For the problems below, **approximate the acceleration of gravity as -10 m/s^2**. (We're on Earth.) The point of this practice is not highly precise answers but rather building up your intuition and mental-math abilities. (And let's not bother putting a directional **j** aside each vector quantity.)

1. A ball was thrown upward at 40 m/s. (This is almost 90 mph, which is ridiculous. Some baseball players can throw a ball this fast, although not upward.) The data table below shows the velocity at one-second intervals.

time (s)	velocity (m/s)
0.0	40.00
1.0	30.00
2.0	20.00
3.0	10.00
4.0	0.00
5.0	-10.00
6.0	-20.00
7.0	-30.00
8.0	-40.00

   a. At what time has the ball reached its peak?
      t = 4 s (v_f = at +v_i : 0 = -10t + 40)
   b. At its peak, what is the ball's *acceleration*?
      a = -10 m/s/s
   c. What is the ball's displacement in that first second?
      Δx = v_{avg}t = ½(40+30)1 = 35 m
   d. What is the ball's total displacement, over the 8.0 seconds?
      Δx = v_{avg}t = ½(40+-40)8 = 0 m
   e. What total distance (not displacement) does the ball travel, over the 8.0 seconds?
      distance up = |½(40+0)4| = |80 m| = 80 m
      distance down = |½(0+-40)4| = |-80 m| = 80 m
      total distance = 2(80 m) = 160 m

2. A ball was thrown upward at 60 m/s.
   a. How many seconds does it take to reach its peak?
      t = 6 s
   b. How many seconds does it take to return to its starting height?
      t = 12 s
   c. What is the acceleration of the ball at 4.0 seconds?
      a = -10 m/s/s
   d. What is the velocity of the ball at 8.0 seconds?
      v = -20 m/s (v_f = at + v_i : v_f = -10(8) + 60)
   e. How high does the ball travel? (This is another way of asking for its displacement, when it's at its peak.)
      Δx = v_{avg}t = ½(60+0)6 = 180 m
   f. What is the displacement of the ball between t = 1.0 and t = 3.0 seconds?
      Δx = v_{avg}t = ½(50+30)2 = 80 m (the "t" in the model represents a time interval, not a particular time; if the initial time is t = 0, then there is no meaningful difference between the two concepts; in this problem, there is a meaningful difference)

3. A ball was thrown downward at 20 m/s, over a deep hole.
    a. What is the velocity of the ball at 3.0 seconds?
       v = -50 m/s
    b. What is the acceleration of the ball at 3.0 seconds?
       a = -10 m/s/s
    c. What is the displacement of the ball at 3.0 seconds?
       $\Delta x = v_{avg}t = ½(-20+-50)3 = -105$ m

4. A ball was thrown upward at 25 m/s.
    a. How many seconds does it take to reach its peak?
       t = 2.5 s ($v_f = at + v_i$: $0 = -10t + 25$)
    b. At its peak, what is the ball's acceleration?
       a = -10 m/s/s
    c. At its peak, what is the ball's velocity?
       v = 0 m/s
    d. What is its velocity upon returning to its original height?
       v = -25 m/s (due to symmetry, but also $v_f = -10(5) + 25$)
    e. How high does the ball travel?
       $\Delta x = v_{avg}t = ½(25+0)2.5 = 31.25$ m
    f. What is the ball's displacement at 4.0 seconds?
       $\Delta x = v_{avg}t = ½(25+-15)4 = 20$ m