KEY.

This is P110, Quiz 3. You are allowed to use a cheat sheet and a calculator.

1. A student class gives you data of position vs. time measured every second for an object as taken in a Friday group session that you missed. Your job is to pick out the data that is consistent with constant acceleration:
   a) 1m, 2m, 3m, 4m, …   const ✓
   b) 1m, 4m, 9m, 16m, … ✓ $1^2(1m), 2^2(1m), 3^2(1m), \ldots$
   c) 1m, 3m, 5m, 7m, …   const ✓
   d) 5m, 20m, 45m, 80m, … ✓ $1^2(5m), 2^2(5m), \ldots$
   e)) Both (b) and (d)

A ball falls under the influence of gravity alone, covering 5 m in 1 second and moving at 22 mph.

2. How fast is it moving after 7 seconds?
   a) 7 mph
   b) 77 mph
   c) 120 mph
   d)) 154 mph
   e) 176 mph

$$V = a \cdot t \qquad v \propto t$$
$$7s = 7 \cdot (1s)$$
$$V_7 = 7 \cdot V_1 = 7 \cdot 22 = 154 \text{ mph}$$

3. How far has it fallen after 7 seconds?
   a) 40 m
   b) 80 m
   c) 245 m
   d) 35 m
   e) 4800 m

$$7s = 7 \cdot 1 s \qquad d \propto t^2$$
$$t_7^2 = 49 \, t_1^2 \rightarrow d_7 = 49 \cdot d_1 = 245 m$$

In class we learned that you need to leave the ground at roughly 10 mph to reach 1m (40") high and that you are in the air for about 1sec. Suppose you have a merely mortal vertical of 20":

4. How long are you in the air?
   a) 1 s
   b) 2 s
   c) ½ s
   d) ¼ s
   e) √½ s (0.7s)

$$20 = \tfrac{1}{2} 40 \leftarrow \text{distance} \propto t^2$$
$$t_{20}^2 = \tfrac{1}{2} t_{40}^2$$
$$t_{20} = \sqrt{\tfrac{1}{2}} \, t_{40}$$

5. What speed do you hit the ground with when you land?
   a) 3 mph
   b)) 7 mph
   c) 5 mph
   d) 10 mph

$$V_{20} \propto t_{20} = \sqrt{\tfrac{1}{2}} \, t_{40} \propto \sqrt{\tfrac{1}{2}} \, V_{40}$$