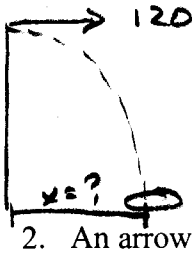
5/5

Problem Set 3:

1. A plane flying 100 ft above and at a speed of 120 m/s is dropping a life raft to a person in the ocean. How far ahead of the person does the life raft need to be dropped?

$?_m = 100\,ft \times \frac{12\,in}{1\,ft} \times \frac{2.54\,cm}{1\,in} \times \frac{1\,m}{100\,cm} = 30.48\,m$



$y = v_{yi}t + \frac{1}{2}gt^2$

$30.48\,m = 0 + \frac{1}{2}\left(9.8\,\frac{m}{s^2}\right)t^2$

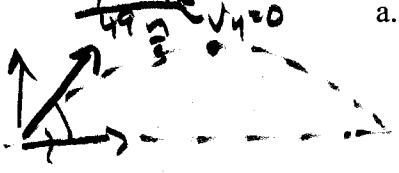
$t = 6.22\,s$

$x = v_{xi}t$

$= 120\,\frac{m}{s}\,(6.22\,s)$

$= \boxed{7.46 \times 10^2\,m}$

2. An arrow is shot at 30° with the horizontal. It has a velocity of 49 m/s.



a. How high will the arrow go?

$\sin 30 = \frac{v_y}{49}$

$v_y = 24.5\,\frac{m}{s}$

$v_y = v_{yi} + gt$

$= 24.5 + \left(-9.8\,\frac{m}{s^2}\right)t$

$t = 2.5\,s$

$y = v_{yi}t + \frac{1}{2}gt^2$

$= \left(24.5\,\frac{m}{s}\right)(2.5\,s) + \frac{1}{2}\left(-9.8\,\frac{m}{s^2}\right)(2.5\,s)^2$

$= 61.25\,m - 30.63\,m = \boxed{3.06 \times 10^1\,m}$

b. What horizontal distance will it travel?

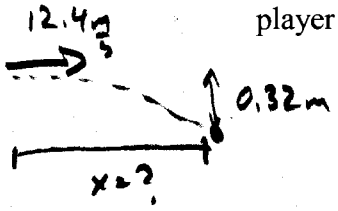
$\cos 30 = \frac{v_x}{49}$

$v_x = 42.44\,\frac{m}{s}$

$x = v_{xi}t$

$= 42.44\,\frac{m}{s}\,(5\,s) = \boxed{2.12 \times 10^1\,m}$

3. A dart player throws a dart horizontally at a speed of 12.4 m/s. The dart hits the board 0.32 m below the height from which it was thrown. How far away is the player from the board.



$y = v_{yi}t + \frac{1}{2}gt^2$

$0.32\,m = 0 + \frac{1}{2}\left(9.8\,\frac{m}{s^2}\right)t^2$

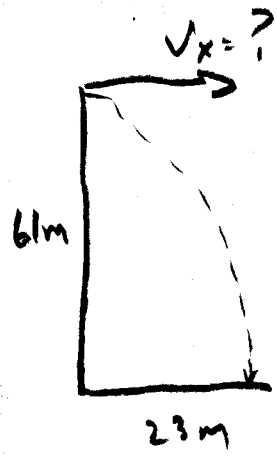
$t = 0.26\,s$

$x = v_{xi}t$

$= 12.4\,\frac{m}{s}\,(0.26\,s)$

$= \boxed{3.22\,m}$

4. Divers at Acapulco dive from a cliff that is 61 m high. If the rocks below the cliff extend outward for 23 m, what is the minimum horizontal velocity a diver must have to clear the rocks safely?



$x = v_{xi}t$

$23\,m = v_{xi}(3.53\,s)$

$\boxed{v_{xi} = 6.52\,\frac{m}{s}}$

$y = v_{yi}t + \frac{1}{2}gt^2$

$61\,m = 0 + \frac{1}{2}\left(9.8\,\frac{m}{s^2}\right)t^2$

$t = 3.53\,s$