Part I

1. An object goes from one point in space to another. After it arrives at its destination

    (a) its displacement is the same as its distance traveled.

    (b) its displacement is always greater than its distance traveled.

    (c) its displacement is always smaller than its distance traveled.

    (d) its displacement is never larger than its distance traveled.

    Answer: (d). Displacement is always the distance between the initial position and the final position. The distance depends on the path taken so can be longer but not shorter.

2. An accelerated body must at all times

    (a) have positive velocity.

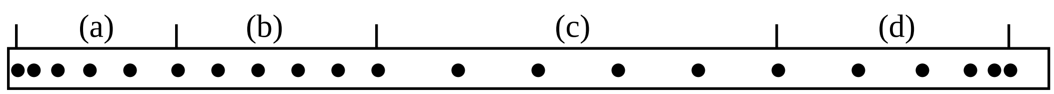
    (b) have an increasing velocity.

    (c) have a changing direction.

    (d) have a changing velocity.

    Answer (d). Acceleration means that the velocity is changing. An object can have constant speed and accelerate provided its direction is changing. An accelerating object can have constant direction provided its speed is changing.

3. The diagram below shows a piece of a ticker tape which passed through a vibrating marker which vibrated at a constant rate of 20 s^{-1}



    Which region shows where the average velocity was greatest?

    Answer (c). The object covers the greatest distance in the same time interval.

4. Again referring to the ticker tape above, which region shows where the magnitude of the acceleration was greatest?

    Answer (d). The change in velocity is greatest in this interval.

5. A child throws a ball into the air. After the ball leaves the child's hands it move vertically upward for a while, reaches a maximum height and then falls back toward the ground. Ignoring air resistance, the forces acting on the ball at this time are

    (a) The constant downward force of gravity alone.

    (b) The constant force of gravity and a steadily decreasing upward force of inertia.

    (c) A decreasing upward force as the ball reaches its maximum height and an increasing downward force of gravity after.

(d) No forces act on the ball. It returns to the ground naturally.

Answer (a). Gravity is the only force acting on the ball

6. Imagine that you push a car gently but constantly forward with your index finger. Imagine that the car's wheels are completely frictionless. How will the car respond to your push?

    (a) It will not move unless the push is strong enough to overcome its inertia.

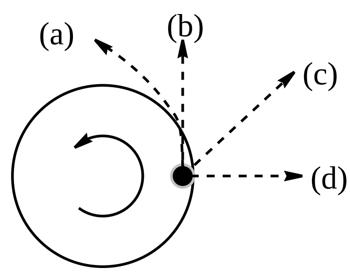
    (b) It will move with steadily increasing speed.

    (c) It will move at a very small constant speed.

    (d) Its speed increase until it reaches a certain value.

    Answer (b). Provide you push with a constant force that is not balanced by friction then the car will continue to accelerate.

7. Imagine that we set a penny near the edge of horizontal turntable. Then imagine that we spin the turntable faster and faster until the penny flies off. What path does the penny follow after if it leaves the turntable in the indicated position?



    Answer (b). After the coin leaves the turntable there is no longer a force keeping it moving in a circle so it continues in a straight line in the direction it was moving when it left the table

8. A ball is thrown straight up from height H while a second is thrown straight down. Neglect air resistance. After the balls have been released

    (a) the one thrown up has the greater acceleration.

    (b) the one thrown down has the greater acceleration.

    (c) the accelerations are the same.

    (d) neither ball accelerates after it has been released.

    Answer (c). After the balls have been released the only force acting on the ball is gravity, so the acceleration is the same 9.8 m/s^2 acting down.

9. A rock which is dropped from rest reaches a speed of about 10 m/s in 1 second. How far would you expect it to fall in one second?

    (a) about 10 m

    (b) more than 10 m

    (c) less than 10 m

    (d) any of the above.

    Answer (c).Its average speed during the first second is 5 m/s so it will travel 5 metres

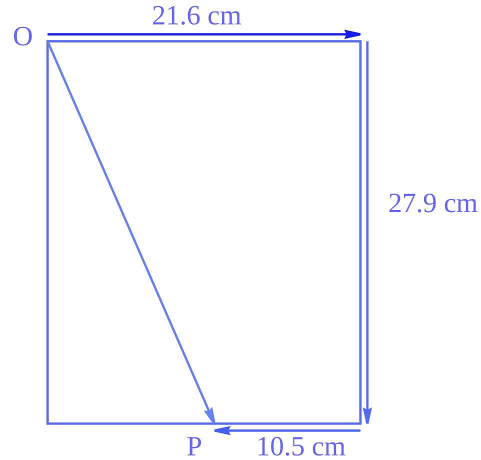
Part II

1. An ant walks clockwise around this sheet of paper starting from the top left hand corner traveling at 0.03 m/s.

   (a) How far will the ant have walked after 20 seconds?
   $d = vt = 0.03 \times 20 = 0.6 \text{ m} = 60 \text{ cm}$

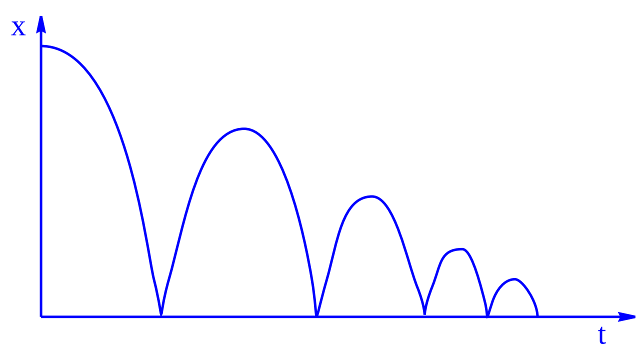
   (b) Find the position of the ant after 20 seconds and hence find its average velocity to get to that position?

   Letter Size Paper is 8.5 in $\times$ 11 in which is 21.6 cm $\times$ 27.9 cm.
   Since the ant travels a distance 60 cm around the paper it arrives point P on the diagram on the right.
   By Pythagorus' Theorem the displacement OP is
   $\sqrt{(27.9^2 + (21.6 - 10.5)^2} = 30.0 \text{ cm}$

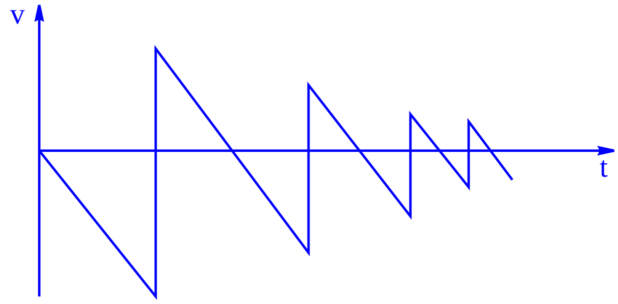


2. A ball is dropped from above the ground and bounces several times before coming to rest. Assuming the ground is the origin and the positive direction is measure upwards sketch graphs of

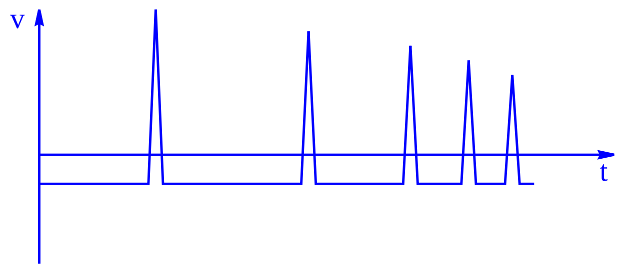
   (a) position vs. time



   (b) velocity vs. time



(c) acceleration vs. time



3. A car travels 120 km along a road at 40 km/hr and then immediately returns along the same road at a speed of 60 km/hr.

   (a) How long does each leg of the trip take?
   $v = d/t$ so $t = d/v$. Thus $t = 120/40 = 3$ hours for the outward trip and $t = 120/60 = 2$ hours for the return trip.

   (b) What is the average speed for the round trip? The average speed is total distance over total time which is 240/5=48 km/hr. Notice the average speed is not 50 km/hr since the car spends more time going at the slower speed of 40 km/hr.

   (c) What is the average velocity for the round trip? Since the car returns to the starting point the average velocity is zero.

4. In each of the following cases state whether the motion is accelerated or not.

   (a) A meteoroid traveling in outer space with negligible gravitational influence.
   No acceleration

   (b) A satellite orbiting earth at a constant speed of 30,000 km/hr
   Acceleration. The speed is constant but the direction changes.

   (c) An ice skater coasting on ice in a straight line.
   No acceleration assuming friction is negligible

   (d) A skydiver falling at terminal velocity?
   No acceleration - the skydiver is no longer gaining speed

5. A car is moving at a constant speed of 30 km/hr. The driver then presses harder on the accelerator causing an acceleration of 2.25 km/hr/sec, which she maintains for 4 seconds. How fast is the car moving at the end of 4 seconds?
   in 4 seconds the car gains $4 \times 2.25 = 9$ km/hr so the car is moving at 39 km/hr after 4 seconds.