

**Is Pluto a Planet?**

#1. Enter the position number into L1 and the distance from the sun into L2. If you were to fit a linear model to this data, what you expect to see in the residuals?

	Position Number	Distance from Sun (million miles)	Length of Year (earth years)
Mercury	1	36	0.24
Venus	2	67	0.61
Earth	3	93	1.00
Mars	4	142	1.88
Jupiter	5	484	11.86
Saturn	6	887	29.46
Uranus	7	1784	84.07
Neptune	8	2796	164.82
Pluto	9	3666	247.68

#2. Straighten the data and fit a linear model to the straightened data. Does the original data follow an exponential model or a power model? Write the LSRL and  $r^2$  for the best model.

#3. Comment on how well your model fits the data (residuals,  $r^2$ ).

#4. What are the largest residuals and which planets do they correspond to?

#5. Do these residuals indicate actual difference in distance from the sun?

#6. Now delete Pluto from L1 and L2. Re-straighten the data and fit a line to the straightened data. Write the LSRL and  $r^2$  for your model.

#7. Predict how far Pluto should be from the sun, using this model (don't forget to undo the log). Do you think Pluto is a planet according to this result? Why or why not?

#8. The asteroid belt between Mars and Jupiter may be the remnants of a failed planet. If so, Jupiter is in position 6, Saturn is in 7 and so on. Re-number the planets but leave Pluto out of the list, and re-straighten the data, then re-fit your model and write down the LSRL and  $r^2$  for your model. Is this a better model for the planets other than Pluto?

#9. With this latest model, predict how far Pluto should be from the sun. Now, do you think Pluto is a planet?

#10. Go back to the original planet data (no asteroid belt, and leave Pluto removed). (The LSRL for this data is your answer for #6.) In 2002, astronomers discovered a new large body that could possibly be a planet, called Quaoar. Quaoar is about 4 billion (4000 million miles) from the sun. do you think it's a better candidate for the 9<sup>th</sup> planet than Pluto? Why or why not?

#11. **World Population**

(a) Straighten the data shown in the table. Does the data follow an exponential or power model (check original data and both models)? Write out the LSRL and justify your decision (you must use residual plots).

Year	Population (millions)
1950	2519
1955	2755
1960	3020
1965	3334
1970	3691
1975	4066
1980	4430
1985	4825
1990	5255
1995	5662
2000	6057

Original data

Exponential Model

Power Model

Best LSRL:

(b) Using the best model, find the predicted world population for 2005.