1. When you throw an object up vertically from the surface of the earth, it will fall back down after reaching the highest point. This highest point depends on the initial velocity you threw it with. The greater the initial velocity the further up it will reach. However, there is a certain velocity you can throw an object so that it will escape gravity's influence of the planet and continue to move away from it. The velocity needed for this to happen is called the escape velocity of the planet. The formula for the escape velocity is $v_e = \sqrt{\frac{2GM}{r}}$, where M is the mass of the planet and r the radius of the planet. G is Newton's constant and has a value $G = 6.674 \times 10^{-11} m^3 kg^{-1} s^{-2}$. Anything equal or faster than v_e will escape. Calculate the escape velocity of an object here on earth. For mass of the earth is $M = 5.972 \times 10^{24} kg$ and its radius $r = 6.371 \times 10^6 m$. Given the result you found, can light escape the earth's gravity?

2. A black hole is an object whose gravitational pull is so strong that not even the fastest object there is, light, can escape its region of influence (that's why it's black). In order to make a black hole, the mass of the object has to be very concentrated. To what radius do we have to squeeze the earth to convert it into a black hole? Hint: use the formula for the escape velocity but now what you want to calculate is the radius r needed for v_e to be equal to the speed of light $c = 300,000,000\ m/s$.

3. Watch the following video before answering the question:
   https://www.youtube.com/watch?v=hSXNE0pNtr8
   Scientists first discovered there was a discrepancy in the orbital motion of Mercury and the prediction by Newton's theory. Before Einstein gave an explanation to it applying his new theory, what did scientists think was causing this discrepancy?

4. Watch the following video before answering the question:
   https://www.youtube.com/watch?v=HLxvq$_M$4218
   Another crucial test of general relativity is the bending of light by gravity. Make a drawing explaining how this bending happens and why do we need to do the measurement during a solar eclipse.

5. Watch this video showing how we were able to detect gravitational waves for the first time:
   https://www.youtube.com/watch?v=FlDtXIBrAYE
   What caused the gravitational waves that we observed for the first time in September 14th 2015?

6. What is the effect of a gravitational wave when it passes through earth?

7. Watch the following scene from Interestellar:
   https://www.youtube.com/watch?v=lznM-fygfqo
   What causes time to run slower for Matthew McConaughey in the Interestellar movie?

8. Watch the following video about GPS system:
   https://www.youtube.com/watch?v=HiFW2d2gvt8
   What is the effect from Einstein's theory of general relativity that we have to take into account to build an accurate GPS system?

9. Finally, if you haven't done it yet, I'd really appreciate if you fill the instructor's survey for this course. Thank you! You can find here:
   https://utdirect.utexas.edu/ctl/ecis/