HW 5
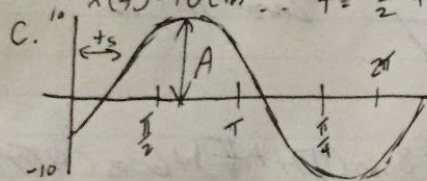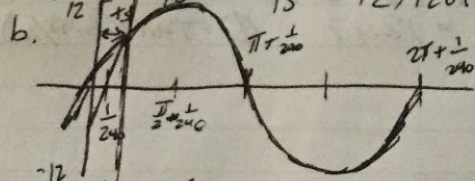
6-3. $\phi = -\pi/4$ $w = 2\pi$ $1 = 20cm$ $T = 1$

$\therefore x = 20\cos(\theta) = 20\cos(2\pi t + -\pi/4)$

$y = 20\sin(\theta) = 20\sin(2\pi t + -\pi/4)$

6-7 $A = 2$ $T = .5s$ $f = 2$ No ϕ

$\therefore y(t) = 2\sin(\theta) = 2\sin(4\pi t)$

6-14a. $\phi = \frac{-\pi}{2}$ $w = 4\pi$ $\therefore f = \frac{4\pi}{2\pi} = 2$

$A = 10$ $T = \frac{1}{2}$ $T_s = \frac{\pi/2}{4\pi} = \cancel{} = \frac{1}{8}s$

b. $x(t) = 0cm$ $\therefore$ $t = $ ▓▓▓▓ $\frac{1}{8}s$

$x(t) = 10cm$ $\therefore$ $t = \frac{\pi}{2} + \frac{1}{8}$

c.

6-20.a. $A = 12$ $w = 120\pi$ $\therefore f = 60$ $T = \frac{1}{60}$

$\phi = \frac{\pi}{2} \to 90°$ $t_s = \frac{-\pi/2}{120\pi} = \frac{-1}{240}s$
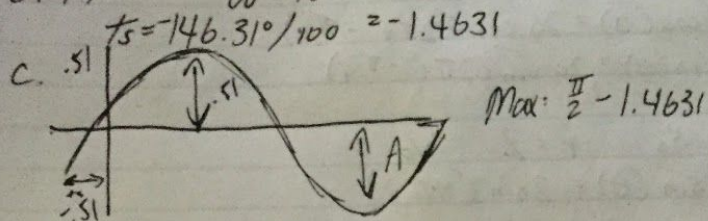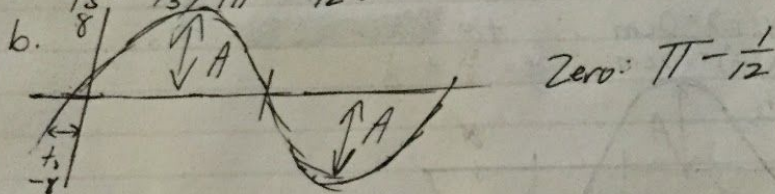
b.

Earliest Max: $\frac{\pi}{2} - \frac{1}{240}$

c. $M\cos(120\pi t + \theta) = 10\cos(120\pi t +) + 12\cos(120\pi t + \pi/2)$

$M\cos(120\pi t)\cos(\phi) - M\sin(120\pi t)\sin(\phi) = 10\cos(120\pi t) + 12\cos(\frac{\pi}{2})\cos(120\pi t)$

▓▓▓▓▓▓▓▓ $M\cos\phi = $ ▓▓ 10 $-12\sin(\frac{\pi}{2})\sin(120\pi t)$

▓▓▓▓▓▓▓▓ $M\sin\phi = +12$

$M = \sqrt{244} = 15.62$

$\phi = \tan^{-1}(12/10) = 50.2°$

6-26.a. $M\sin(100t + \phi) = 100\cos(100t + \frac{\pi}{4}) + 500\cos(100t + \frac{3\pi}{4})$

$M\sin(100t)\cos\phi + M\cos(100t)\sin\phi = 100\cos(100t)\cos(\frac{\pi}{4}) - 100\sin(100t)(\frac{\pi}{4}) + 500$

$M\cos\phi = 100\cos(\frac{\pi}{4}) + 500\cos(\frac{3\pi}{4}) = -400/\sqrt{2}$ $\cos(100t)\cos(\frac{3\pi}{4}) - 500\sin(100t)\sin(\frac{3\pi}{4})$

$M\sin\phi = -100\sin(\frac{\pi}{4}) - 500\sin(\frac{3\pi}{4}) = -600/\sqrt{2}$

$M = \sqrt{(-400/\sqrt{2})^2 + (-600/\sqrt{2})^2} = 509.9$ $\phi = \tan^{-1}(-600\sqrt{2}/-400\sqrt{2}) = 56.3°$

b. $A = .51$ $w = 100t$ $\therefore f = \frac{50}{\pi} \approx 15.91$ $\therefore T = \frac{1}{15.91} \approx .062$

$t_s = -146.31°/100 = -1.4631$

c. .51

$Max: \frac{\pi}{2} - 1.4631$

6-31. a. $A = 8$ $w = 4\pi$ $\therefore f = \frac{4\pi}{2\pi} = 2$ $\therefore T = \frac{1}{2}$

$t_s = \frac{\pi/3}{4\pi} = \frac{1}{12} s$

b.

$Zero: \pi - \frac{1}{12}$

c. $M\cos(4\pi t + \phi) = 8\sin(4\pi t + \frac{\pi}{3}) + 6\cos(4\pi t)$

$M\cos(4\pi t)\cos(\phi) - M\sin(4\pi t)\sin\phi = 8\sin(4\pi t)\sin(\frac{\pi}{3}) + 8\cos(4\pi t)\cos(\frac{\pi}{3}) + 6\cos 4\pi t$

$M\cos\theta = 8\cos(\frac{\pi}{3}) + 6 = 4 + 6 = 10$

$M\sin\theta = -(8\sin(\frac{\pi}{3})) = 8(\frac{\sqrt{3}}{2}) = 6.93$

$M = \sqrt{10^2 + 6.93^2} = 12.17$ $\phi = \tan^{-1}(6.93/10) = 34.72°$