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# AST 10: Homework 6

1. According to the theory of relativity, gravity is not a true force. What is it?
2. What attribute of an object is connected to the curvature of spacetime that it causes? (Color? Shape? Charge? Mass?)
3. What are the three effects explained (or predicted) by Einstein when he proposed the final version of the theory of relativity?
4. You are an astronaut orbiting the earth, when catastrophe strikes and the earth goes black hole. How does that affect your orbit?
5. A white dwarf is a solid physical object. A neutron star is a solid physical object. What about a black hole?
6. The sun has an average density of  $1.4 \text{ gm/cm}^3$ . That's 1.4 times the density of water. As mentioned in class, the sun would have to compress to a density of  $2 \times 10^{16} \text{ g/cm}^3$  to "go black hole." That's 20 million billion times the density of water. What would the density be for the formation of a black hole that's (a)  $10M_{\odot}$ ? (b)  $\frac{1}{10}M_{\odot}$ ?
7. We said in class that  $\frac{m}{\frac{4\pi}{3}\left(\frac{2Gm}{c^2}\right)^3} = \frac{3c^6}{32\pi G^3} \frac{1}{m^2}$ . Work out the algebra to go from left to right.
8. You're at  $r = 3M$  from a black hole center, with a jet-propulsion pack. Can you safely orbit the black hole? If you shine a flashlight as shown, what might you see? What would happen if you were at  $r = M$ ?

