Exercise – Math for Games

1. A base jumper is planning a jump from the top of a 300-metre tall building. The jumper needs to be in free-fall as long as possible to gain enough horizontal distance from the wall of the building to open their parachute safely.  
     
   Assuming that the parachute opens in two seconds, what is the maximum time that the jumper can delay before pulling the rip cord?  
     
   Acceleration due to gravity is 9.8 metres per second per second.  
     
   For this exercise, you can ignore air resistance.
2. At what speed will the jumper be falling when they pull the rip cord?
3. Write a C++ program that writes out a table of velocity and distance for the base jumper for every half a second from the start of the jump to pulling the rip cord.
4. The provided *Console Game Framework* provides a very simple framework for making a simple console game. The framework provides a game loop that runs at 50 frames per second, simulating a typical games API. The framework also provides a simple function to test whether any specified key on the keyboard is held down (without blocking the application waiting for input).  
     
   Download the framework and write a simple ‘game’ that simulates the base jumper jumping from a building. Here are some ideas for your game:  
   1. Press a certain key to ‘jump’ from the building
   2. Open the parachute by pressing a certain key
   3. Make the base jumper ‘die’ if they hit the ground before pulling the rip cord and make them get ‘injured’ if they hit the ground after they pull the rip cord but before the parachute fully opens (allow two seconds for the parachute to open).
   4. **CHALLENGE** - Typical parachutes decelerate at about 30 metres per second per second. Once fully open, they will descend at about 7 metres per second. Use this to compute the decreasing velocity of the base jumper after they pull the rip cord and finally compute the velocity when they ‘touch down’. From the velocity at the moment of touch down, determine whether the jumper dies, is injured, or lands safely. You can assume that a safe touch down must be less than 10 metres per second and any velocity more than 20 metres per second will be fatal (anything in between would be an injury).
   5. **CHALLENGE**. Extendthis example in any way you wish to do something interesting. Use your imagination.