Star Magnitudes and Multiplying Decimals

The brightness of a star is indicated by the Apparent Magnitude scale, which leads to some interesting math!

Rule 1: The larger the number, the fainter the star. For example, Procyon has a magnitude of +0.4 while Wolf-359 has a magnitude of +13.5, so Wolf-359 is <u>fainter</u> than Procyon.

Rule 2: Each difference, by one whole magnitude, represents a brightness change of 2.51 times. For example, the star Tau Ceti has a magnitude of +3 while Fomalhaut has a magnitude of +1. The brightness difference between them is +3 - (+1) = 2 magnitudes or a factor of 2.51 x 2.51 = 6.3 times.

Problem 1 - UV Ceti has a magnitude of +13.0 while Wolf-294 has a magnitude of +10.0. Which star is fainter, and by what factor?

Problem 2 - Sirius has a magnitude of -1 and Mintaka has a magnitude of +2, which star is faintest. What is the magnitude difference, and by what factor do they differ?

Problem 3 - Betelgeuse has a magnitude of +1 and 70 Ophiuchi has a magnitude of +6. What is the magnitude difference and by what factor do they differ?

Problem 4 - Capella has a magnitude of +0 and Barnard's Star has a magnitude of +9. What is the magnitude difference, and by what factor do they differ?

Problem 5 - Sort the stars in the table so that the brightest star appears first, and the faintest star appears last.

Star	Apparent Magnitude
Ross-47	+11.6
Antares	+1.0
Alpha Centauri	-0.1
36 Ophichi	+5.1
Beta Hydra	+2.7
Rigel	+0.1
Eta Cassiopeia	+3.5
Sirius	-1.5
Wolf-359	+13.5
Kruger-60	+9.9

Answer Key

Problem 1 - UV Ceti has a magnitude of +13.0 while Wolf-294 has a magnitude of +10.0. Which star is fainter, and by what factor?
Answer: UV Ceti has the larger apparent magnitude so it is the fainter star. They differ by +13 - +10 = +3 magnitudes, which is a factor of 2.51 x 2.51 x 2.51 = **15.8 times.**

Problem 2 - Sirius has a magnitude of -1 and Mintaka has a magnitude of +2, which star is faintest. What is the magnitude difference, and by what factor do they differ?
Answer: Mintaka has the larger apparent magnitude so it is the fainter star. They differ by +2 - (-1) = +3 magnitudes, which is a factor of 2.51 x 2.51 x 2.51 = **15.8 times.**

Problem 3 - Betelgeuse has a magnitude of +1 and 70 Ophiuchi has a magnitude of +6. What is the magnitude difference and by what factor do they differ?
Answer: 70 Ophichi has the larger apparent magnitude so it is the fainter star. They differ by +6 - (+1) = +5 magnitudes, which is a factor of 2.51 x 2.51 x 2.51 x 2.51 x 2.51 **= 100 times**.

Problem 4 - Capella has a magnitude of +0 and Barnard's Star has a magnitude of +9. What is the magnitude difference, and by what factor do they differ?
Answer: Barnard's Star has the larger apparent magnitude so it is the fainter star. They differ by +9 - (+0) = +9 magnitudes, which is a factor of 2.51 x 2.51 x 2.51x 2.51 x 2.51 x 2.51 x 2.51 x 2.51 x 2.51 = **3,950 times.**

Problem 5 - Sort the stars in the table so that the brightest star appears first, and the faintest star appears last.

Star	Apparent Magnitude
Sirius	-1.5
Alpha Centauri	-0.1
Rigel	+0.1
Antares	+1.0
Beta Hydra	+2.7
Eta Cassiopeia	+3.5
36 Ophichi	+5.1
Kruger-60	+9.9
Ross-47	+11.6
Wolf-359	+13.5