2. (40 pts.) A student tries to throw a stone over an 8m high wall that is 25m away. The stone is thrown with an initial speed of 18m/s at an angle of 50° above the horizontal.

a. (10 pts.) How long does it take the stone to reach the wall?

b. (10 pts.) Does the stone make it over the wall? What is the height of the stone when it reaches the wall?

c. (10 pts.) What is the *speed* (magnitude of $\vec{v}$) of the stone just before it reaches the wall?

d. (10 pts.) What is the *direction* of $\vec{v}$ just before the stone hits the wall? Express your answer in degrees away from the positive x-axis (that is, the usual convention for expressing an angle). Watch out for the sign!

2. (40 pts.) A student tries to throw a stone over an 8m high wall that is 25m away. The stone is thrown with an initial speed of 18m/s at an angle of 50° above the horizontal. (Let $y_0 = 0$)

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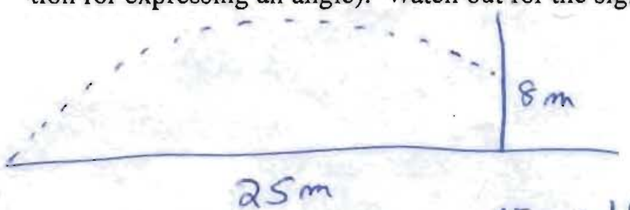

$\vec{v}_0 = 18\,m/s$ @ $50°$

$v_{0x} = 18\cos 50° = 11.57\,m/s$

$v_{0y} = 18\sin 50° = 13.79\,m/s$

(a) $x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2 = 0 + 11.57t + 0$

$25 = 11.57t \Rightarrow \boxed{t = 2.16\,s}$

(b) $y = y_0 + v_{0y}t - \frac{1}{2}gt^2 = 0 + 13.79(2.16) - \frac{1}{2}(9.8)(2.16)^2$

$\boxed{y = 6.92\,m}$ $\boxed{\text{Doesn't clear wall}}$

(c) $v_x = v_{0x} = 11.57\,m/s$

$v_y = v_{0y} - gt = 13.79 - 9.8(2.16) = -7.38\,m/s$

$v = \sqrt{v_x^2 + v_y^2} = \boxed{13.72\,m/s}$

(d) $\tan\theta = \frac{v_y}{v_x}$ $\theta = \tan^{-1}\left(\frac{-7.38}{11.57}\right) = \boxed{-32.5°}$

Max height? $v_y = v_{0y} - gt_{peak} \Rightarrow t_{peak} = v_{0y}/g = 1.407\,s$

$y_{peak} = y_0 + v_{0y}t - \frac{1}{2}gt^2 = 9.70\,m$

OR $v_y^2 = v_{0y}^2 - 2g(y - y_0) \Rightarrow y = v_{0y}^2/2g = 9.70\,m$