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AST 9: Homework 7

1] In the late 1700s the German astronomer Johann Bode published a book whose title translates (i'm told) to "Manual for Knowing the Starry Sky". He had a formula in it that he attributed to an earlier astronomer, Johann Titius. It seemed to predict where the orbits of the planets after Mercury should lie. If we number the planets by n, where Mercury is the first planet ($n = 1$), Venus the second ($n = 2$), etc., then the formula is

$$.4 + \left(\frac{3}{40}\right) \times 2^n$$

where the 0.4 is taken from the Sun-Mercury distance. This is called the Bode-Titius Rule. Calculate the predicted distances from this rule and complete the following table. (The "S-m (AU)" column is the known distance.)

Bode-Titius Rule

Planet	n	S-m (AU)	BT Rule
Mercury	1	0.39	.4
Venus	2	0.72	
Earth	3	1.0	
Mars	4	1.5	
???	5	???	
Jupiter	6	5.2	
Saturn	7	9.5	
Uranus	8	19.2	
Neptune	9	30.1	

The line with the question marks in it was a puzzle for Bode. He said "After Mars there follows a space ... in which no planet has yet been seen. Can one believe that the Founder of the universe had left this space empty?" What do we now think this space represents? Is there a significant disagreement with the predicted and the known distances anywhere else on the table?

Translate the column heading "S-m (AU)" above into plain English (see HW3).

2] The title of a scientific paper says "A lower limit of 9.5 Gyr on the age of the Galactic disk." Translate this into plain English.

3] What are the reasons to believe in the theory that our solar-system formed out of a giant dust and gas cloud?

4] Which of the planets are likely to have hard surfaces?

5] The earth is the only planet that can support life because it is the only one with an atmosphere. True or false? Why?

6] Which of these is the best estimate we now have of the number of possible solar systems in the Universe: 0, 1, a million, a billion, a billion-billion? Why?

7] Have we sent missions to explore the outermost parts of the solar system? How were the fuel considerations dealt with?