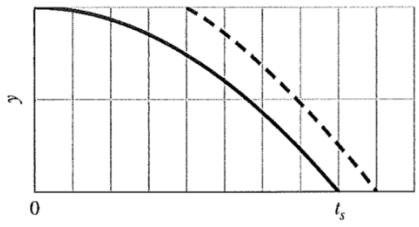
The University of Zambia
School of Natural Sciences
Department of Physics

PHY1015 Tutorial Sheet 02
Linear Motion

1. During a hard sneeze, your eyes might shut for 0.50 s. If you are driving a car at 90 km/h during such a sneeze, how far does the car move during that time?
2. Compute your average velocity in the following two cases: (a) You walk 73.2 m at a speed of 1.22 *mls* and then run 73.2m at a speed of 3.05 *mls* along a straight track. (b) You walk for 1.00 min at a speed of 1.22 m/s and then run for 1.00 min at 3.05 m/s along a straight track. (c) Graph *x* versus *t* for both cases and indicate how the average velocity is found on the graph.
3. The position of an object moving along an *x* axis is given by $x = 3t - 4t^2 + t^3$, where *x* is in meters and *t* in seconds. Find the position of the object at the following values of t: (a) 1 s, (b) 2 s, (c) 3 s, and (d) 4 s. (e) What is the object's displacement between t = 0 and t = 4 s? (f) What is its average velocity for the time interval from *t*=2s to t=4s? (g) Graph *x* versus *t* for $0 \leq t \leq 4\ s$ and indicate how the answer for (f) can be found on the graph.
4. At time *t* = 0, apple 1 is dropped from a bridge onto a road-way beneath the bridge; somewhat later, apple 2 is thrown down from the same height. The figure below gives the vertical positions *y* of the apples versus *t* during the falling, until both apples have hit the roadway. The scaling is set by t_s = 2.0 s. With approximately what speed is apple 2 thrown down?



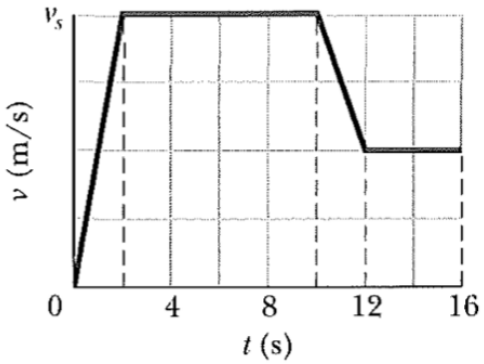
5. A bolt is dropped from a bridge under construction, falling 90 m to the valley below the bridge. (a) In how much time does it pass through the last

20% of its fall? What is its speed (b) when it begins that last 20% of its fall and (c) when it reaches the valley beneath the bridge?

6. A key falls from a bridge that is 45 m above the water. It falls directly into a model boat, moving with constant velocity, that is 12 m from the point of impact when the key is released. What is the speed of the boat?

7. A drowsy patient spots a flowerpot that sails first up and then down past an open window. The pot is in view for a total of 0.50 s, and the top-to bottom height of the window is 2.00 m. How high above the window top does the flowerpot go?

8. How far does the runner whose velocity-time graph is shown in the figure below travel in 16 s? The figure's vertical scaling is set by $v''= 8.0 m/s.$



9. Two particles move along an x axis. The position of particle 1 is given by $x = 6.00t^2 + 3.00t + 2.00$ (in meters and seconds); the acceleration of particle 2 is given by $a = -8.00t$ (in meters per second squared and seconds) and, at $t = 0$, its velocity is 20 m/s. When the velocities of the particles match, what is their velocity?

10. A rock is shot vertically upward from the edge of the top of a tall building. The rock reaches its maximum height above the top of the building 1.60 s after being shot. Then, after barely missing the edge of the building as it falls downward, the rock strikes the ground 6.00 s after it is launched. In SI units: (a) with what upward velocity is the rock shot, (b) what maximum height above the top of the building is reached by the rock, and (c) how tall is the building?