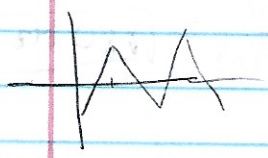
Ch. 12 Ex.

12.1 $v = 10.00\ m/s$

a) λ = cm to cm
= 6 m (from graph)

b) ψ vs. t min $\psi = -1$
max $\psi = 2$



c) T = time for a full oscillation,

$v = f\lambda = \frac{\lambda}{T}$

$T = \frac{\lambda}{v} = \frac{6m}{10 m/s} = 0.60$ s

d) $f = \frac{1}{T} = \frac{10}{6}$ Hz = 1.67 Hz

12.2) $v = 4.0\ m/s$

a) $v = f\lambda = \frac{\lambda}{T}$

$T = \frac{\lambda}{v} = \frac{0.20m}{4.0 m/s}$

= 0.05 s

b) $f = \frac{1}{T}$ = 20 Hz

12.3) $\psi(x,t) = 0.4m \cos[(6.00 \frac{rad}{m})x - (10.0 \frac{rad}{s})t]$

a) A = 0.4 m

b) $k = \frac{2\pi}{\lambda}$

$\lambda = \frac{2\pi}{k} = \frac{2\pi}{6.00\ rad/m}$ = 1.05 m

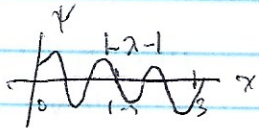
c) $\omega = 2\pi f$

$f = \frac{\omega}{2\pi} = \frac{10 rad/s}{2\pi}$ = 1.6 Hz

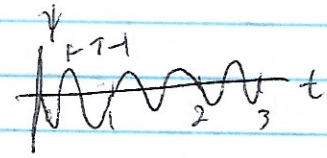
d) $v = f\lambda = (1.6\ Hz)(1.05m)$
= 1.68 m/s

e) $\psi(5,2) = 0.4m \cos(6.00(5) - 10(2))$
= −0.34 m

f) $t = 2.00$ s $\psi(x,2) = 0.40m \cos(6.00\pi - 20)$



g) $\psi(5,t) = 0.40m \cos(30 - 10t)$



12.4) $\psi(x,t) = A\cos(kx - \omega t - \frac{\pi}{2})$

$\psi(x,t) = A\sin(kx - \omega t)$

$\cos(90 - \phi) = \sin\theta$

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

$\psi(x,t) = A\cos(kx - \omega t - \frac{\pi}{2})$

$\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

$= A[\cos(kx - \omega t)\cos\frac{\pi}{2} + \sin(kx - \omega t)\sin\frac{\pi}{2}]$

$= A\sin(kx - \omega t)$

12.5) $v = \sqrt{\frac{F}{\mu}} = \sqrt{\frac{F}{m/l}}$

$= \sqrt{\frac{5.1N}{(0.076kg)/5.0m}}$ = 18.3 m/s

12.6) $v = \sqrt{\frac{B}{\rho}} = \sqrt{\frac{0.2 \times 10^{10}\ N/m^2}{1.000 kg/m^3}}$

$= \sqrt{1414\ m/s}$

12.7) $P = \frac{1}{2}\mu\omega^2 A^2 v$

$v = \sqrt{\frac{F}{\mu}} = \sqrt{\frac{50N}{0.076 kg/5m}}$ = 57 m/s

$\omega = 2\pi f = 2\pi(10\ Hz)$ = 63 rad/s

A = 2.0 cm = 0.02 m

$P = \frac{1}{2}(\frac{0.076\ kg}{5.0\ m})(63 \frac{rad}{s})^2(0.02m)^2(57 m/s)$

= 0.69 W

12-8) $I = \frac{P}{4\pi r^2}$ $P = 4\pi r^2 I = 4\pi r_0^2 I_0$

$r^2 = \frac{4\pi r_0^2 I_0}{4\pi (0.1) I_0}$

$= 10 r_0^2$

$r = \sqrt{10 r_0^2} = \boxed{3.16 r_0}$

12-9) $\beta = 10\,dB \log_{10} \frac{I}{I_0}$

$\frac{I}{I_0} = 10^{\frac{\beta}{10\,dB}}$

$\beta + 3.00\,dB = 10\,dB \log \frac{I'}{I_0}$

$\frac{I'}{I} = \frac{10^{\frac{\beta+3}{10}}}{10^{\beta/10}}$

$= 10^{0.3} = \boxed{2.00}$

12-10) $f_s = 261.6\,Hz$ $v_{w.s} = -5.0\,m/s$

$v_{sound} = +10.00\,m/s$ $v_{obs} = +20.00\,m/s$

$f' = f_s \left(\frac{v_{sound} \pm v_{obs}}{v \pm v_{sound} \mp v_{src}} \right)$

$= (261.6\,Hz)\left(\frac{343 + 5.0 + 20.0}{343 - 5.0 + 10.0}\right)$

$= 794\,Hz$

$f' = (261.6\,Hz)\left(\frac{343 - 5 - 20}{343 - 5 + 10}\right)$

$= \boxed{239\,Hz}$

12-11) $l = 0.585\,m$ $\mu = 5.74 \times 10^{-5}\,kg/m$

$f = 440\,Hz$

a) $v = \sqrt{\frac{F}{\mu}} = f\lambda$ $\lambda_1 = 2l$

$= (440\,Hz)(2 \times 0.585\,m)$

$= \boxed{515\,m/s}$

b) $\lambda = 2l = 2 \times 0.58\,m = \boxed{1.17\,m}$

c) $\lambda_n = \frac{2l}{n}$ $v = f\lambda$ $f = \frac{v}{\lambda}$

$f_n = \frac{nv}{2l}$

$f_2 = \frac{2(515\,m/s)}{2(0.585\,m)} = \boxed{880\,Hz}$

d)

$d = \frac{\lambda}{2} = \frac{2(0.585\,m)}{2}/2$

$= \boxed{0.29\,m}$

12-12) closed pipe, $f = 440\,Hz$

$\lambda_n = \frac{4l}{n}$, $n = 1$

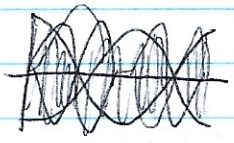
$\lambda_1 = 4l$ $l = \frac{\lambda_1}{4}$

$v = f\lambda$ $\lambda = \frac{v}{f}$ $l = \frac{v}{4f}$

$= \frac{343\,m/s}{4(440\,Hz)} = \boxed{0.19\,m}$

12-13) $f_1 = 8.000\,Hz$ $f_2 = 8.250\,Hz$

a) $\psi_1(0,m,t)$ $\psi_2(0,m,t)$



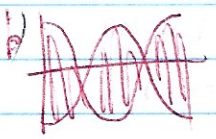
$y(x,t) = A\cos(kx - \omega t)$

$\omega = 2\pi f$

$\psi_1(0,t) = A\cos(-2\pi f_1 t)$

, assume $A = 1$

$\psi_2 = \cos(-2\pi f_2 t)$



c) $f_b = f_2 - f_1$

$= 0.250\,Hz$

d) $T_b = \frac{1}{f} = \boxed{4\,s}$