Pluto Math Problems

On July 14, 2015, NASA's New Horizons spacecraft sped past Pluto–a destination that took nearly nine and a half years to reach–and collected scientific data along with images of the dwarf planet.

Through careful measurements of new images, scientists determined that Pluto is actually larger than previously thought: 2,370 kilometers in diameter.

Because of the orbital interactions between Pluto and its moon Charon, Pluto's mass is well known and understood (1.31×10^{22} kg). Having a more precise diameter gives scientists the ability to more accurately calculate Pluto's average density. This is important information for scientists because it helps them understand the composition of Pluto.

1. Find the radius(r) of Pluto.
   2,370 kilometers ÷ 2 = 1,185 km

2. Find the circumference of Pluto.
   $C = 2 \pi r = 7{,}446$ km

3. Find the surface area of Pluto.
   $SA = 4 \pi r^2 = 17{,}646{,}012$ km^2

4. Find the volume of Pluto.
   $4/3 \pi r^3 = 6{,}970{,}174{,}651$ km^3

5. Find the density of Pluto in kg/m^3.
   Convert volume in km^3 to m^3: $6{,}970{,}174{,}651 \times 1{,}000{,}000{,}000 = 6.970174651 \times 10^{18}$ m^3
   1.31×10^{22} kg / $6.970174651 \times 10^{18}$ m^3 = 1,879 kg/m^3

6. How does this new density calculation compare to the previous calculation when Pluto's diameter was thought to be 2,302 km?
   Pluto's density is 172 kg/m^3 less than previously thought.

7. Most rock has a density between 2,000-3,000 kg/m^3 and ice at very cold temperatures has a density of 927 kg/m^3. What can we conclude about Pluto's composition based on the new density measurement?
   The new density measurement tells us that Pluto is more icy than previously believed.