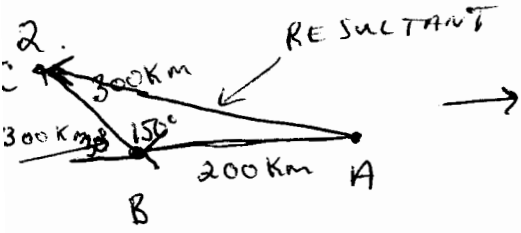
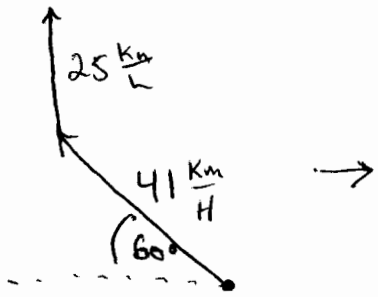
1A PROBLEM SET #2.

2.

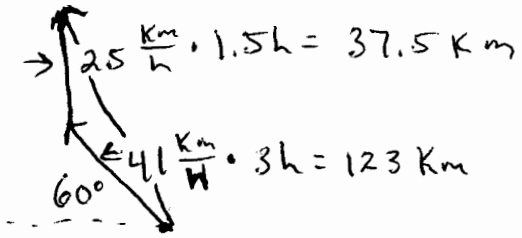


→ PUT THIS ON GRAPH PAPER USING EACH 1cm = 100Km.
YOU SHOULD FIND NET DISPLACEMENT:
$\Delta S \approx 480$ Km & $\measuredangle \approx 18.17°$

15.



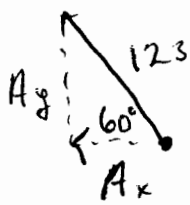
VELOCITY VECTORS



DISPLACEMENT VECTORS

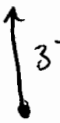
MUST FIND THE COMPONETS OF EACH VECTOR TO FIND THE RESULTANT VECTOR.

1ST VECTOR



$A_x = -61.5$ Km
$A_y = 106.52$ Km

2ND VECTOR



$A_y = 37.5$
$A_x = 0$

A_{TOT} = RESULTANT $= (-61.5\hat{i} + 106.52\hat{j}) + (37.5\hat{j})$

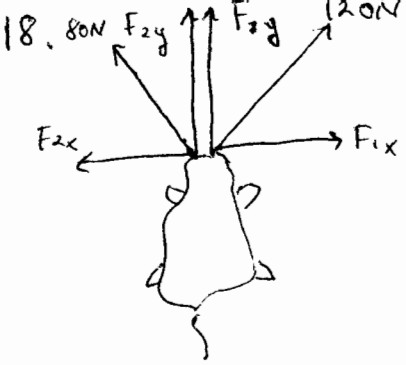
$\hat{i}$ ≡ IN X-DIRECTION
$\hat{j}$ ≡ IN y-DIRECTION.

$A_{TOT} = -61.5\hat{i} + 144.02\hat{j}$

$A_x = -61.5$

$A_y = 144.02$

$|A_{TOT}| = \sqrt{144.02^2 + 61.5^2} = \underline{156.6\text{m}}$

18. 

(A) $F_{1y} = 120 \sin 60 = 103.9\,N$

$F_{2y} = 80 \sin 75 = 77.3\,N$

$F_{1x} = 120 \cos 60 = 60\,N$

$F_{2x} = -80 \cos 75 = -20.7\,N$

ADD F_y'S $\Rightarrow$ $F_{y\,TOT} = 103.9 + 77.3 = 181.2\,N$

ADD F_x'S $\Rightarrow$ $F_{x\,TOT} = 60 - 20.7 = 39.3\,N$

$$F_{TOT} = \sqrt{F_{x\,TOT}^2 + F_{y\,TOT}^2} = \sqrt{(181.2)^2 + (39.3)^2} = \underline{185.4\,N}$$

(B) A 3RD PERSON WOULD HAVE TO ALSO EXERT 185.4 N

BUT $F_{3y} = -181.2\,N$ & $F_{3x} = -39.3\,N$

23.

x	y
$V = 200 \frac{mi}{h}$	$V =$
$V_0 = 200 \frac{mi}{h}$	$V_0 = 0$
$a = 0$	$a = -9.8 \frac{m}{s^2}$
$\Delta x = .0621\,mi$	$\Delta y = ?$
$t = ?$	$t = ?$

$$100m \left(\frac{1Km}{1000m}\right)\left(\frac{.621mi}{1Km}\right)$$

$100m = .0621\,mi$

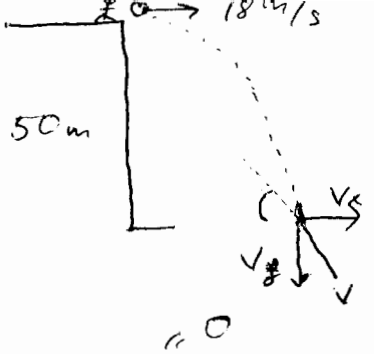
TIME LINKS THE TWO DIMENSIONS. HOW LONG DOES IT TAKE THE BIRD TO FLY $100m / .0621\,mi$?

$$t = \frac{\Delta x}{V} = \frac{.0621\,mi}{200 \frac{mi}{h}} = 1.1\,s \quad (1h = 3600\,s)$$

NOW HOW FAR WILL HE DROP IN 1.1 S?

$$\Delta y = V_0 t + \frac{1}{2} a t^2 = -\frac{1}{2}(9.8)(1.1s)^2 = \mathbf{6.1\,m}$$

24.



x	y
$V = 18 \frac{m}{s}$	V
$V_0 = 18 \frac{m}{s}$	$V_0 = 0$
$a = 0$	$a = -9.8 \frac{m}{s^2}$
$\Delta x =$	$\Delta y = -50\,m$
$t =$	$t =$

$\Delta y = V_0 t + \frac{1}{2} a t^2$

$V = V_0 + a t$

(A) $\Delta y = V_0 t + \frac{1}{2} a t^2$

$-50m = -\frac{1}{2}(9.8) t^2$

$\boxed{t = 3.2\,s}$

(B) $V_y = V_0 + at = 0 - 9.8(3.2) = -31.36 \frac{m}{s}$

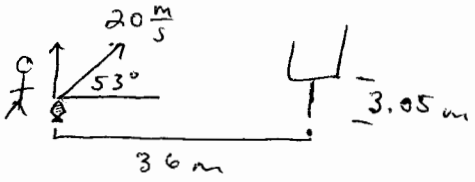
$V_x = V_0 + at = 18 \frac{m}{s} + 0 = 18 \frac{m}{s}$

$\text{TAN}\,\theta = \frac{V_y}{V_x} = \frac{31.36\ m/s}{18\ m/s} = 1.74$

$\boxed{\theta = 60°}$

$V = \sqrt{V_x^2 + V_y^2} = \boxed{36 \frac{m}{s}}$

30.



$V_{x_0} = 20 \cos 53 = 12 \frac{m}{s}$

$V_{y_0} = 20 \sin 53 = 16 \frac{m}{s}$

x	y
$V_x = 12 \frac{m}{s}$	$V_y =$
$V_{x0} = 12 \frac{m}{s}$	$V_{y0} = 16 \frac{m}{s}$
$a = 0$	$a = -9.8 \frac{m}{s}$
$\Delta x = 36m$	$\Delta y = 3.05$
$t =$	$t =$

FIRST WE SEE IF FOOT BALL WILL CLEAR THE GOAL. FOR THIS TO HAPPEN $\Delta y \geq 3.05m$ WHEN Δx 36m. START BY FINDING t:

$t = \frac{36m}{12\ m/s} = 3s \Longrightarrow \Delta y = V_0 t + \frac{1}{2} a t^2$

$= (16 \frac{m}{s})(3s) - \frac{1}{2}(9.8 \frac{m}{s^2})(3s)^2$

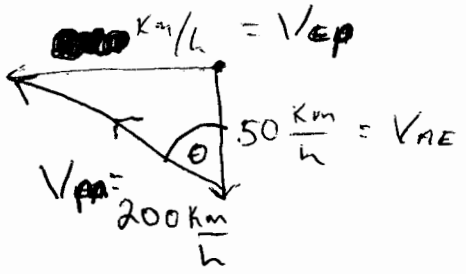
$= 48 - 44.1$

$= 3.9m > 3.05m \Rightarrow$ WE HAVE CLEARAGE.

BY .85 m!

(B) WHILE FALLING.

40.



(A) $\cos\theta = \frac{ADJ}{Hyp} = \frac{50\ \frac{Km}{h}}{200\ \frac{Km}{h}} = .25$

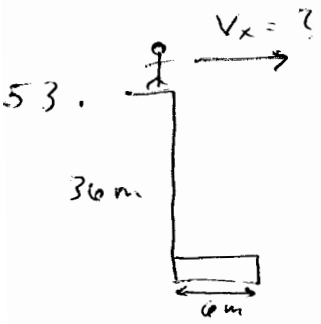
$\theta = 75^\circ$ WEST OF NORTH

$= 15^\circ$ NORTH OF WEST

(B) $50^2 + V_{PE}^2 = (200)^2$

$V_{PE} = 193.65\ \frac{Km}{h}$

53.



x	y
V_x = ?	V_y = ?
V_{ox} = ?	$V_{oy} = 0$
$a = 0$	$a = -9.8\ \frac{m}{s}$
$\Delta x = 6m$	$\Delta y = -36m$
t = ?	Δt = ?

FIRST MUST FIND HOW LONG JUMPER IS IN AIR:

$\Delta y = V_o t + \frac{1}{2} a t^2$ ($V_o = 0$)

$-36m = -\frac{1}{2}(9.8\ \frac{m}{s})t^2$

$t = 2.7\ s$

NOW ~~[redacted]~~ CONTACT IS MIN V_x SO THAT Δx IS ≥ 2.7 s

$V_x = \frac{6m}{2.7s} = 2.2\ \frac{m}{s}$

59.

x	y
$V_x = V_0 \cos\theta_0$	$V_y =$?
$V_{x0} = V_0 \cos\theta_0$	$V_{oy} = V_0 \sin\theta_0$
$a = 0$	$a = -9.8 \frac{m}{s^2}$
$\Delta x =$	$\Delta y =$
$t =$	$t =$

WHEN PROJECTILE & TARGET HIT THE SAME AMOUNT OF TIME HAS GONE BY FOR BOTH THE TARGET & PROJECTILE.

HOW LONG DOES IT TAKE ~~PROJECTILE~~ TARGET TO FALL A DISTANCE Δy?

$$\Delta y = V_0 t + \frac{1}{2} a t^2$$

$$-\Delta y = -\frac{1}{2}(9.8) t^2$$

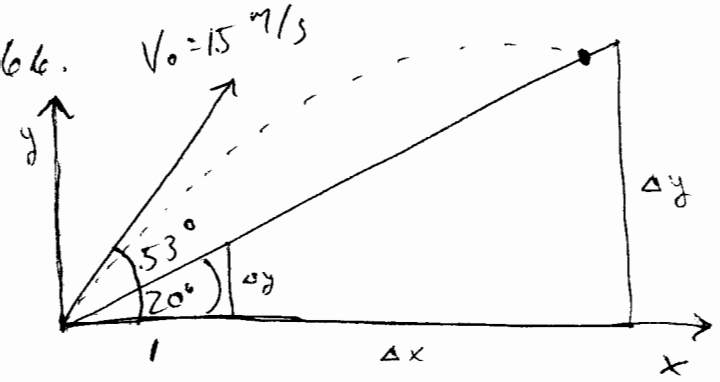
$$t = \sqrt{\frac{\Delta y}{4.9}}$$

WHEN GUN IS FIRED HOW LONG DOES IT TAKE PROJECTILE TO FALL Δy FROM WHERE IT WOULD HAVE HIT W/O GRAVITY?

$$\Delta y = \frac{1}{2} a t^2 \Rightarrow t = \sqrt{\frac{\Delta y}{4.9}}$$

SAME AMOUNT OF TIME!

66.



x	y
$V_x = 15\cos(53)^\circ = 9 \frac{m}{s}$	$V_y =$
$V_{x0} = 9$ m/s	$V_{y0} = 15\sin 53^\circ = 12 \frac{m}{s}$
$a = 0$	$a = -9.8 \frac{m}{s^2}$
$\Delta x =$	$\Delta y =$
$t =$	$t =$

INCLINE MAKES A LINE IN x & y PLANE

$y = mx + b \Rightarrow b = 0$ $\quad m = \frac{\Delta y}{\Delta x}$ $\quad \tan 20^\circ = \frac{\Delta y}{1}$ $\quad \Delta y = .364$ $\quad m = \frac{\Delta y}{\Delta x} = \frac{.364}{1}$

$y = .364x$

WHERE THIS LINE INTERCEPTS PARABOLA $y = V_y t + \frac{1}{2} a t^2$ IS OUR POINT.

$$V_{oy} t + \frac{1}{2} a t^2 = .364x$$

$$12t - 4.9t^2 = .364x \quad \text{BUT } t = \frac{x}{V_{ox}} = \frac{x}{9} \quad (V_{ox} = \frac{\Delta x}{t})$$

$$12\left(\frac{x}{9}\right) - 4.9\left(\frac{x}{9}\right)^2 = .364x$$

$$1.33x - .06x^2 = .364x \Rightarrow x = \underline{16.1 \text{ m}} \Rightarrow y = .364(16.1) = \underline{5.86 \text{ m}}$$