11-6-13

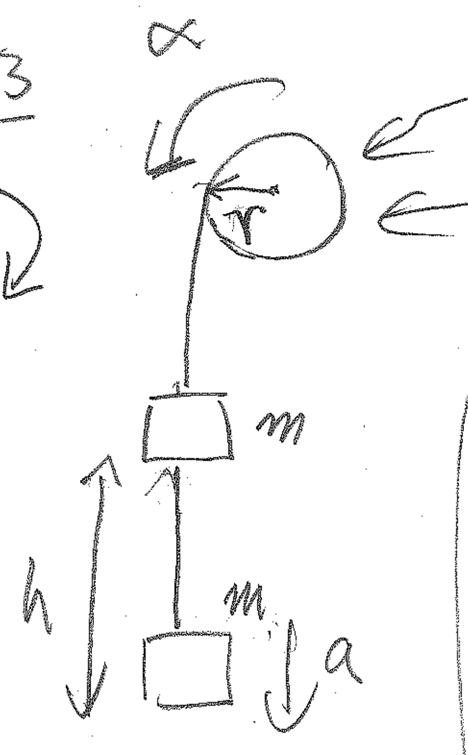
Lab on 11-8 (FRIDAY)

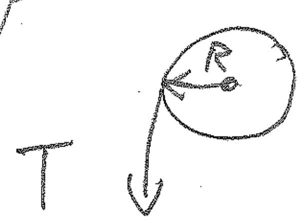
see Example 10.3 before <u>Lab</u>

<u>EXAMPLE 10.3</u>

CH 9, 10

$a = \alpha \cdot R$





$\tau = r \cdot T$

$\tau = I \cdot \alpha$

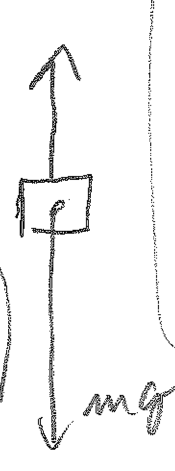
$I \cdot \dfrac{a}{R} = r \cdot T$

$\boxed{I \dfrac{a}{r^2} = T}$

$\Sigma F_y = \text{pos} - \text{neg}$

$\boxed{ma = mg - T}$

solve for a, T
see Example 10.3



<u>Lab formula</u> Derivation

$h = \frac{1}{2}at^2$ (CH 2)

$$a = \frac{2h}{t^2}$$

$$m\left(\frac{2h}{t^2}\right) = mg - T$$

$$I \cdot \frac{2h}{r^2t^2} = T$$

$$m \cdot \frac{2h}{t^2} + I \cdot \frac{2h}{r^2t^2} = mg$$

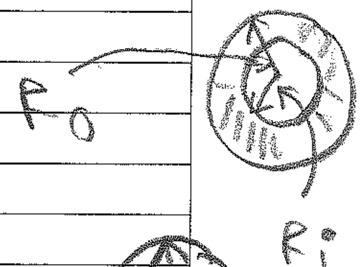
solve for I

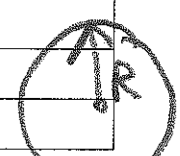
$$I = \frac{mg - m\frac{2h}{t^2}}{2h/r^2t^2}$$

$$\boxed{I = m\left(\frac{gt^2}{2h} - 1\right) \cdot r^2}$$

MOMENT OF INERTIA LAB			
SEE CH. 10 EXAMPLES OF TEXTBOOK			
FROM EXAMPLE REFERENCED ABOVE AND FROM CHAPTER 2, IT CAN BE SHOWN $I = m\left(\frac{gt^2}{2h} - 1\right) \bullet r^2$. We will use this formula to find the moment of inertia I of a disk and ring and then compare with the theoretical values. Here h is the vertical distance fallen by hanging mass m in time t, and r = radius of axle and I is the moment of inertia for horizontally spinning disk and/or ring of demonstration equipment used in class for the past few weeks. You will measure r with vernier calipers, t with a digital timer, and m is from the weight sets and sits on a 50 g hanger. The data sheet below suggests we must eliminate I for the spindle (SP) to find the ring (RING) and disk (DISK) I's. We will get these I's by subtracting various results given below in data sheet			
DATA SHEET:			
r =	m =	h =	
SPINDLE + RING			
TIME t		$I_{SP} + I_{RING}$ = I_1	
1			
2			
3			
4			
Average t		average $I_{SP} + I_{RING}$	
SPINDLE + DISK			
TIME t		$I_{SP} + I_{DISK}$ = I_2	
1			
2			
3			
4			
Average t		average $I_{SP} + I_{DISK}$	

SPINDLE + DISK +RING	
TIME t	$I_{SP} + I_{DISK} + I_{RING}$ $= I_3$
1	
2	
3	
4	
Average t	average $I_{SP} + I_{DISK} + I_{RING}$
1. COMPUTE I_{DISK} USING APPROPRIATE SUBTRACTION. $= I_3 - I_1$	
2. COMPUTE I_{RING} USING APPROPRIATE SUBTRACTION. $= I_3 - I_2$	
COMPARE DYNAMIC MEASUREMENTS WITH THEORETICAL I-VALUES.	
RING MASS M_{RING} =	
RING RADIUS R_{RING} =	
THEORETICAL I_{RING} = $\frac{1}{2}M(R_0^2 + R_i^2)$	
PERCENT DIFFERENCE	
DISK MASS M_{DISK} =	
DISK RADIUS R_{DISK} =	
THEORETICAL I_{DISK} = $\frac{1}{2}MR^2$	
PERCENT DIFFERENCE	





ENTER RAW DATA IN THE ABOVE TABLE. SHOW CALCULATIONAL WORK IN SPACE BELOW AND ATTACHED WHITE SHEETS.

$$\left|\frac{I_{RING_{TH}} - (I_3 - I_2)}{\text{Average}}\right| \times 100\%$$

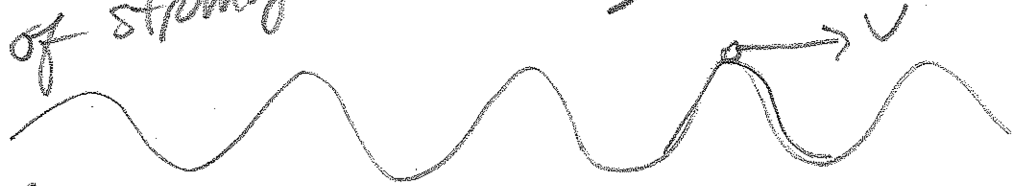
$$\left|\frac{I_{DISK_{th}} - (I_3 - I_1)}{\text{Average}}\right| \times 100\%$$

Ch 12

WAVES

SHAKE end of string

$\longrightarrow v =$ wave speed



$\uparrow\downarrow$ vibration

$|\leftarrow \lambda \rightarrow|$

frequency $= f = \dfrac{1}{\text{period}}$

$= \dfrac{1}{T}$

$\lambda = v \cdot T$

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

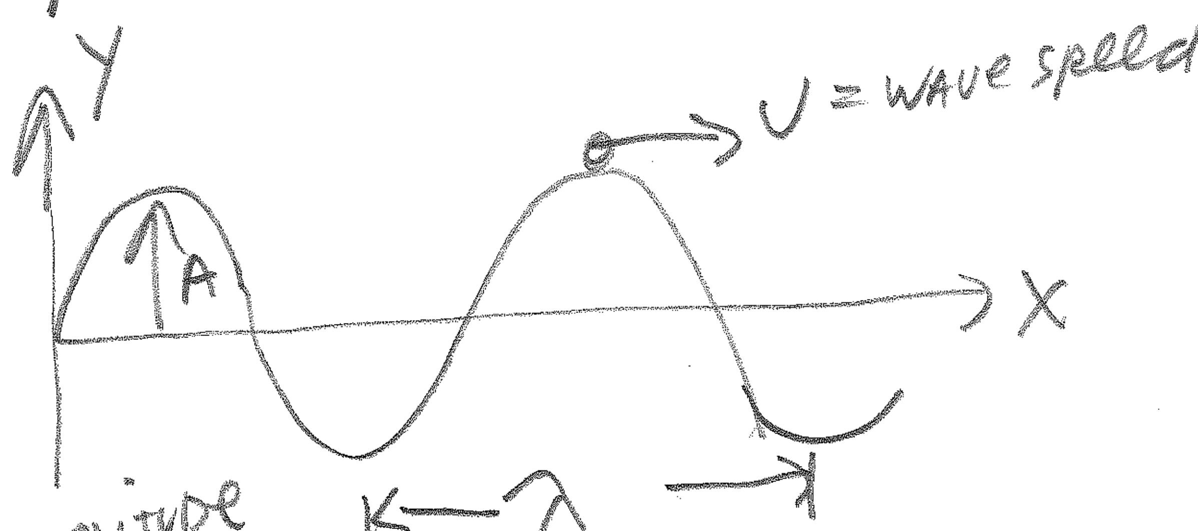
$v =$ speed of a crest (peak)

fig 12.3

$$v = \sqrt{\frac{F_T}{\mu}}$$

F_T string tension

μ = mass density $\left(\frac{kg}{m}\right)$



A = AMPLITUDE

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

$$k = \frac{2\pi}{\lambda} \quad \text{and} \quad \omega = \frac{2\pi}{T}$$

$$\frac{w}{k} = \frac{2\pi/T}{2\pi/\lambda} = \frac{\lambda}{T} = \lambda \cdot f$$

$$\boxed{\frac{w}{k} = v = \lambda \cdot f}$$

$$\frac{w}{k} = v$$

12.5 reflections

fig 12.11

(a)

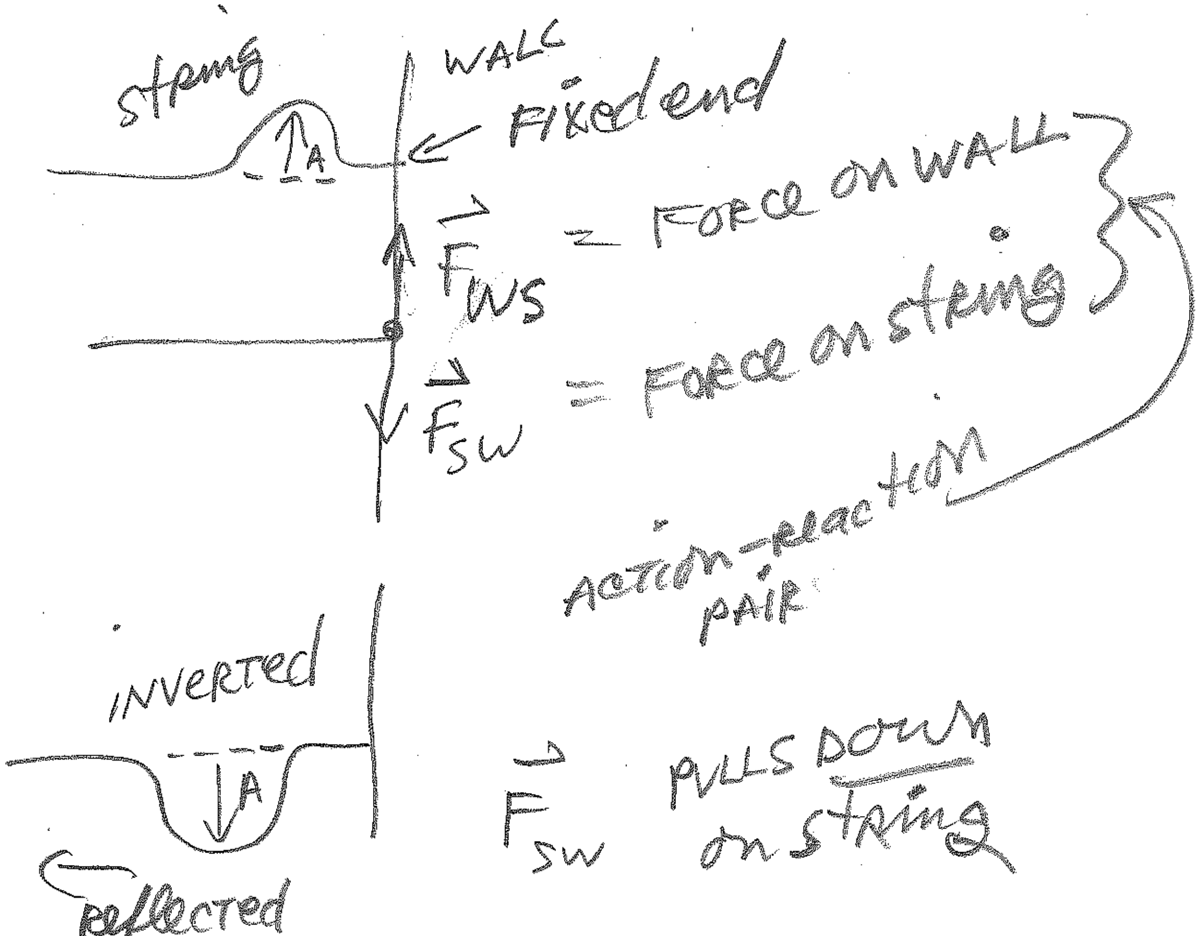
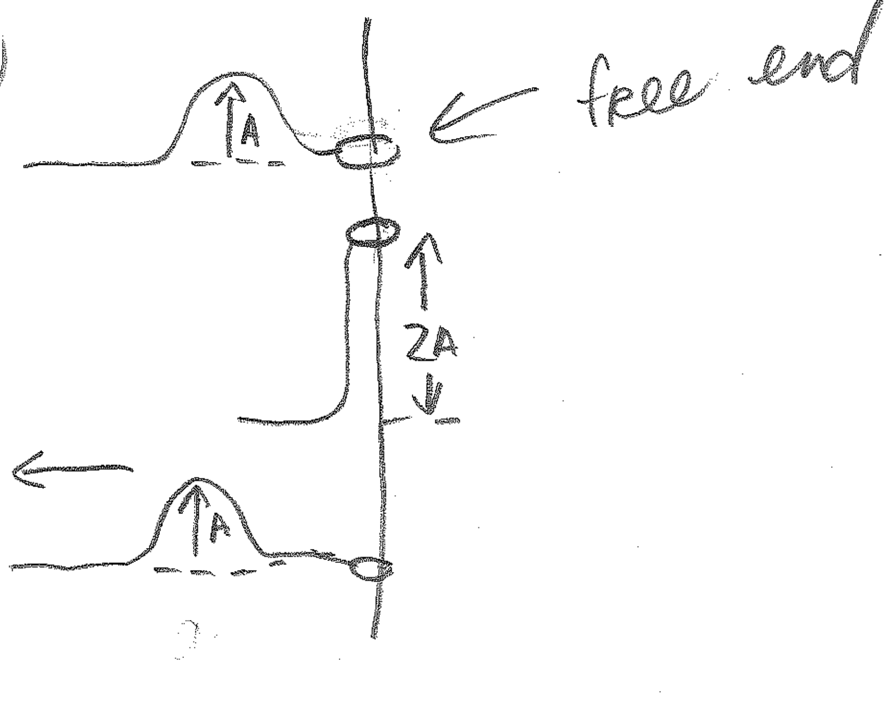


fig 12.11

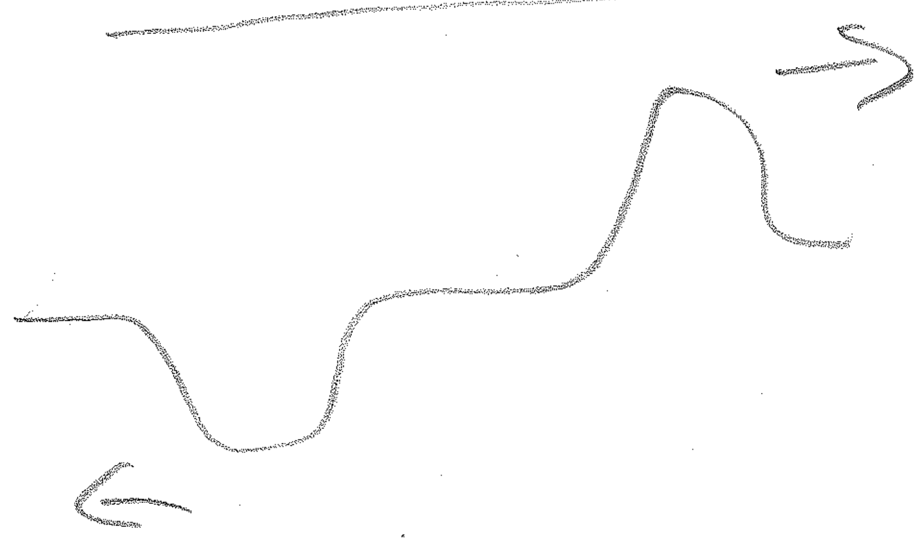
(b)



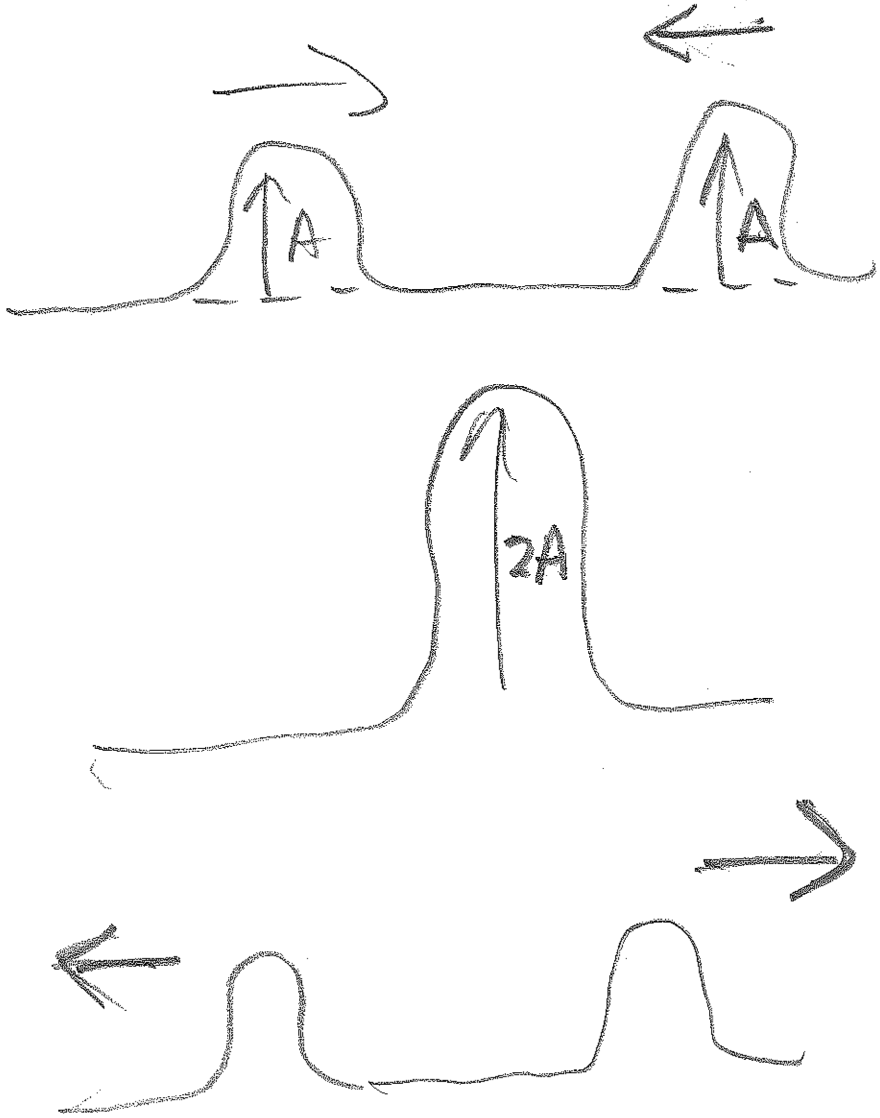
Interference in detail:
page 374

Destructive:

zero

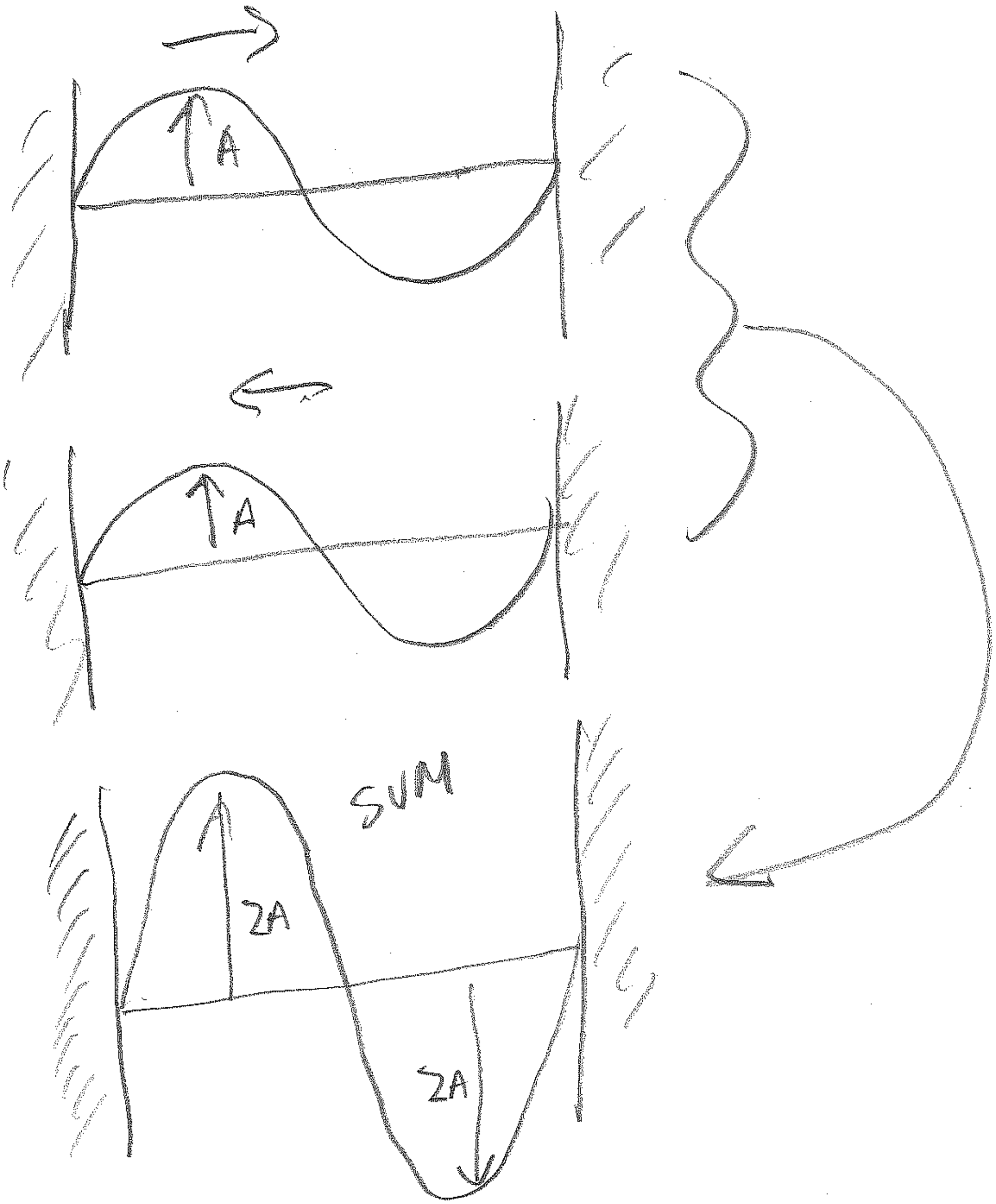


constructive:

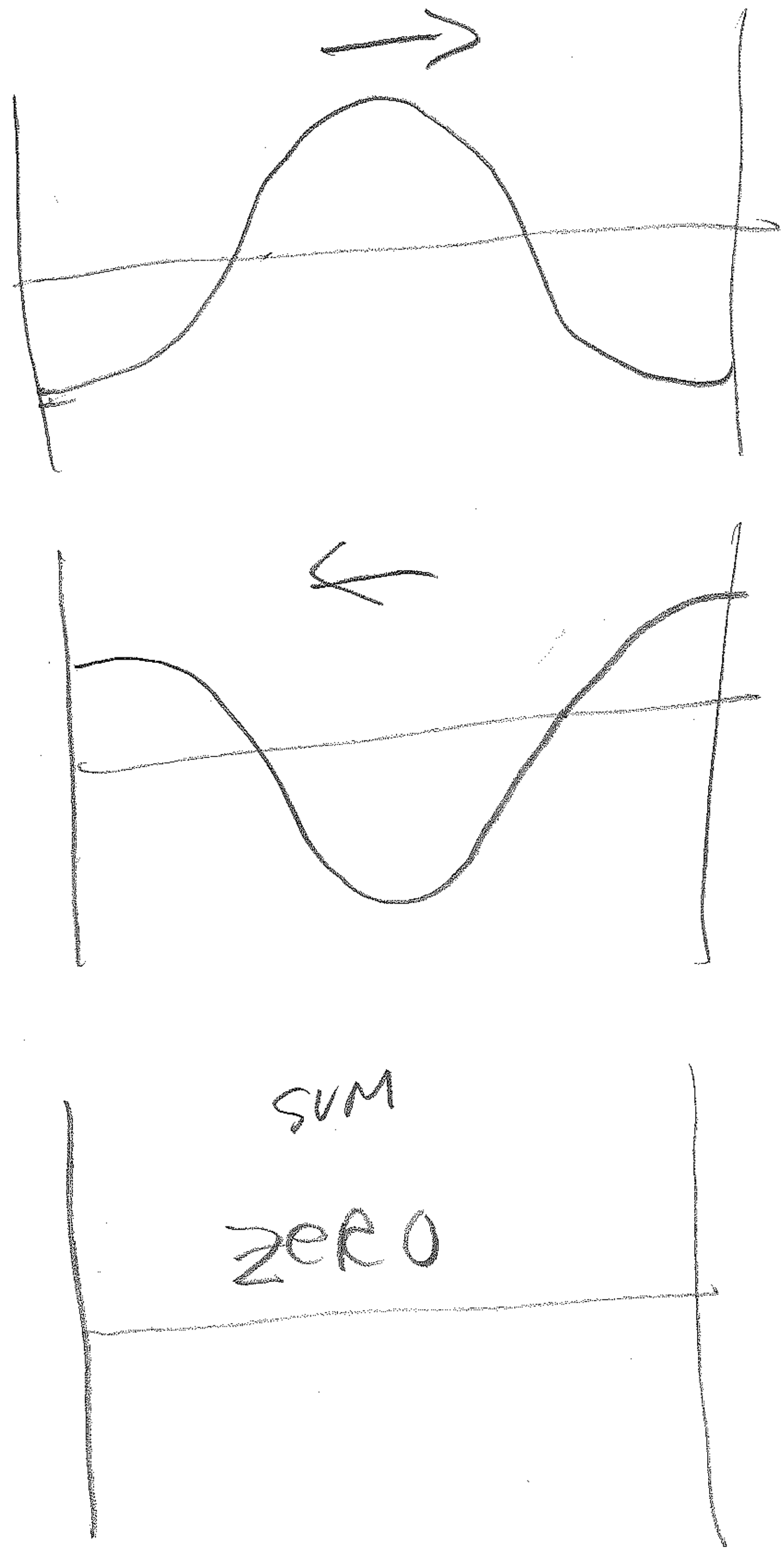


standing waves

t=0

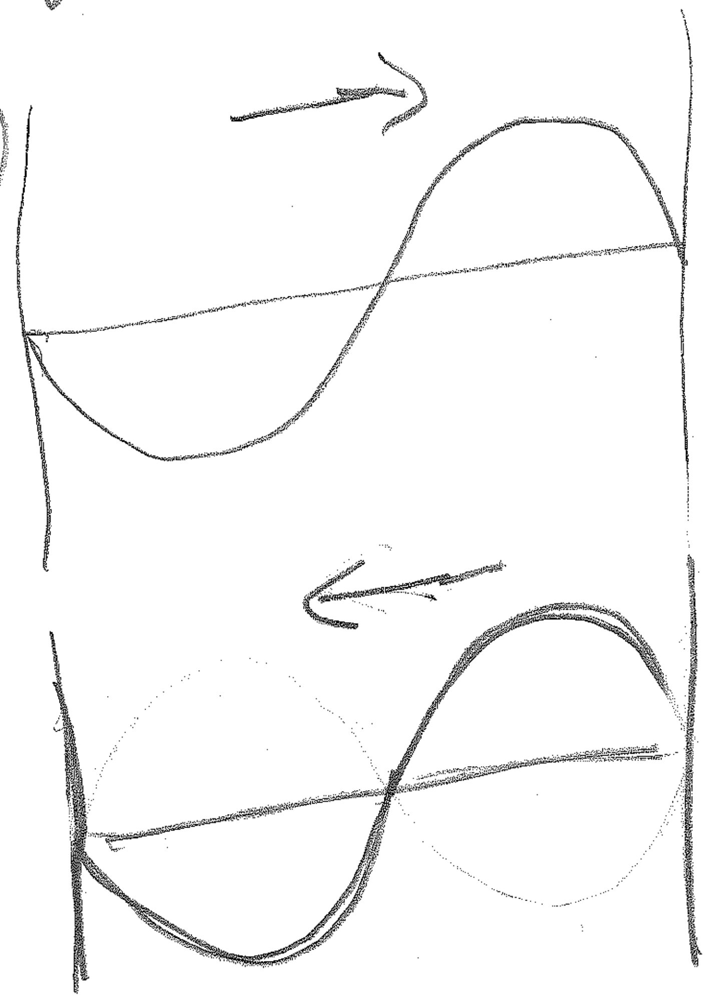


$t = \frac{T}{4}$

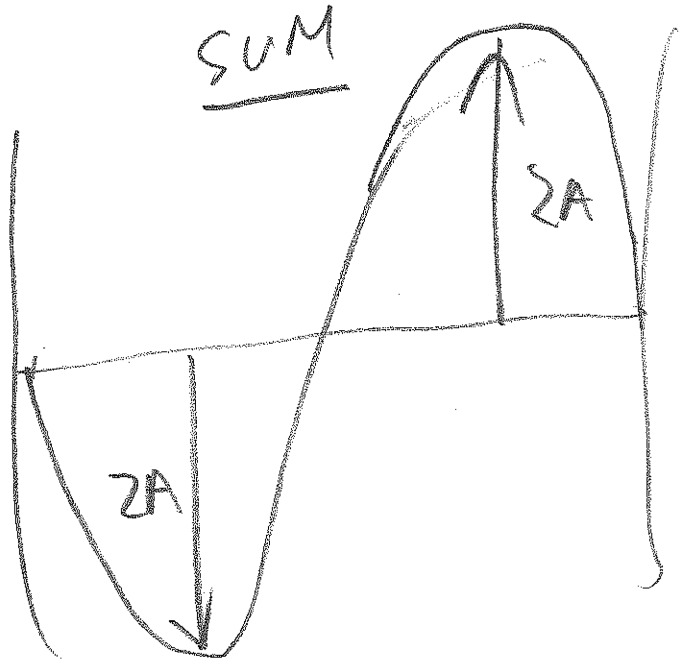


standing wave

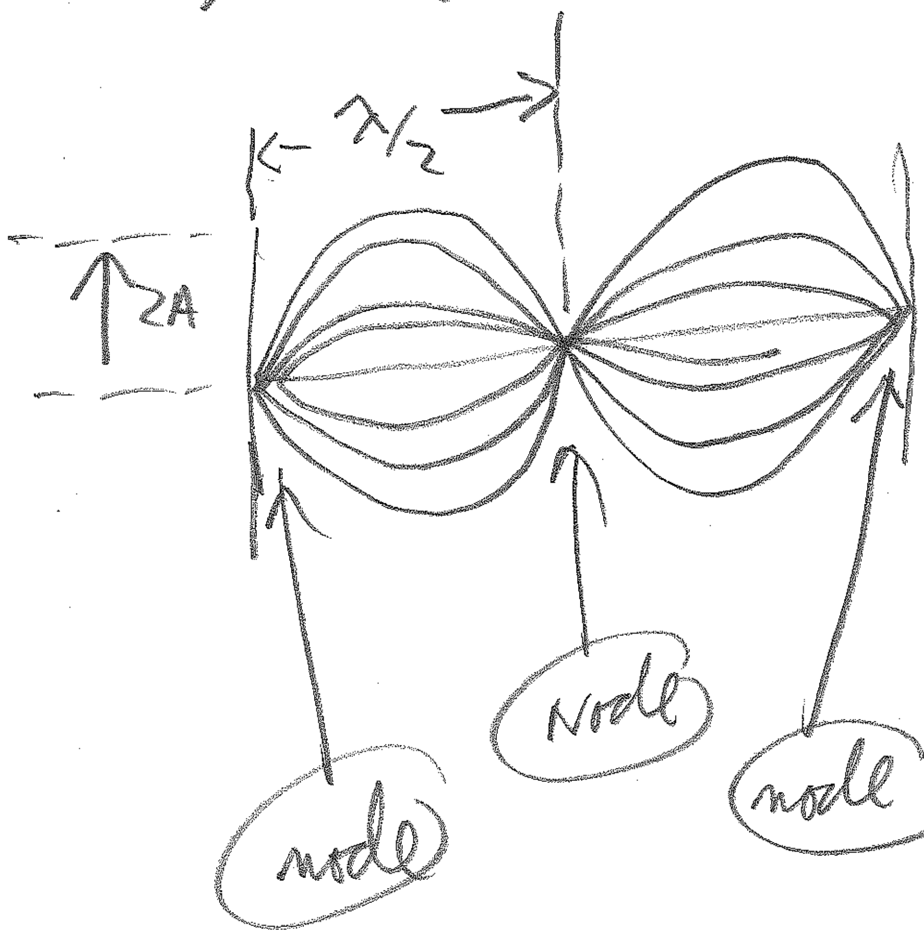
$t = \frac{T}{2}$



SUM



Summary:

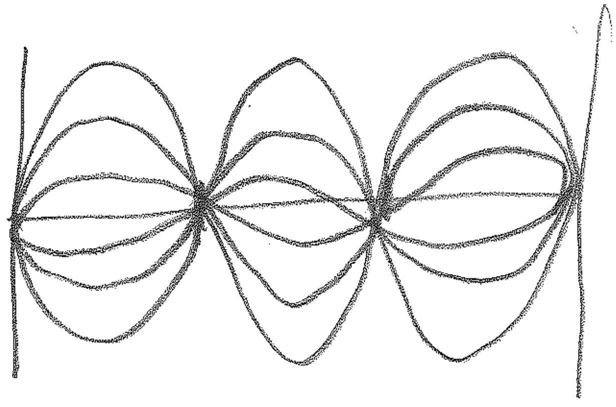


$n = 2$

(see below

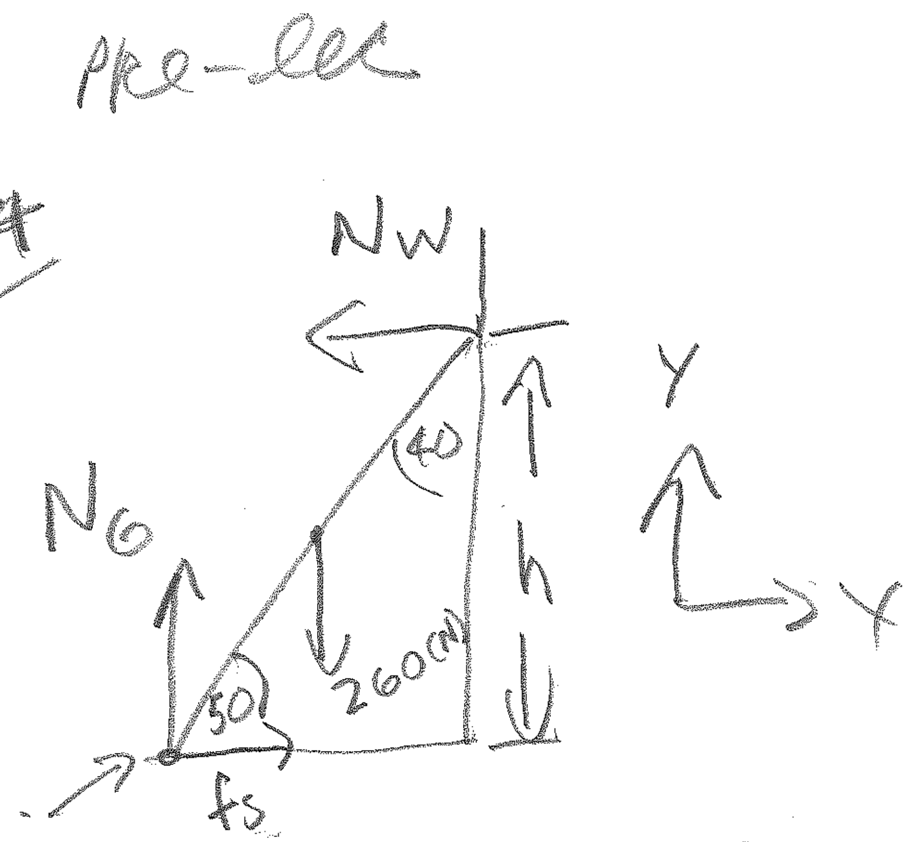
Modes $f_n = \frac{nV}{2L}$, $n = 1, 2, 3, \ldots$

$n = 3$



Pre-lec

10.44



$\sum F_y = \text{pos} - \text{neg}$

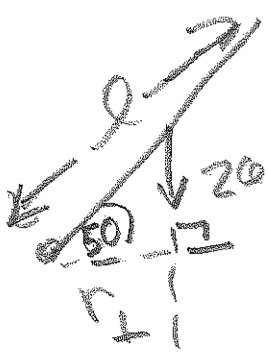
$\boxed{\begin{matrix}\sum F_x = \text{pos} - \text{neg} \\ 0 = f_s - N_W\end{matrix}}$

$0 = N_G - 260(N)$

$\sum \tau = ↺ - ↻$

AXIS

$0 = h \cdot N_W - r_\perp \cdot 260$



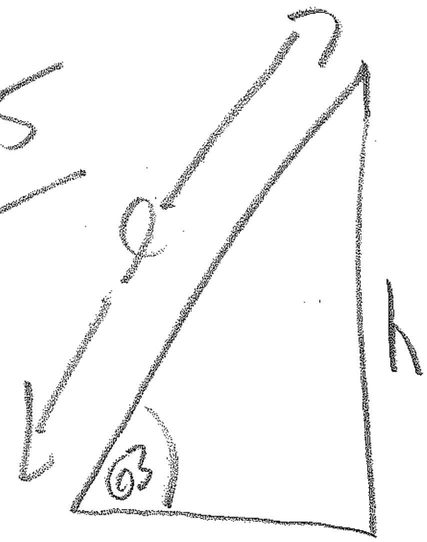
$0 = h \cdot N_W - \frac{l}{2} \cdot \cos 50 \cdot 260$

FIND N_W

note $h = l \cdot \sin 50$

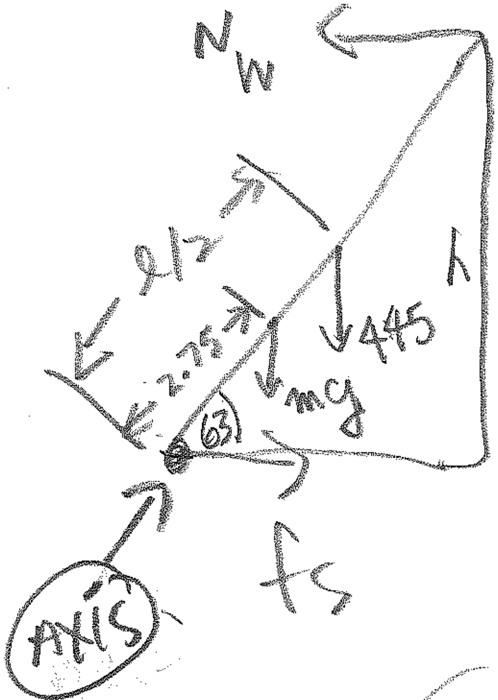
l cancels out.

10.45



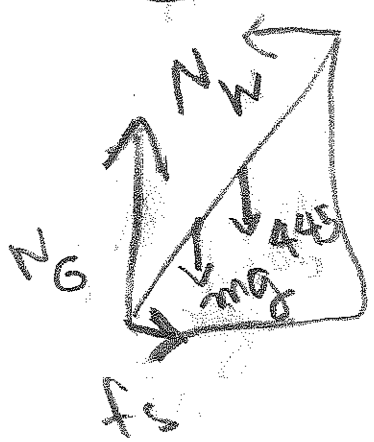
$\sum F_x = 0:$

$f_s = N_W$



$\sum \tau = 0$

$0 = h \cdot N_W - \frac{l}{2} \cos 63 \cdot 445 - 2.75 \cos 63 \cdot mg$



(A) FIND N_W.

(B) $f_s = N_W$

(C) $\sum F_y = N_G - 445 - mg = 0$