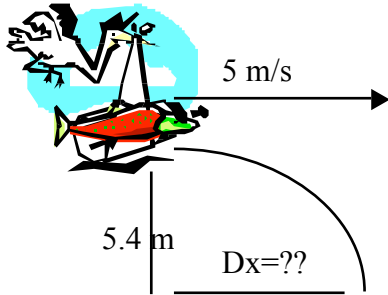


Pg. 102

1) A pelican flying along a horizontal path drops a fish from a height of 5.4 m while traveling 5 m/s. How far does the fish travel horizontally before it hits the water below?

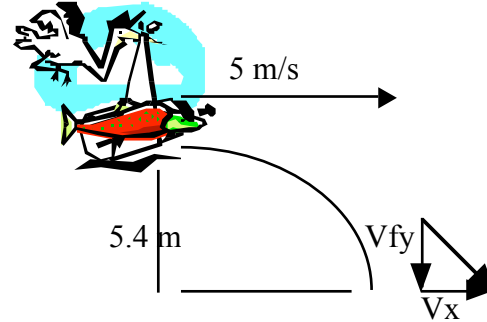


X
 $V_x = 5 \text{ m/s}$
 $D_x = ??$
 $T = ??$
 $D_x = V_x T$

Y
 $V_{iy} = 0 \text{ m/s}$
 $A_y = -9.8 \text{ m/s}^2$
 $D_y = -5.4 \text{ m}$

$D_y = V_{iy} T + \frac{1}{2} A_y T^2$
 $-5.4 = 0(T) + \frac{1}{2} (-9.8) T^2$
 $-5.4 = -4.9 T^2$
 $T = 1.05 \text{ sec}$
 Back to X
 $D_x = 5(1.05) = 5.25 \text{ m}$

2) Give both the horizontal and vertical components of the velocity of the fish from item 1 before the fish enters the water. (Find V_{fx} and V_{fy} if $D_y = -5.4 \text{ m}$, $V_{ix} = 5 \text{ m/s}$, $V_{iy} = 0$)



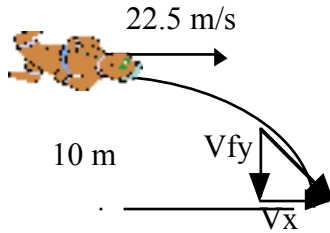
X
 $V_{fx} = V_x = 5 \text{ m/s}$
Y
 $D_y = -5.4 \text{ m}$
 $A_y = -9.8 \text{ m/s}^2$
 $V_{iy} = 0 \text{ m/s}$
 $V_{fy} = ????$

$V_{fy}^2 = V_{iy}^2 + 2 A_y D_y$
 $V_{fy}^2 = (0) + 2 (-9.8) (-5.4)$
 $V_{fy}^2 = 105.84$
 $V_{fy} = -10.29 \text{ m/s (downward)}$

For the final velocity
 $V^2 = V_x^2 + V_y^2$
 $V^2 = 5^2 + (10.29)^2$
 $V = 11.44 \text{ m/s}$ $\theta = \tan^{-1} (V_y/V_x) =$
 $\tan^{-1} (10.29/5) = 64 \text{ degrees to the water}$

Final Velocity is 11.44 m/s at 64 degrees to the water

3) Find the instantaneous velocity of the stunt dummy in Sample Problem 3D as it hits the water. (Find V_{fx} and V_{fy} if $Dy = -10$ m, $V_{ix} = 22.5$ m/s , $V_{iy} = 0$)



X

$$V_{fx} = V_x = 22.5 \text{ m/s}$$

Y

$$Dy = -10 \text{ m}$$

$$Ay = -9.8 \text{ m/s}^2$$

$$V_{iy} = 0 \text{ m/s}$$

$$V_{fy} = \text{????}$$

$$V_{fy}^2 = V_{iy}^2 + 2 Ay Dy$$

$$V_{fy}^2 = (0)^2 + 2 (-9.8) (-10)$$

$$V_{fy}^2 = 196$$

$$V_{fy} = -14 \text{ m/s (downward)}$$

For the final velocity

$$V^2 = V_x^2 + V_y^2$$

$$V^2 = 22.5^2 + (14)^2$$

$$V = 26.5 \text{ m/s}$$

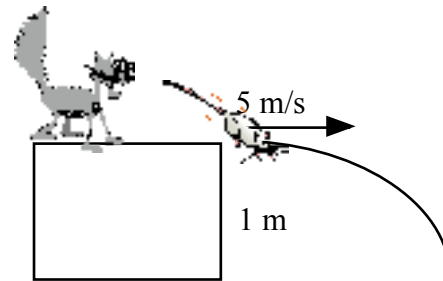
$$\theta = \tan^{-1} (V_y/V_x) = \tan^{-1} (14/22.55) =$$

31.9 degrees to the ground

Final Velocity is 25.5 m/s at 31.9

degrees to the ground

4) A cat chases a mouse across a 1.0 m high table. The mouse steps out of the way and the cat slides off the table at a speed of 5 m/s. Where does the cat strike the floor?



X

$$V_x = 5 \text{ m/s}$$

$$D_x = ??$$

$$T = ??$$

$$D_x = V_x T$$

Y

$$V_{iy} = 0 \text{ m/s}$$

$$Ay = -9.8 \text{ m/s}^2$$

$$Dy = -1 \text{ m}$$

$$Dy = V_{iy} T + \frac{1}{2} Ay T^2$$

$$-1 = 0 (T) + \frac{1}{2} (-9.8) T^2$$

$$-1 = -4.9 T^2$$

$$T = .45 \text{ sec}$$

Back to X

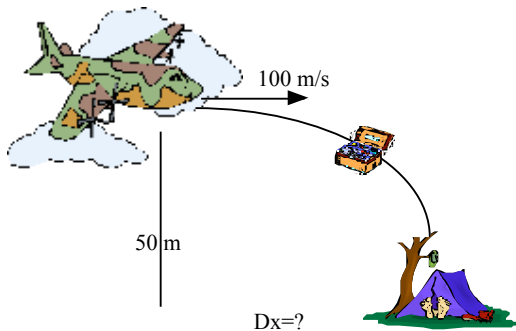
$$D_x = 5(.45) = 2.26 \text{ m}$$

ANSWERS Bookwork Chapter 3 pg. 105 Section Review (do on fresh paper so you have room!)

1) Which of the following are examples of projectile motion?
 a) airplane taking off, **b) tennis ball lobbed over a net.** c) plastic disk sailing over the lawn d) a hawk diving to catch a mouse e) a parachutist drifting to Earth **f) a frog jumping from the land into the water.**

2) Which of the following exhibit parabolic motion?
a) a flat rock skipping over the surface of the lake b) a three point shot in basketball c) the space shuttle while orbiting the Earth **d) a ball bouncing across the room e) a cliff diver f) a life preserver dropped from a stationary helicopter g) a person skipping**

3) An Alaskan rescue plane drops a package of emergency rations to a stranded party of explorers. The plane is traveling horizontally at 100 m/s at a height of 50 m above the ground. What horizontal distance does the package travel before striking the ground?



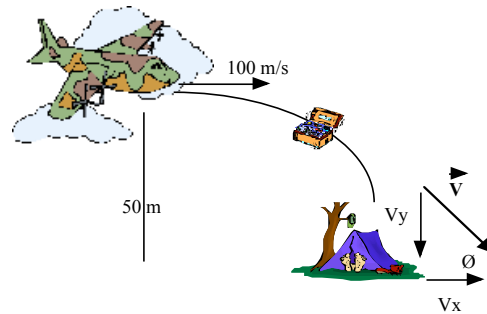
X
 $V_x = 100 \text{ m/s}$
 $D_x = ??$
 $T = ??$
 $D_x = V_x T$

Y

$V_{iy} = 0 \text{ m/s}$
 $A_y = -9.8 \text{ m/s}^2$
 $D_y = -50 \text{ m}$

$D_y = V_{iy} T + \frac{1}{2} A_y T^2$
 $-50 = 0 (T) + \frac{1}{2} (-9.8) T^2$
 $-50 = -4.9 T^2$
 $T = 3.19 \text{ sec}$
 Back to X
 $D_x = 100 (3.19) = 319 \text{ m}$

4) Find the velocity (vector magnitude and direction) of the package in item 3 just before it hits the ground.

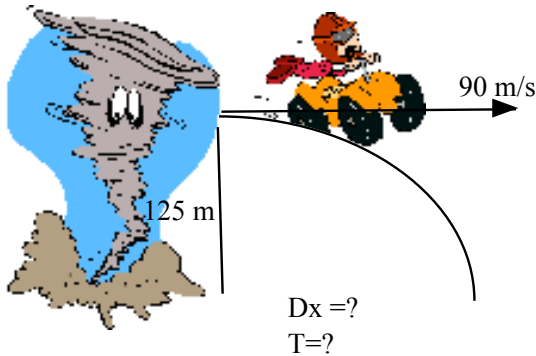


X
 $V_{fx} = V_x = 100 \text{ m/s}$
Y
 $D_y = -50 \text{ m}$
 $A_y = -9.8 \text{ m/s}^2$
 $V_{iy} = 0 \text{ m/s}$
 $V_{fy} = ????$

$V_{fy}^2 = V_{iy}^2 + 2 A_y D_y$
 $V_{fy}^2 = (0)^2 + 2 (-9.8) (-50)$
 $V_{fy}^2 = 980$
 $V_{fy} = -31.3 \text{ m/s (downward)}$

For the final velocity
 $V^2 = V_x^2 + V_y^2$
 $V^2 = 100^2 + (31.3)^2$
 $V = 104.7 \text{ m/s}$
 $\theta = \tan^{-1} (V_y/V_x) = \tan^{-1} (31.3/100) = 17.33 \text{ degrees to the ground}$
 Final Velocity is 104.7 m/s at 17.33 degrees to the ground

5) During a thunderstorm, a tornado lifts a car to a height of 125 m above the ground. Increasing in strength, the tornado flings the car horizontally with an initial speed of 90 m/s. How long does the car take to reach the ground? How far horizontally does the car travel before hitting the ground?

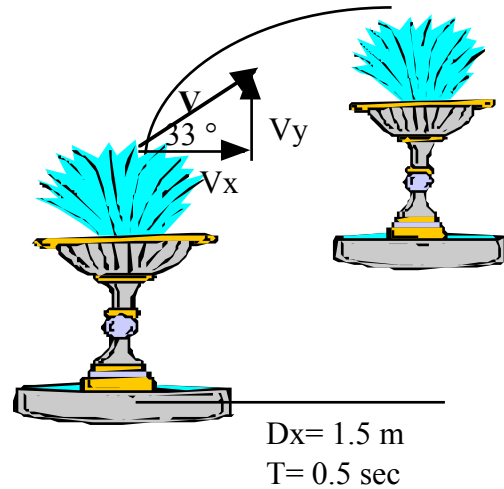


X
 $V_x = 90 \text{ m/s}$
 $D_x = ??$
 $T = ??$
 $D_x = V_x T$

Y
 $V_{iy} = 0 \text{ m/s}$
 $A_y = -9.8 \text{ m/s}^2$
 $D_y = -125 \text{ m}$

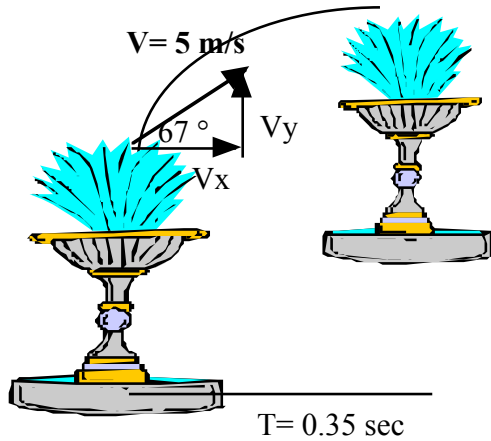
$D_y = V_{iy} T + \frac{1}{2} A_y T^2$
 $-125 = 0 (T) + \frac{1}{2} (-9.8) T^2$
 $-125 = -4.9 T^2$
 $T = 5.05 \text{ sec}$
 Back to X
 $D_x = 90 (5.05) = 454.57 \text{ m}$

*** 6) Streams of water in a fountain shoot from one level to the next. A particle of water in a stream takes 0.5 seconds to travel between the first and the second level. The receptacle on the second level is a horizontal distance of 1.5 m away from the spout on the first level. If the water is projected at a 33° angle, what is the initial speed of the particle?



X
 $D_x = 1.5 \text{ m}$
 $T = 0.5 \text{ sec}$
 $D_x = V_x T$
 $1.5 = V_x (.5)$
 $V_x = 3 \text{ m/s}$
 $V_x = V \cos (\theta)$
 $3 = V \cos (33)$
 $3 = V (.83867)$
 $V = 3.577 \text{ m/s}$

*** 7) If a water particle in a stream of water in a fountain takes 0.35 seconds to travel from spout to receptacle when shot at an angle of 67° and an initial speed of 5 m/s, what is the vertical distance between the levels of the fountain?



Y

$$V_y = V \sin(\theta)$$

$$V_y = 5 \sin(67)$$

$$V_{iy} = 4.6 \text{ m/s}$$

$$A_y = -9.8 \text{ m/s}^2$$

$$T = 0.35 \text{ sec}$$

$$D_y = \text{????}$$

$$D_y = V_{iy} T + \frac{1}{2} A_y T^2$$

$$D_y = 4.6 (.35) + \frac{1}{2} (-9.8) (.35)^2$$

$$D_y = 1.61 + -4.9 \cdot .1225$$

$$D_y = 1.00975 \text{ m}$$