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Lab 1

The goal of this lab is to estimate the mass of Jupiter using gathered data on orbital properties of different moons of Jupiter. The semi-major axises and orbital periods of 19 moons were implemented to find the moons' T^2 vs. R^3 graph. Using the points on these graphs, the line of best fit is calculated and then used to calculate an estimate of the mass of Jupiter with the reduced version of Kepler's third law.

Data of Moons

	A	B	C	D	E	F	G
1	Name	Semimajor(km)	Orbital Period (days)	meters	seconds	R^3	T^2
2	Ganymede	1,070,412	7.15455296	1070412000		618153.3757	9.24836E+13	53408451664
3	Callisto	1,882,709	16.6890184	1882709000		1441931.19	6.67344E+27	2.07917E+12
4	Io	421,700	1.769137786	421700000		152853.5047	7.49913E+25	23364193902
5	Europa	671,034	3.551181041	671034000		306822.0419	3.02158E+26	94139765422
6	Metis	127,690	0.29479167	127690000		25470.00029	2.08195E+24	648720914.7
7	Adrastea	129,000	0.29826389	129000000		25770.0001	2.14669E+24	664092904.9
8	Amalthea	181,366	0.49818287	181366000		43042.99997	5.96579E+24	1852699846
9	Thebe	221,889	0.67450231	221889000		58276.99958	1.09246E+25	3396208681
10	Themisto	7,393,216	129.87	7393216000		11220768	4.04111E+29	1.25906E+14
11	Leda	11,187,781	241.75	11187781000		20887200	1.40033E+30	4.36275E+14
12	Himalia	11,451,971	250.37	11451971000		21631968	1.5019E+30	4.67942E+14
13	Lysithea	11,740,560	259.89	11740560000		22454496	1.61833E+30	5.04204E+14
14	Elara	11,778,034	261.14	11778034000		22562496	1.63387E+30	5.09066E+14
15	Dia	12,570,424	287.93	12570424000		24877152	1.98632E+30	6.18873E+14
16	Carpo	17,144,873	458.62	17144873000		39624768	5.03968E+30	1.57012E+15
17	Thelxinoe	20,453,753	597.61	20453753000		51633504	8.55695E+30	2.66602E+15
18	Euanthe	20,464,854	598.09	20464854000		51674976	8.57089E+30	2.6703E+15
19	Helike	20,540,266	601.4	20540266000		51960960	8.66599E+30	2.69994E+15
20	Orthosie	20,567,971	602.62	20567971000		52066368	8.7011E+30	2.71091E+15
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CITED: Wikipedia. 2020. *List Of Jupiter's Moons*. [online] Available at: <https://simple.wikipedia.org/wiki/List_of_Jupiter%27s_moons> [Accessed 24 November 2020].

T2 x R3 Graph (19 Moons)
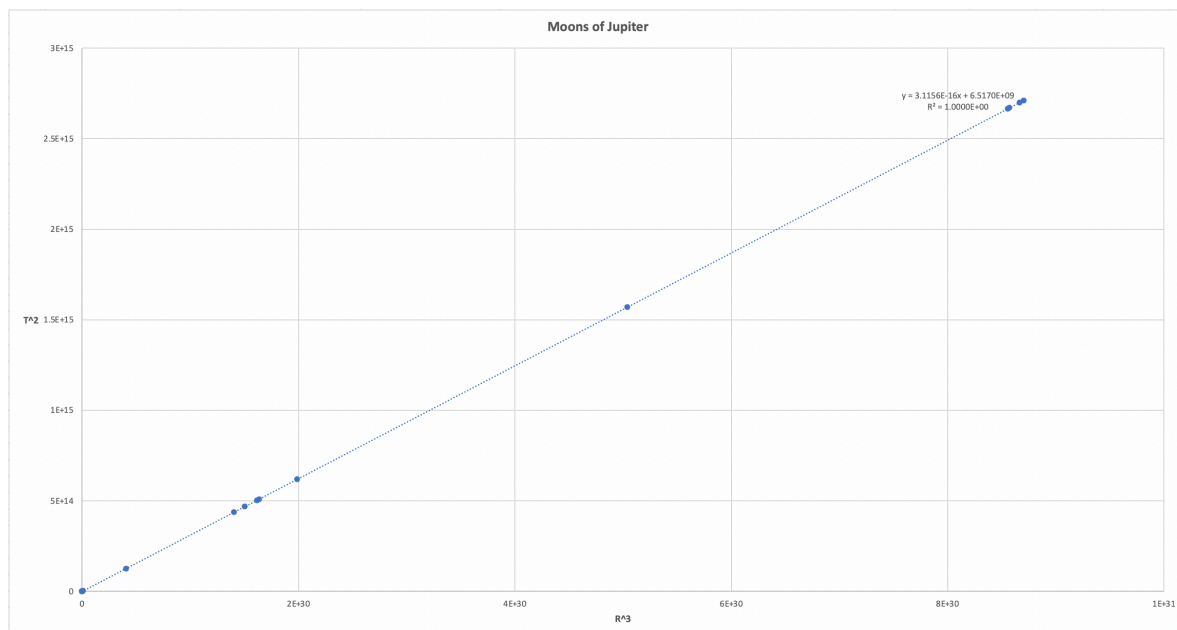
T2 x R3 Graph (Galileo's Moons)

Galileo's Moons

$y = 3.0864E\text{-}16x + 1.8505E\text{+}10$
$R^2 = 9.9939E\text{-}01$
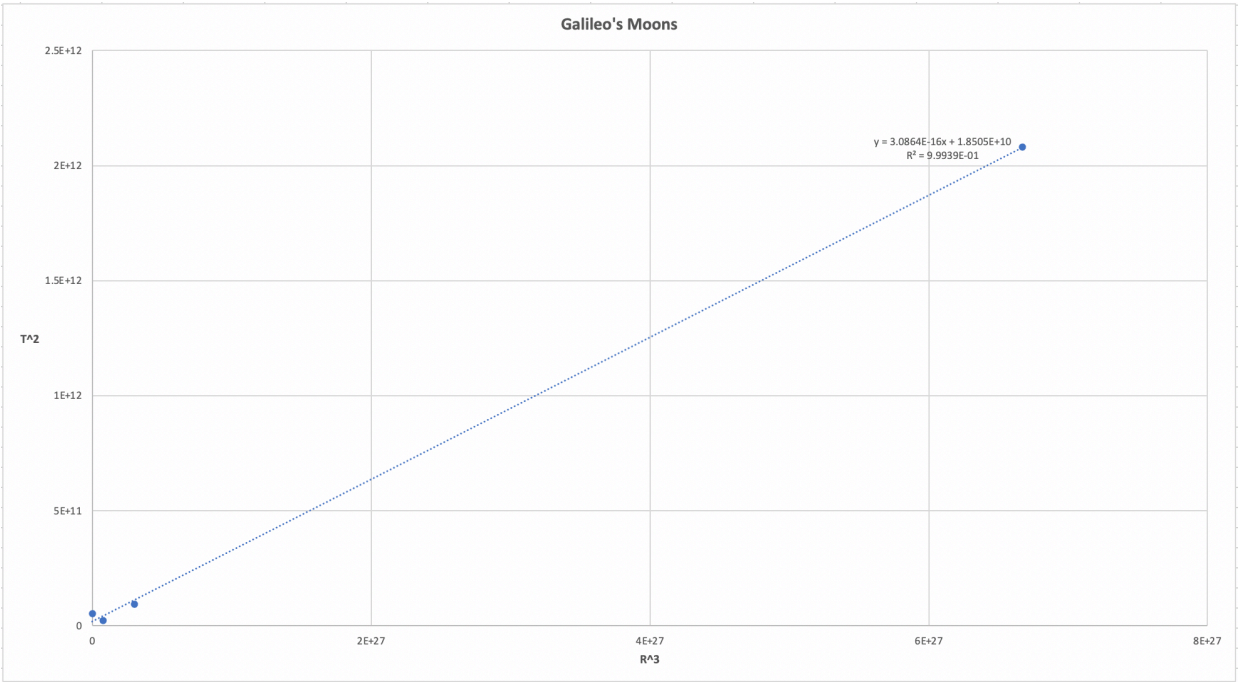
Estimates of Jupiter's Mass

Multiple Moons $y = 3.1156E-16x + 2.1135E+09$

$$\frac{4\pi^2}{GM} = 3.1156E-16$$

$$M = \frac{4\pi^2 / (3.1156E-16)}{6.674 \times 10^{-11} \; m^3 kg^{-1} s^{-2}}$$

$$M = 1.898592842216161 \; e+27 \; kg$$
estimated mass of Jupiter

The estimated mass of Jupiter using the slope of fitted-line and *19 of Jupiter's moons*
= **1.89859 E+27 kg**

Galileo's Moons $y = 3.0864 E-16x + 1.8505 E+10$

$$\frac{4\pi^2}{GM} = 3.0864 E-16$$

$$M = \frac{4\pi^2 / (3.0864E-16}{6.674 \times 10^{-11} \; m^3 kg^{-1} s^{-2}}$$

$$M = 1.91655516433660I4 \; e+27 \; kg$$
estimated mass of Jupiter

The estimated mass of Jupiter using the slope of fitted-line and *Galileo's moons*
= **1.91655 E+27 kg**

When compared to the established mass of Jupiter, 1.899 E+27 kg, both of my estimates fall relatively close. However, my estimated using 19 moons is closer to the established mass rather than Galileo's moon estimate. I believe this is because I used a variety of larger and smaller moons.

Citations

Wikipedia. 2020. *List Of Jupiter's Moons*. [online] Available at: <https://simple.wikipedia.org/wiki/List_of_Jupiter%27s_moons> [Accessed 24 November 2020].