USE A DATA BANK

You must locate information to solve some problems. There are many sources of information, including the Internet, the media, print data banks, and experts.

The brightness of planets and stars as they appear from the Earth is described on a scale of apparent magnitudes. A lower apparent magnitude signifies a brighter object. A difference of 5 magnitudes corresponds to a factor of 100 times as bright. So, a star of magnitude 3 is 100 times as bright as a star of magnitude 8, and a star of magnitude 0 is 100 times as bright as a star of magnitude 5.

A difference of 1 magnitude corresponds to a factor of $\sqrt[5]{100}$ times as bright. A difference of 2 magnitudes corresponds to $\sqrt[5]{100} \times \sqrt[5]{100}$ or $(\sqrt[5]{100})^2$ times as bright. A positive difference of $d$ magnitudes corresponds to $(\sqrt[5]{100})^d$ times as bright.

Aside from our sun, the brightest star in the sky is Sirius. How many times as bright as the North Star, Polaris, is Sirius, to the nearest whole number?

1. What information are you given?
2. What are you asked to find?
3. Do you need an exact or an approximate answer?

Locate values for the apparent magnitudes of Sirius and Polaris. Find the positive difference, $d$, between these magnitudes. Substitute the difference into the formula $(\sqrt[5]{100})^d$ to find how many times as bright Sirius is as Polaris.
The apparent magnitude of Sirius is $-1.5$, and the apparent magnitude of Polaris is $2$.

The positive difference, $d = 2 - (-1.5) = 3.5$.

Substitute for $d$ in the formula.

$$
\left(\frac{5}{100}\right)^d = \left(\frac{5}{100}\right)^{3.5} \\
= \left(100^{\frac{1}{2}}\right)^{3.5} \\
= 100^{0.7} \\
= 25
$$

So, Sirius is 25 times as bright as Polaris, to the nearest whole number.

Check by estimation.

A difference of 1 magnitude means a factor of $\frac{5}{100}$, which is about 2.5.

A difference of 3 magnitudes is a factor of about $2.5 \times 2.5 \times 2.5$, or about 15.

A difference of 4 magnitudes is a factor of about $2.5 \times 2.5 \times 2.5 \times 2.5$, or about 40.

So, a difference of 3.5 magnitudes is a factor between about 15 and 40.

Does the answer seem reasonable?

Is there a way to solve the problem graphically?

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**Apply, Solve, Communicate**

Locate the necessary information and solve the problems.

1. **Moons** Most planets in our solar system have moons. Which planets have moons that are larger than the planet Mercury?

2. **Land area** Suppose the land area of each province were divided equally among all the people living in that province. In which province would a person receive
   a) the most land?   b) the least land?
3. **Species at risk** Species at risk are grouped into five categories: extinct, extirpated, endangered, threatened, or vulnerable.  
   a) What does each category mean?  
   b) What things are included when the word species is used?  
   c) What is the total number of species now at risk in Canada?  
   d) What is the average annual rate of increase in the species at risk in Canada?  
   e) What is the current estimate of the rate of extinction of species worldwide?  

4. **Astronomy** Some objects in our solar system can be brighter than the brightest stars in the night sky. The moon and the planet Venus can be the brightest objects. How many times as bright as the planet Venus is a full moon, when Venus is at its brightest? Round your answer to the nearest whole number.  

5. **Driving distance** a) What is the shortest driving distance from Sudbury to Brownsville, Texas?  
   b) How long would the trip take if you could average 100 km/h and you drove, at most, 10 h a day?  

6. **National debt** If Canada’s current national debt were divided equally among all Canadians, what would be each person’s share?  

7. **Coastal communities** What percent of Canadians live in coastal communities?  

8. **Identifying people** Verification systems based on hand geometry have been developed to identify people. These systems are suited for applications that do not require extreme security.  
   a) How do these systems use hand measurements to identify people?  
   b) Where could these systems be used?  

9. **Renewable energy** a) What percent of Canadian energy comes from renewable sources, such as solar and wind power?  
   b) What is the projected percent increase in renewable energy use over the next 25 years?  
   c) What country produces the most wind energy? What is Canada’s wind energy production as a percent of that country’s wind energy production?  

10. **Canada** a) What percent of the world’s population lives in Canada?  
   b) What percent of the world’s energy consumption is used by Canadians?  

11. **Oil supply** a) Graph the actual or projected annual world oil production for every tenth year from 1950 to 2050.  
   b) On the same set of axes or in the same viewing window, graph the actual or projected annual world oil consumption for every tenth year from 1950 to 2050.  
   c) Use the data to decide if oil consumption is projected to exceed oil production before the year 2051.  

12. **Formulating problems** Write a problem using information from a data bank. Have a classmate locate the information and solve your problem.