Hints on calculating the relative distance of two stars

So, you have two stars, **A** and **B**. Star **A** is nearby, and has a good, solid distance $\mathbf{d_A}$ based on parallax. But star **B** is far away, too far for our best parallax measurements.

Fortunately, these two stars appear to be very similar: same temperature, color, and spectral class. So, you make the ASSUMPTION that the two have identical luminosities. Now you can use the inverse square law to turn the ratio of their brightnesses into the ratio of their distances:

$$\frac{I_A}{I_B} = \left(\frac{d_B}{d_A}\right)^2$$

However, instead of intensities, all you can find are magnitudes for the two stars: $\mathbf{m_A}$ and $\mathbf{m_B}$. What can you do?

Well, there is a connection between magnitude and intensity:

$$\frac{I_A}{I_B} = 10^{\,0.4(\mathrm{m}_B - \mathrm{m}_A)}$$

So, you can first compute the ratio of the intensities from the magnitudes, and then use the inverse square law to find the ratio of distances.

Or, if you wish, you can combine those two equations into a single step:

$$d_B = d_A \; 10^{\,0.2(\mathrm{m}_B - \mathrm{m}_A)}$$
