Acceleration due to gravity and free fall

1. Consider an object that is dropped from a 20m-height.
   a) How much time does it take for the object to hit the ground? **(t=2.02 s)**
   b) What is the object's final velocity just before it hits the ground? $(\vec{v_f} = 19.8\frac{m}{s}[down]$)
   c) What assumptions do you make?

2. Consider an object being thrown from the ground straight upwards with velocity of 60m/s.
   a) How much time does the object take to reach its maximum height? **(t=6.1 s)**
   b) What is the object's maximum height? **(d=183.7 m)**
   c) How much time will the object take to fall to the ground from its maximum height?
      (t = 6.1s)
   d) What is the object's final velocity just before it hits the ground? $(\vec{v_f} = 60\frac{m}{s}[down])$
   e) What assumptions do you make?

3. Consider an object being thrown straight upwards from a 20-m height with a velocity
   of 60 m/s.
   a) How much time does the object take to reach its maximum height? **(t=6.1 s)**
   b) What is the object's maximum height, measured from the ground? **(d=203.7 m)**
      How much time does the object take to fall from the maximum height to the point it was thrown from? **(t = 6.1s)**
      Assuming that there is nothing in the object's way, how much time will it take to reach the ground from its maximum height? **(t = 6.4s)**
   c) What is the object's final velocity just before it hits the ground? $(\vec{v_f} = 63\frac{m}{s}[down])$
   d) How much time will the object spend in the air? **(t = 12.5s)**
   e) What assumptions do you make?

? What generalizations can you make about objects moving strictly vertically, close to the Earth's surface and when neglecting air resistance or other factors that could slow down or stop moving objects?

4. What height did a 20-kg object fall if it took 5 s for it to hit the ground after it was dropped? What assumptions do you make? **(d =123 m)**
   Would your answer change if the object weighed 60 kg instead of 20kg? Why or why not?

5. What height did a 10-kg object fall if its final velocity just before it hit the ground was $\vec{v_f} = 120\frac{m}{s}[down]$? What assumptions do you make? **(d =735 m)**
   Would your answer change if the object weighed 100 kg instead? Why or why not?

6. With what velocity was an object thrown downwards if it took 1.4 s to reach the ground from the height of 70 m? $(\vec{v_i} = 43\frac{m}{s}[down])$