PHYSICS 631: General Relativity

Homework # 6
Due June 12, 2017 – Yes. This is after the end of classes.

Please show all of your work. By all means, if you have any questions, please come see me.

1. 11.7
2. 11.21
3. Using the relations that we derived in class:
   \[ a_{y-stretching} = \frac{2M}{r^3} \Delta y \]
   and
   \[ a_{x-compressing} = \frac{M}{r^3} \Delta x \]

Throughout this problem, assume that you dropped from rest at infinity.

(a) Find the smallest black hole in which you could survive long enough to pass the event horizon. You will need to do a little searching to determine the stresses that humans can survive.

(b) For a 1M⊙ black hole, how long does it take between the time you feel mildly uncomfortable (tidal force between head and feet is 2g) and you die? This should be in proper time, of course.

(c) How about a 10M⊙ black hole?

4. 12.9 - It is vital to this problem that your starting point be the Einstein field equation, and that you use an arbitrary non-zero density at the present.

5. 12.20