

The Milky Way is a spiral galaxy. There are many other kinds of galaxies, some much larger than the Milky Way, and some much smaller. This exercise lets you create a scale model of the various kinds, and learn a little about working with fractions too!

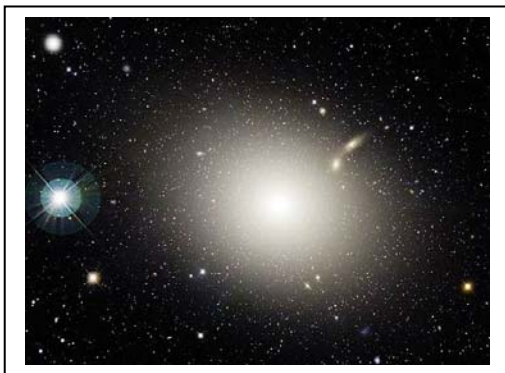


Problem 1 - The irregular galaxy IC-1613 is twice as large as the elliptical galaxy M-32, but 10 times smaller than the spiral galaxy NGC-4565. How much larger is NGC-4565 than M-32?

Problem 2 - The spiral galaxy Andromeda is three times as large as the elliptical galaxy NGC-5128, and NGC-5128 is 4 times as large as the Large Magellanic Cloud, which is an irregular galaxy. How much larger is the Andromeda galaxy than the Large Magellanic Cloud?

Problem 3 - The Milky Way spiral galaxy is 13 times larger than the irregular galaxy IC-1613. How much larger than NGC-4565 is the Milky Way?

Problem 4 - The elliptical galaxy Leo-1 is $\frac{1}{4}$ as large as the elliptical galaxy Messier-32, and the spiral galaxy Messier-33 is 9 times larger than Messier-32. How large is Leo-1 compared to Messier-33?



Problem 5 - The elliptical galaxy NGC-205 is $\frac{2}{3}$ as large as the Large Magellanic Cloud. How large is NGC-205 compared to the Andromeda galaxy?

Problem 6 - The irregular galaxy NGC-6822 is $\frac{8}{5}$ the diameter of Messier-32, and Messier-32 is 20 times smaller than NGC-4565. How large is NGC-6822 compared to IC-1613?

Problem 7 - Draw a scale model of these galaxies showing their relative sizes and their shapes.

Images: Top: The spiral galaxy Messier 74 taken by the Gemini Observatory; Bottom: The elliptical galaxy Messier-87 obtained at the Canada-France-Hawaii Telescope (copyright@cfht.hawaii.edu);

Answer Key

The galaxies used in this exercise, with the diameter given in light years, and relative to Messier-32:

Name	Type	Diameter	M-32
Large Magellanic Cloud	Irregular	15,000 LY	3
NGC-5128	Elliptical	65,000	13
NGC-4565	Spiral	100,000	20
IC-1613	Irregular	10,000	2
Andromeda	Spiral	200,000	40
NGC-205	Elliptical	10,000	2
Messier-32	Elliptical	5,000	1
Milky Way	Spiral	130,000	26
Messier-33	Spiral	45,000	9
Leo-1	Elliptical	1,000	1/4
NGC-6822	Irregular	8,000	8/5

Problem 1 - $IC-1613/M-32 = 2.0$, $NGC-4565/IC-1613 = 10$ so $NGC-4565/M-32 = 10 \times 2 = \mathbf{20 \text{ times}}$

Problem 2 - $Andromeda/NGC-5128 = 3$ and $NGC-5128/LMC = 4$ so $Andromeda/LMC = 3 \times 4 = \mathbf{12 \text{ times}}$

Problem 3 - $MW/IC-1613 = 13$ and also $NGC-4565/IC-1613 = 10$, so $Milky \text{ Way} / NGC-4565 = 13 \times 1/10 = \mathbf{1.3 \text{ times}}$.

Problem 4 - $Leo-1 / M-32 = 1/4$ and $M-33 / M-32 = 9$, so $Leo-1 / M-33 = 1/4 \times 1/9 = \mathbf{1/36 \text{ times smaller}}$.

Problem 5 - $NGC-205 / LMC = 2/3$ and $Andromeda/LMC = 12$ so $NGC-205 / Andromeda = 2/3 \times 1/12 = \mathbf{2/36 \text{ or } 1/18 \text{ as large}}$.

Problem 6 - $NGC-6822 / M-32 = 8/5$ and $M-32 / NGC-4565 = 1/20$ and $NGC-4565 / IC-1613 = 10$ so $NGC-6822 / IC-1613 = 8/5 \times 1/20 \times 10 = 8/5 \times 1/2 = \mathbf{8/10 \text{ or } 4/5 \text{ as large}}$.

Problem 7 - Students can use the ratios in the problems, together with the ones they derived, to create a table that gives the relative sizes for each galaxy. The table at the top gives the 'official' numbers, and the relative sizes in the last column.