

## Dark Matter Worksheet

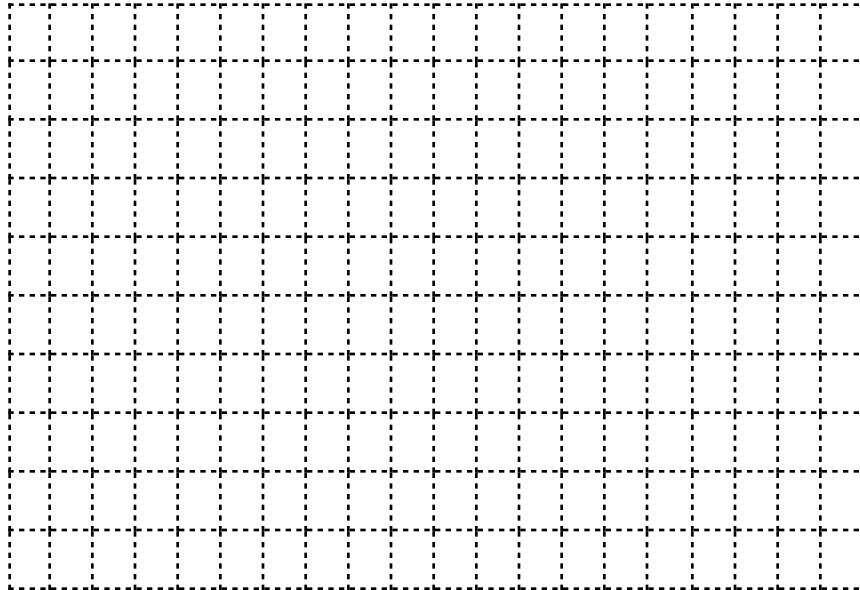
### Table 1

A. Radius (kpc)	B. Rotational Velocity (km/s)	C. Gravitational Mass (solar masses)	D. Luminosity (solar lum.)	E. Luminous Mass (solar masses)

### Important Equation

$$M = \frac{v^2 \cdot R}{G}, \text{ where } G = 4.31 \times 10^{-6} \frac{\text{kpc km}^2}{M \text{ s}^2}$$

F. Plot



### Questions

1. a) Determine the mass to light ratio for NGC 2742 at your largest radius by dividing your gravitational mass by your radiation mass.
- b) Put the mass to light ratio another way: What percentage of the total mass is luminous?
- c) What percentage of the total mass cannot be accounted for in the light that we see (we call this the dark matter)?

2. Figure 3 plots how much luminosity is produced inside of some radius. It does not decline at large radii even though the galaxy gives off less light out there. Explain why.

3. We assumed that for every 1 solar luminosity that we see, there are 2 solar masses of matter.

a) How would our assumption for the amount of luminous matter change if NGC 2742 has more low mass stars than we thought, but remains just as luminous? Remember that a star's luminosity depends sensitively on its mass.

b) Following from part a, how would the mass to light ratio (total mass divided by luminous mass) change if NGC 2742 contains more low mass stars than we thought?

4. These are 2 galaxies that we cannot use in our search for dark matter.



**M101 The Pinwheel Galaxy**



**M104 The Sombrero**

Why not?

M101:

M104:

5. Comment on the existence of Dark Matter. Are you convinced that it exists?