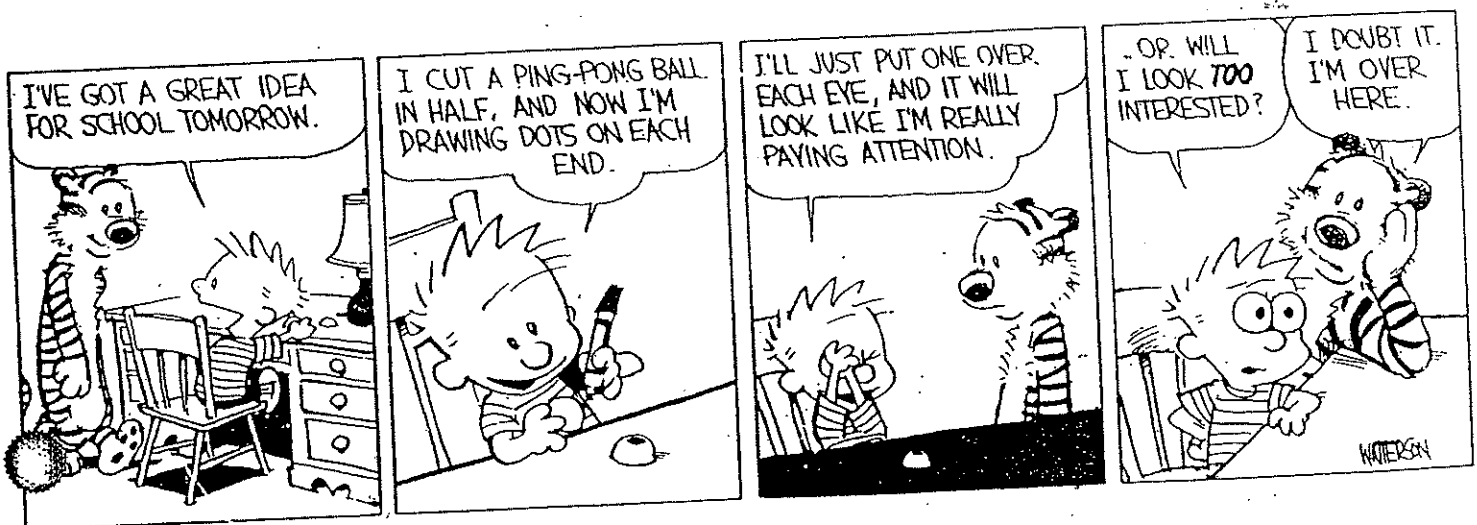


Physics 12 Vector Kinematics

1. (a) A airplane whose airspeed is 250 km/h heads due south. If a wind of 85 km/h is blowing towards the direction 35 degrees south of East, what is actual direction the plane travels?
(b) What is the speed of the plane with respect to the ground?
(c) If the pilot wants the plane to travel due south, what direction should its heading be?

2. A hose lying on the ground shoots a stream of water upward at an angle of 35.0 degrees to the horizontal. The speed of the water is 36.0 m/s as it leaves the hose. How high up will it strike a wall which is 8.0 m away?

3. A swimmer can swim at a speed of 0.60 m/s in still water. She wants to cross a 75.0 m wide river and which has a current of 0.45 m/s.
(a) If she wishes to land on the other bank at a point directly across the river from her starting point, in what direction must she swim?
(b) How long will it take her to cross?
(c) If she wants to cross the river in the shortest possible time, in what direction must she swim?



Physics 12 Vector Kinematics ~~Practice Test~~ Practice Test

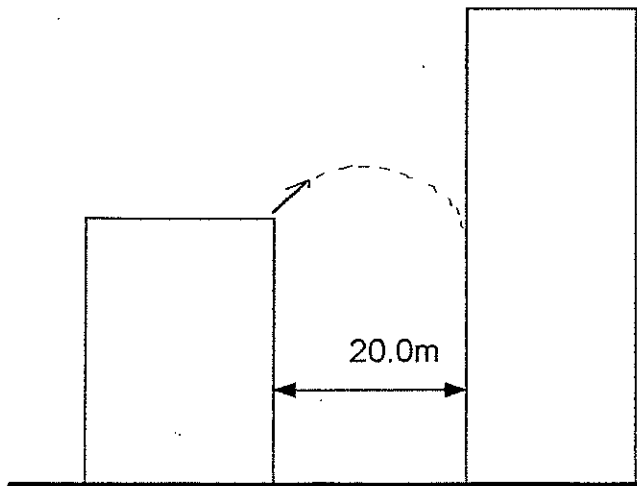
1. (a) A airplane whose airspeed is 250 km/h heads due south. If a wind of 85 km/h is blowing towards the direction 35 degrees south of East, what is actual direction the plane travels?
 (b) What is the speed of the plane with respect to the ground?
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2. A helicopter is moving straight up with a speed of 8.0 m/s. The pilot of the helicopter throws her apple core out the window horizontally with a speed of 4.0 m/s. What is the initial velocity of the apple core with respect to the ground?

3. A 10.0 kg cannon ball is launched at an angle of 35.0 degrees to the horizontal with a speed of 38.0 m/s.
 (a) What is the maximum height reached by the cannon ball?
 (b) How fast will the canon ball be traveling when it reaches its maximum height?

4. A skier makes a wrong turn and travels off the marked trail. After a downhill section he came to a flat part of the hill and continued at a speed of 15.0 m/s. Unfortunately, the flat part of the hill ended at a sharp cliff. He flew off the edge of the cliff and landed in a snowbank 20.0 m below.
 (a) How long was he in the air?
 (b) What was his velocity the instant before he hit the ~~water~~ snowbank?
 (c) How far from the cliff did he land? (horizontal distance)

5. A tennis ball is thrown from the roof of one building towards a tall building 20.0m away. If the ball is thrown with a velocity of 7.0 m/s at an angle of 43.0 degrees to the horizontal. How far above or below its original level will the ball strike the opposite wall?



Answers

1. (a) 13° S of S
 (b) 3.1 x 10² km/h
 (c) 16° W of S

2. 8.9 m/s [27° to vertical]

3. (a) 2.9 m
 (b) 31 m/s

4. (a) 2.00 s
 (b) 24.8 m/s [52.9° below horiz]
 (c) 30.0 m

5. 5.6 m below original level.
 (a) 7.1 s (b) 77 m/s (3.7° to vert) (c) 7.5 s

7. (a) 4.3 m
 (b) 8.3 s
 (c) 5.2 m

8. 4.81 m

9. (a) 49° to the from shore
 (b) 189 s = 3.1 min
 (c) straight across

6. A helicopter was dropping towards the Earth at a speed of 8.0 m/s. When the helicopter was 300 m above the ground, a passenger threw a physics book horizontally out the window with a speed of 5.0 m/s (relative to the helicopter).

- How long was the book in the air?
- With what velocity did the book hit the ground? (speed and direction!!!)
- If the book had been thrown **vertically upwards** with a speed of 5.0 m/s, rather than horizontally, how long would the book have been in the air?

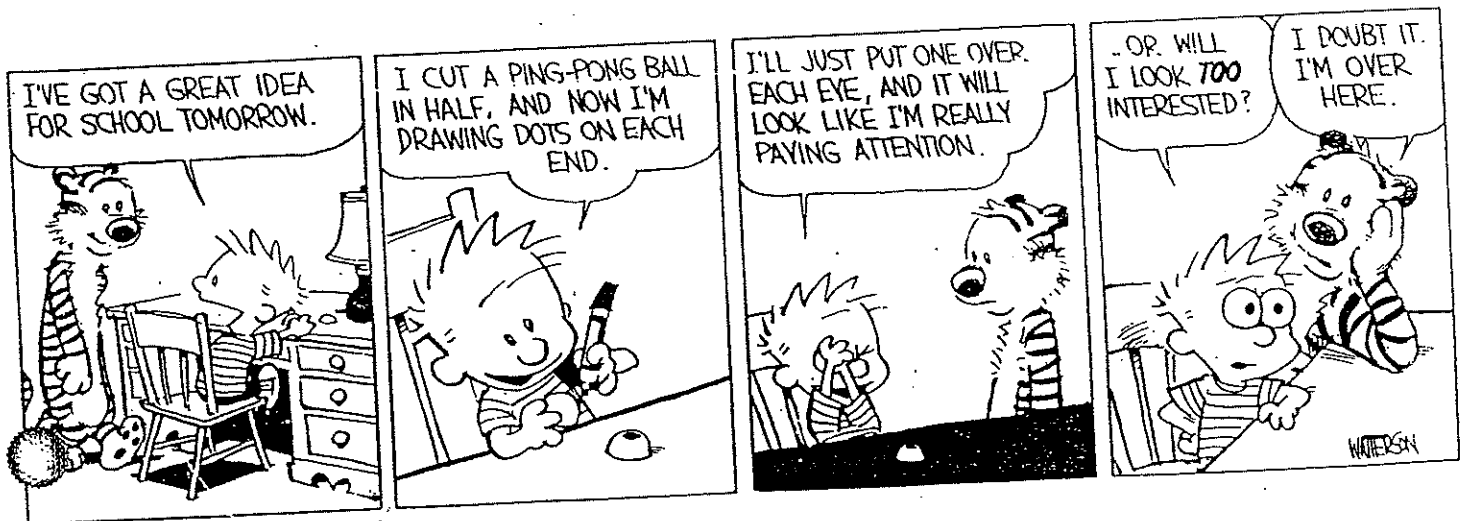
7. A monkey in a perch 25.0m high in a tree drops a coconut directly above your head as you run with a speed of 1.90 m/s beneath the tree.

- How far behind you does the coconut hit the ground?
- If the monkey had really wanted to hit your toes, how much earlier should the coconut have been dropped?

8. A hose lying on the ground shoots a stream of water upward at an angle of 35.0 degrees to the horizontal. The speed of the water is 36.0 m/s as it leaves the hose. How high up will it strike a wall which is 8.0 m away?

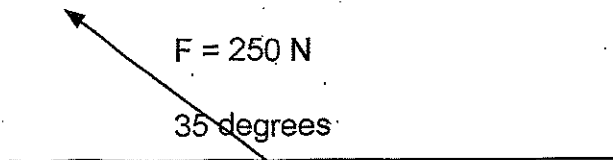
9. A swimmer can swim at a speed of 0.60 m/s in still water. She wants to cross a 75.0 m wide river and which has a current of 0.45 m/s.

- If she wishes to land on the other bank at a point directly across the river from her starting point, in what direction must she swim?
- How long will it take her to cross?
- If she wants to cross the river in the shortest possible time, in what direction must she swim?



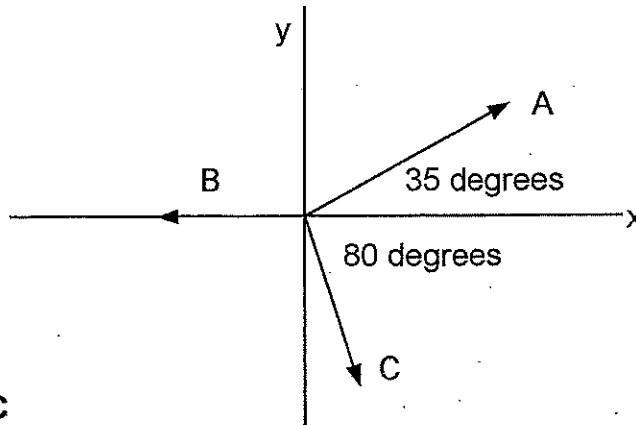
ANSWER ALL QUESTIONS ON FOOLSCAP, THEN STAPLE YOUR ANSWERS TO THIS QUESTION SHEET. REMEMBER TO SHOW ALL WORK (INCLUDING DIAGRAMS), AND BE CAREFUL WITH UNITS AND SIGNIFICANT DIGITS!!!

1. (a) What are the x and y components of the vector shown?



- (b) Use analytical methods (ie, components) to find the resultant in the following case.

- A: 100 N
B: 50 N
C: 70 N



Find: $A + B - C$

2. A girl slides down a ramp with uniform acceleration. She starts from rest and attains a speed of 3.5 m/s in 4.45 s. Find:
- Her acceleration
 - The distance she moved in the first 4.45 s
3. Billy went for a ride in a hot air balloon at a fair. While the balloon was rising at a rate of 8.0 m/s and it was 150m above the ground, Billy accidentally dropped his camera.
- Find the maximum height that the camera reached.
 - How long did it take for the camera to hit the ground?
4. The acceleration due to gravity on Mars is 4.0 m/s^2 . If an astronaut on Mars were to toss a ball upwards with a speed of 10.0 m/s,
- How high would it go?
 - What would be its velocity after 3.0 s?

5. How fast must a marble be rolled along an 80 cm high table so that when it rolls off the edge it will strike the floor at this same distance (80 cm) from the point directly below the table edge?
6. A water droplet is shot horizontally at 2.0 m/s from a hose. How far would it have dropped after traveling a horizontal distance of 1.00m?
7. A tennis ball was thrown off the roof of a 150m high building at an angle of 25 degrees above the horizontal, and with a speed of 30.0 m/s.
- How long before the ball hits the ground?
 - How far from the building will the ball hit the ground?
 - What will be the velocity of the ball when it hits the ground?
8. Robin Hood shoots an arrow downwards off the castle tower at an angle of 35 degrees to the horizontal. The speed of the arrow as it left the bow was 25 m/s. If the castle tower is 75.0 m high, and Prince John is 60.0 m from the base of the tower, will Prince John be hit by the arrow? Show all work!
9. A boat can travel at 10.0 m/s in still water. The river's current is 4.0 m/s East and the river is 120 m wide.
- If the boat heads directly North, across the river, how long will it take to reach the opposite side of the river?
 - How far is the boat pushed downstream by the time it reaches the opposite shore?
 - If instead the boat is aimed upstream so that it goes directly across the river, what direction should the boat head?
 - What is the resultant velocity for the situation in (c)?
10. An airplane can travel at 450 km/h in still air. A wind is blowing from the East with a speed of 80.0 km/h. What should the plane's heading be if it needs to go to a place that is in the direction 35.0 degrees east of south?
11. "Donna the Daredevil" is shot out of a cannon at 45 degrees to the horizontal with an initial speed of 25.0 m/s. A net is located at a horizontal distance of 50.0 m from the cannon. At what height above the cannon should the net be placed in order to catch the Daring Donna?

T

50.0

$h = \frac{v_y^2}{2g}$

Net