

Astronomy 142: Review Guide For Midterm 1

The first midterm exam will be Monday, February 9, in class. The exam will consist of multiple choice questions and a short essay. It will take the whole class period.

You may bring one page (both sides) of *handwritten* notes, and a calculator.

There will be a Q&A review session on Friday, February 6, 5 pm - 6:15 pm, in McPherson Lab 4054.

The topics for the midterm are the black hole overview (course introduction), Newton's theory of motion and gravity, Special Relativity, and General Relativity.

You should review the lecture notes, the Prologue and Chapters 1 and 2, of Thorne's book, and the first two homework sets and their solutions.

You should be familiar with the following equations: what principles they express, and how they can be used.

$$v_{\text{esc}} = \sqrt{\frac{2GM}{R}}$$

$$R_{\text{Sch}} = \frac{2GM}{c^2}$$

$$d = vt = \frac{1}{2}at^2$$

$$F = ma$$

$$F = \frac{GMm}{r^2}$$

$$(P/1 \text{ year})^2 = (a/1 \text{ AU})^3$$

$$a = \frac{v^2}{r}$$

$$\frac{GM}{4\pi^2} = \frac{r^3}{P^2}$$

$$E = hc/\lambda$$

$$E = mc^2$$

$$t'/t = l'/l = \gamma, \quad \gamma = \left(1 - \frac{v^2}{c^2}\right)^{-1/2}$$

$$\lambda_o = \lambda_e \times \left(1 + \frac{v}{c}\right) = \lambda_e \times \left(1 + \frac{gl}{c^2}\right)$$

You should also know what a geodesic is, and you should know what the geodesic equation describes (geodesic paths through spacetime) even though you don't know how to write

it down. You should know what the Einstein Field Equation describes, even though you don't know how to write it down.

You should know what Newton's laws of motion are. You should know what Kepler's laws are of planetary motion are and why they were important to the development of Newton's theory of gravity.

Names you should know: Newton, Einstein.

Pay attention to the relation between Einstein's theory of gravity and Newton's theory of gravity.

Most important of all: Pay attention to the empirical evidence that supports Newton's theory of gravity, Special Relativity, and General Relativity.