Name _____

Gravitational Potential Energy = $\Delta PE = mgh$ (positive if object is above reference point, negative if object is below reference point)

Work done by gravity: $W_g = -\Delta PE$

Recall: $W_{tot} = \Delta KE$, so if gravity is the only force doing work, then $W_{tot} = W_g = -\Delta PE = \Delta KE$

1. A person with a mass of $63kg$ rides the elevator from the ground floor to the top floor of the Burj Khalifa in Dubai a vertical height of $830m$ (2717'!).

   (a) What is the work done by the weight force of the person? Is it **A**: positive, **B**: negative, or **C**: 0?

   (b) What is the change in gravitational potential energy of the person? Is it **A**: positive, **B**: negative, or **C**: 0?

   (c) What are the signs of the work done by the weight force when going back down to the ground floor? What is the sign of the change in gravitational potential energy?

   (d) How would your answers change if the same person climbs a mountain of the same vertical height of 830m, but takes a long, windy path to get to the top?

2. What is the change in gravitational potential energy of a 60kg person riding an escalator a distance of $20m$ and the escalator makes an angle of $35°$ with the horizontal?

3. Suppose a ball is dropped from the top of the Burj Khalifa. Ignoring air resistance, how fast will it be moving just before it hits the ground?
   First solve using kinematics:

   Now use $-\Delta PE = \Delta KE$ (Hint: The mass of the ball will cancel out)

4. A ball is launched at an angle of $32°$ with a speed of $5m/s$ from a height of $3m$ above the ground. What is the final speed of the ball, just before it hits the ground? Take a moment to think about how much work this problem would have been using kinematics and vectors!

5. In a downhill ski race, surprisingly, little advantage is gained by getting a running start. This is because the initial kinetic energy is small compared with the total gravitational potential energy, even on small hills.

   (a) What is the change in gravitational potential energy of a $60kg$ skier on a slope with a vertical drop of $600m$, if she starts at the top and ends at the bottom?

   (b) How fast would she be moving at the bottom of the hill, if starting from rest?

   (c) How fast would she be moving at the bottom of the hill with a running start of $1m/s$?

   (d) Friction will play a role in slowing the skier. If she actually moves at $60m/s$ at the bottom of the hill, how much work was lost to friction?