Assignment 1-Game Physics

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Problem Question:

Over a completely flat surface a thermal detonator (Star Wars) is thrown by a wookiee (a

member of the rebel alliance) towards a group of imperial stormtroopers. The thermal

detonator always leaves the wookiee's hand with a speed of 95m/s and the thermal detonator

has a mass of 2.2Kg.

a) Suppose that the Stormtroopers are 485m away. What is the correct angle for the

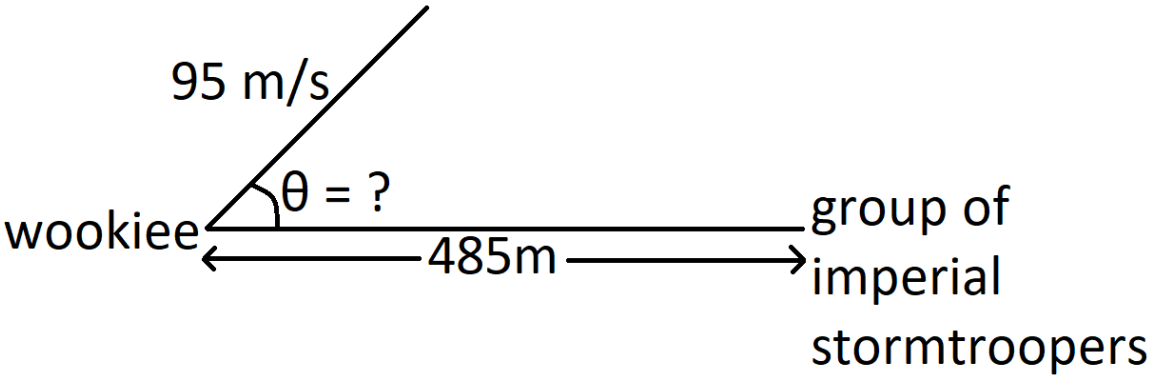
wookiee to throw the thermal detonator so that it reaches the Stormtroopers. (10

Marks)

b) What is the maximum distance the thermal detonator could travel? (10 Marks)

c) Include a short document (report) that includes a diagram that illustrates the problem

and your solution. Ensure you include appropriate labels and show your work (10 Marks)



As we know the equation for $R = v^2\sin(2\theta)/g$

Method 1: We can find only one angle into this

So,

$\sin(2\theta) = R*g/v^2$

$2\theta=\sin^{-1}(R*g/v^2)$

$\theta=1/2 * \sin^{-1}(R*g/v^2)$

We know that the R = 485 , g =9.8 , v = 95

So ,if we put the values into the equation,

$\theta=1/2 * \sin^{-1}(485*9.8/95*95)$

$\theta=1/2 * \sin^{-1}(485*9.8/95*95)$

$\theta=1/2 * \sin^{-1}(4753/9025)$

$\theta=1/2 * \sin^{-1}(0.5266481994)$

$\theta=1/2 * 31.77926564$

$\theta=15.88963282$

Method 2:We can find both the angles into this

We know that the R = 485 , g =9.8 , v = 95

For x-direction,

V_x=95 cos θ

Δd_y = 485 m

Δt=t=?

For y-direction,

v_1=95 sin θ

v_2=?

a=9.8m/s

Δt=t=?

We know the equation Δd=v* Δt

That's why,
v= Δd / Δt

95cos θ = 485/t

t=485/95cos θ_____(1)

Δd = vt +1/2*at^2

0= 95 sin θ*t+1/2*(-9.8)*t^2

0=95 sin θ*t-4.9*t^2

4.9*t^2-95 sin θ*t =0_____(2)

Now, if we put the value of t from equation (1) to equation (2)

$4.9*(485/95\cos\theta)^2-95\sin\theta*(485/95\cos\theta)=0$

$127.7121884\sec^2\theta - 485\tan\theta = 0$

Now, we know that the $1+\tan^2\theta = \sec^2\theta$

$127.7121884(1+\tan^2\theta) - 485\tan\theta = 0$

$127.7121884+127.7121884*\tan^2\theta - 485\tan\theta = 0$

$127.7121884*\tan^2\theta - 485\tan\theta+127.7121884=0$

a = 127.7121884, b = – 485, c = 127.7121884

$\tan\theta = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

We will get two values for the

θ = -15.89 degree & θ =-74.11 degree

$$t_{A\to B} = \frac{v\sin\theta}{g}$$

For the Angle -15.89

t= 95 *sin(-15.89)/9.8

t=2.654099909

Now,For the Angle -74.11,we know the time will take more in this case

t=95*sin(-74.11)/9.8

t=9.32346586

We know that the maximum range occurs at θ_i = 45 degree

$R = v^2 * \sin(2\theta)/g$

$R = 95*95*\sin(90)/9.8$

$R = 920.9183673$