***Name*_____**

# Freefall without drag

Consider the *vertical* motion of a basketball as described below.

[0] At $t = 0$ seconds, it is moving straight *upwards* with a speed of 2.0 m/s. (Assume that it has long since left the hand of the person throwing it, and neglect any effect of air resistance throughout its motion.)

[1] At some unknown time, it reaches it maximum height.

[2] At some unknown time, it is moving *downwards* with a speed of 2.0 m/s, past the point at which it started its motion at $t = 0$ seconds.

**1**. Draw a motion diagram for the basketball described above.

**2**. Draw a velocity graph for the basketball, and scale the vertical $v$ and horizontal $t$ axes. What time did the basketball reach its highest height?

**3**. Determine the maximum height of the basketball, above the point at which it started its motion at $t = 0$ seconds. (*use the area under your graph)*

**4**. What is the slope of your $v$ graph at each of the instances in time described above? *Is the ± sign of your slope consistent with the direction of your acceleration vector?*

**5**. Find the total area bounded by your $v$ graph from $t = 0$ seconds to when the basketball reaches it maximum height? What is the total area bounded by your $v$ graph from $t = 0$ seconds to when the basketball falls downwards past its starting point?

**6**. On the same $v$ graph that you have drawn on graph paper, show the motion of a basketball that just after released from rest, and allowed to fall downwards towards the floor.