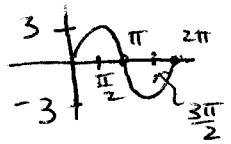
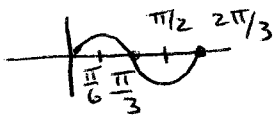
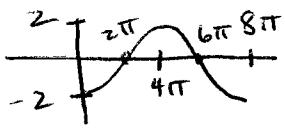
Section 7.3 Solutions

2a) $y = 3\sin x$ 

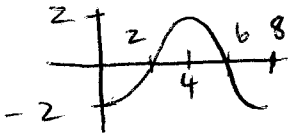
amplitude is 3; period is 2π, x-intercepts $(\pi,0)$ $(2\pi,0)$ incr $0 < x < \pi/2$ and $\frac{3}{2}\pi < x < 2\pi$

b) $y = \sin 3x$ 

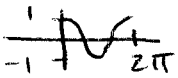
amplitude is 1; period is $\frac{2\pi}{3}$, x-ints $(\frac{\pi}{3},0)$ $(\frac{2\pi}{3},0)$ incr. $0 < x < \frac{\pi}{6}$ $\frac{\pi}{2} < x < \frac{2\pi}{3}$

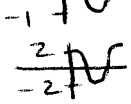
8. a) $y = -2\cos(\frac{x}{4})$ 

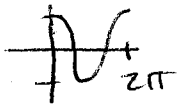
amplitude is 2 period $\frac{2\pi}{1/4} = 8\pi$
x int $(2\pi,0)$ $(6\pi,0)$
incr. $4\pi < x < 8\pi$

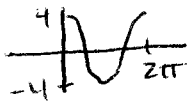
b) $y = -2\cos(\frac{\pi}{4}x)$ 

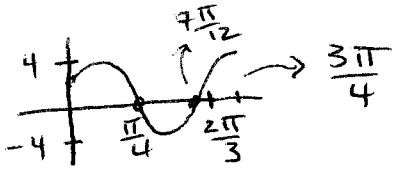
amplitude is 2 period $\frac{2\pi}{\frac{\pi}{4}} = 8$
x-int $(2,0)(6,0)$ incr $0 < x < 4$

10. $y = \cos x$ amplitude is 1 period 2π 

$y = 2\cos x$ amplitude is 2 period 2π 

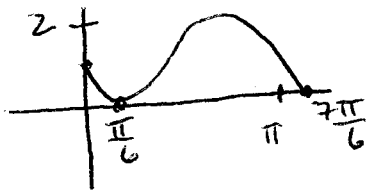


$y = 3\cos x$ amplitude is 3 period 2π ⟶
$y = 4\cos x$ amplitude is 4 period 2π 

26. $y = 4\cos(3x - \frac{\pi}{4}) = 4\cos 3(x - \frac{\pi}{12})$ 

amplitude is 4 period is $\frac{2\pi}{3}$
shift to right is $\frac{\pi}{12}$ (phase shift)
midline is 0 x-int $0 = \cos(3(x - \frac{\pi}{12}))$; $\cos 3x = 0 \Rightarrow x = \frac{\pi}{6}, \frac{\pi}{2}$
So using the shift $\frac{\pi}{6} + \frac{\pi}{12} = \frac{3\pi}{12} = \frac{\pi}{4}$ and $\frac{\pi}{2} + \frac{\pi}{12} = \frac{7\pi}{12}$
max $(\frac{\pi}{12}, 4)$ $(\frac{3\pi}{4}, 4)$ and min $(\frac{5\pi}{12}, -4)$

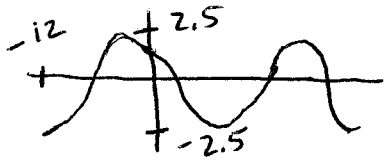
30. $y = 1 - \cos(2x - \frac{\pi}{3}) = 1 - \cos 2(x - \frac{\pi}{6})$
amplitude is 1; period is $\frac{2\pi}{2} = \pi$; horizontal shift: right $\pi/6$ (phase)
Vertical shift is 1



Since $\cos 0 = 1$
$1 - \cos 2(\frac{\pi}{6} - \frac{\pi}{6}) =$
$1 - \cos 0 = 0$
$(\frac{\pi}{6}, 0)$ is a min
$\cos\pi = -1$ so $1 - (-1) = 2$
max $(\frac{2}{3}\pi, 2)$
So $(\frac{\pi}{6}, 0)$ and $1 - \cos 2(\frac{7}{6}\pi - \frac{\pi}{6}) = 1 - \cos 2\pi = 0$ $(\frac{7}{6}\pi, 0)$

34. $y = -2.5\cos\left(\frac{1}{3}x+4\right) = -2.5\cos\left(\frac{1}{3}(x+12)\right)$

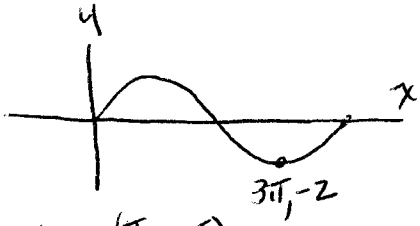
amplitude 2.5 period $\frac{2\pi}{1/3} = 6\pi$ phase shift is -12 (12 units to left)



since $\cos 0 = 1$ and $\cos\frac{1}{3}(-12+12) = \cos 0 \Rightarrow$
$-2.5\cos 0 = -2.5$ so $x=-12$ is a min $(-12, -2.5)$

mins $(-12, -2.5)$ and $(-12+6\pi, -2.5)$

maxs $(-12+3\pi, 2.5)$ and $(-12+9\pi, 2.5)$

40. 

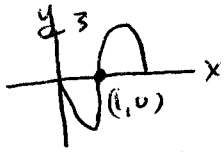
amplitude: 2 period: 4π $B = \frac{2\pi}{4\pi} = \frac{1}{2}$

graph starts at midline and increasing so sine $y = 2\sin\left(\frac{1}{2}x\right)$

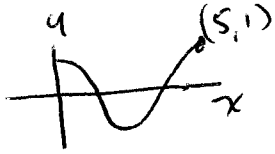
41. 

amplitude: 1.5 period: $\frac{4\pi}{3}$ $B = \frac{2\pi}{\frac{4\pi}{3}} = \frac{3}{2}$

$y = 1.5\sin\left(\frac{3}{2}x\right)$

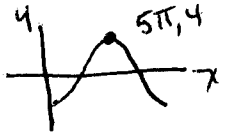
42. 

amplitude: 3 period 2 $B = \frac{2\pi}{2} = \pi$ - starts at midline and decreases $y = -2\sin(\pi x)$

43. 

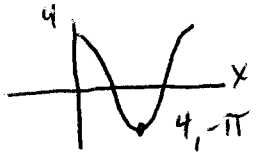
amplitude: 1 period: 5 $B = \frac{2\pi}{5}$

looks like cosine $y = \cos\left(\frac{2\pi}{5}x\right)$

44. 

amplitude: 4 period: 10π $B = \frac{2\pi}{10\pi} = \frac{1}{5}$

looks like negative cosine

45. 

amplitude: π period: 8 $B = \frac{2\pi}{8} = \frac{\pi}{4}$

$y = \pi\cos\left(\frac{\pi}{4}x\right)$

46. amplitude $\frac{105.1-65.5}{2} = 19.8$ period 12 months $B = \frac{2\pi}{12} = \frac{\pi}{6}$

D (midline) is $65.5+19.8 = 85.3$ - shift (horizontal) depends on sine or cosine $y = T = 19.8\sin\left(\frac{\pi}{6}(t-4)\right) + 85.3$ OR

$T = -19.8\cos\left(\frac{\pi}{6}t\right) + 85.3$

48. amplitude $\frac{70-54.3}{2} = 7.85$ period: 12 $B = \frac{\pi}{6}$ midline $54.3+7.85 = 62.15$

$T = 7.85\cos\left(\frac{\pi}{6}t\right) + 62.15$ OR $T = -7.85\sin\left(\frac{\pi}{6}(t-3)\right) + 62.15$

50. Dares Salaam: amplitude $\frac{81.7-73.9}{2} = 3.9$ period 12 $B = \frac{\pi}{6}$ midline 77.8

$T = 3.9\cos\left(\frac{\pi}{6}t\right) + 77.8$ OR $T = -3.9\sin\left(\frac{\pi}{6}(t-3)\right) + 77.8$

Tiksi: amplitude $\frac{43.9-(-24.2)}{2} = 34.05$ $B = \frac{\pi}{6}$ Midline: 9.85 $T = -34.05\cos\left(\frac{\pi}{6}t\right) + 9.85$