sin\theta = 0.5$

per $= \frac{2\pi}{\frac{\pi}{4}} = 8$



$\theta = 2.62$



$\theta = .52$

But $\theta = \frac{\pi}{4}(x-6)$

$\frac{\pi}{4}(x-6) = 2.62$

$x = 9.34$

too big

$x = 9.34 - per$

$x = 9.34 - 8$

$\boxed{x = 1.34}$

$\frac{\pi}{4}(x-6) = 0.52$

$x = 6.66$

too big

$x = 6.66 - per$

$x = 6.66 - 8$

$\boxed{x = -1.34}$

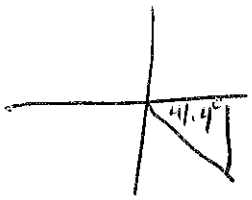
b) $4\cos(x-45^\circ) + 7 = 10$ $\quad 0^\circ \le x \le 360^\circ$

$\cos(x-45^\circ) = \frac{3}{4}$

Let $\theta = x - 45^\circ$

$\cos\theta = \frac{3}{4}$

per $= 360^\circ$



$\theta = 318.6^\circ$

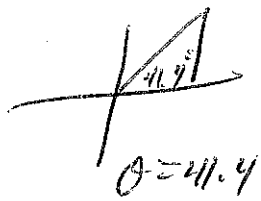
$x - 45^\circ = 318.6^\circ$

$x = 363.6^\circ$

$x = 363.6^\circ - per$

$x = 363.6^\circ - 360^\circ$

$\boxed{x = 3.6^\circ}$



$\theta = 41.4^\circ$

$x - 45^\circ = 41.4^\circ$

$\boxed{x = 86.4^\circ}$

c) $8\cos(2x-5) = 3$

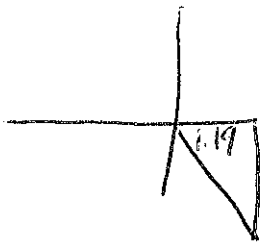
$8\cos 2(x-\frac{5}{2}) = 3$

$\cos 2(x-\frac{5}{2}) = \frac{3}{8}$

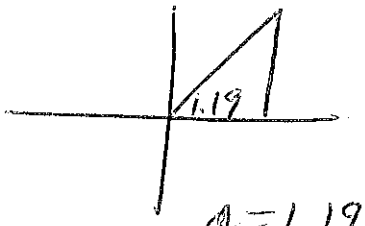
let $\theta = 2(x-\frac{5}{2})$

$\cos\theta = \frac{3}{8}$

per $= \pi$



$\theta = 5.09$



$\theta = 1.19$

But $\theta = 2(x-\frac{5}{2})$

$5.09 = 2(x-\frac{5}{2})$

$x = 5.05$

$x = 5.05 - \pi$

$x = 1.91 + \pi n,\ n \in I$

$1.19 = 2(x-\frac{5}{2})$

$x = 3.095$

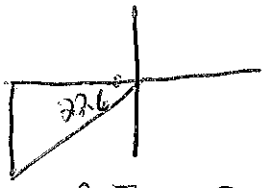
$x = 3.09 \pm \pi n,\ n \in I$

d) $5.2 \sin(45(x+8^\circ)) - 1 = -3$

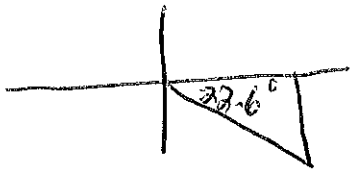
$\sin(45(x+8^\circ)) = -.3846$

Let $\theta = 45(x+8^\circ)$

$\text{per} = \frac{360^\circ}{45} = 8^\circ$



$\theta = 202.6^\circ$



$\theta = 337.4^\circ$

$45(x+8^\circ) = 202.6^\circ$

$x = -3.49^\circ$

~~$x = -3.49^\circ + 8^\circ$~~

$x = -3.49^\circ + 8$

$x = 4.51^\circ + 8^\circ n, \; n \in I$

$45(x+8^\circ) = 337.4^\circ$

~~$x = 15.49^\circ$~~

$x = -0.50$

$x = -0.50 + 8^\circ$

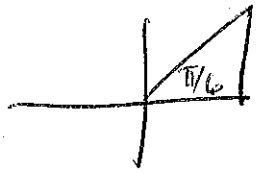
$x = 7.5^\circ + 8^\circ n, \; n \in I$

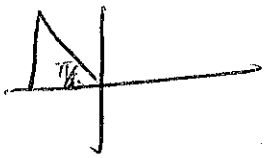
P. 287

#13 $\sin\left(\frac{\pi}{3}(x-1)\right) = \frac{1}{2}$ per $= \frac{2\pi}{\left(\frac{\pi}{3}\right)} = 6$

a) Let $\theta = \frac{\pi}{3}(x-1)$

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





$\theta_1 = \pi/6$ $\theta_2 = 5\pi/6$

$\frac{\pi}{3}(x-1) = \frac{\pi}{6}$ $\frac{3\pi}{3}(x-1) = \frac{5\pi}{6}$

$x-1 = \frac{3}{6}$ $(x-1) = \frac{15}{6}$

$x = \frac{9}{6}$ $x-1 = \frac{5}{2}$

$x = \frac{3}{2}$ $x = \frac{7}{2}$

$x = \frac{3}{2} + 6n$ $x = \frac{7}{2} + 6n$

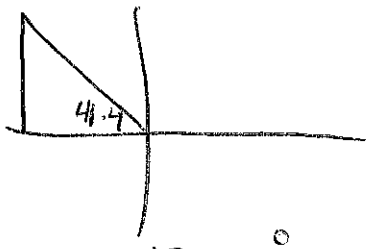
b) $4\cos(15(x+30^\circ)) + 1 = -2$ per $= 24^\circ$

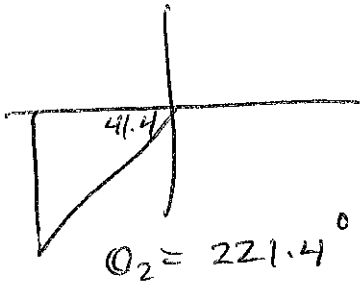
$\cos(15(x+30^\circ)) = -\frac{3}{4}$

Let $\theta = 15(x+30^\circ)$

$\cos\theta = -\frac{3}{4}$

$\theta_R = 41.4^\circ$





$\theta_1 = 138.6^\circ$ $\theta_2 = 221.4^\circ$

$15(x+30^\circ) = 138.6^\circ$ $15(x+30^\circ) = 221.4^\circ$

$x = -20.76^\circ$ $x+30^\circ = 14.76^\circ$

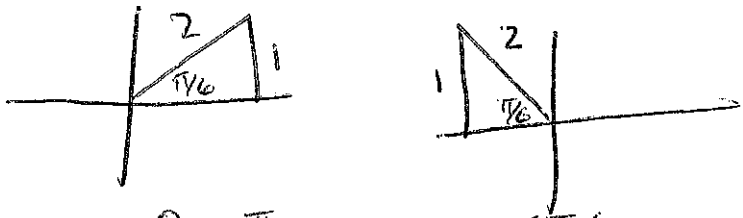
$x = -15.24^\circ$

$x = -20.76^\circ + 24$ $x = -15.24^\circ + 24^\circ$

$x = 3.24^\circ + 24n$ $x = 8.76^\circ + 24n$

20. a) $2\sin x - 1 = 0$ $\quad 0 \le x \le 2\pi$

$\sin x = \frac{1}{2}$ $\quad \theta_R = \pi/6$



$\theta = \pi/6$ $\quad \theta_2 = 5\pi/6$

b) $0 = 2\cos(x - 30°) + 5$ $\quad 0° \le x \le 360°$

$-5 = 2\cos(x - 30°)$

$-\frac{5}{2} = \cos(x - 30°)$

No solution because cosine has a max amplitude of 1.

c) $\sin\left(\frac{\pi}{4}(x-6)\right) = 0.5$ $\quad per = \frac{2\pi}{\frac{\pi}{4}} = 8$

Let $\theta = \frac{\pi}{4}(x-6)$

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

from 20 a)

$\theta = \frac{\pi}{6}$ or $\theta = \frac{5\pi}{6}$

$\frac{\pi}{4}(x-6) = \frac{\pi}{6}$

$x - 6 = \frac{4}{6}$

$x - 6 = \frac{2}{3}$

$x = 6 + \frac{2}{3}$

$x = \frac{20}{3}$

$x = \frac{20}{3} + 8n$

$x = 6.67 + 8n$

$\frac{\pi}{4}(x-6) = \frac{5\pi}{6}$

$x - 6 = \frac{20}{6}$

$x - 6 = \frac{10}{3}$

$x = 6 + \frac{10}{3}$

$x = \frac{28}{3}$

$x = \frac{28}{3} - 8$

$x = \frac{4}{3}$

$x = 1.33 + 8n$

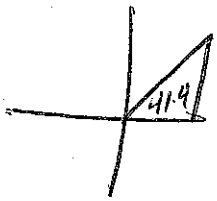
d) $4\cos(x-45^\circ)+7=10$

$\cos(x-45^\circ)=\frac{3}{4}$

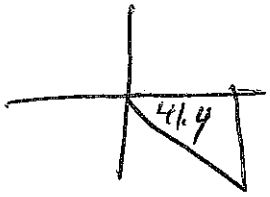
let $\theta = x-45^\circ$

Per $= 360^\circ$

$\cos\theta = \frac{3}{4}$



$\theta = 41.4^\circ$



or $\theta = 318.6^\circ$

$x-45^\circ = 41.4^\circ$ or $x-45 = 318.6^\circ$

$x = 86.4^\circ$ or $x = 363.6^\circ$

$x = 3.6^\circ$

$x = 86.4^\circ + 360^\circ n$

$x = 3.6^\circ + 360^\circ n$