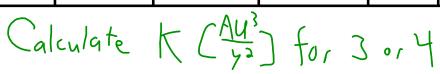
**Law Three** 

Data from different sources varies so references were included below the following table. (4~5 sig figs)

Name	Average radius (m)	Mass (kg)	Mean Orbital Radius (m)	Period(days)	Orbital radius (AU)	Period (years)
Sun	696.0 x 10 <sup>6</sup>	1.991 x 10 <sup>30</sup>				
Mercury	2.43 x 10 <sup>6</sup>	3.2 x 10 <sup>23</sup>	5.80 x 10 <sup>10</sup>	87.77	0.388	0.240
Venus	6.073 x 10 <sup>6</sup>	4.88 x 10 <sup>24</sup>	1.081 x 10 <sup>11</sup>	224.70	0.723	0.615
Earth	6.3713 x 10 <sup>6</sup>	5.979 x 10 <sup>24</sup>	1.4957 x 10 <sup>11</sup>	365.25	1.000	1.000
Mars	3.38 x 10 <sup>6</sup>	6.42 x 10 <sup>23</sup>	2.278 x 10 <sup>11</sup>	686.98	1.523	1.881
Jupiter	69.8 x 10 <sup>6</sup>	1.901 x 10 <sup>27</sup>	7.781 x 10 <sup>11</sup>	4332.62	5.202	11.862
Saturn	58.2 x 10 <sup>6</sup>	5.68 x 10 <sup>26</sup>	1.427 x 10 <sup>12</sup>	10759.20	9.541	29.457
Uranus	23.5 x 10 <sup>6</sup>	8.68 x 10 <sup>25</sup>	2.870 x 10 <sup>12</sup>	30685	19.188	84.011
Neptune	22.7 x 10 <sup>6</sup>	1.03 x 10 <sup>26</sup>	4.500 x 10 <sup>12</sup>	60275.70	30.086	165.026
Pluto	1.15 x 10 <sup>6</sup>	1.2 x 10 <sup>22</sup>	5.9 x 10 <sup>12</sup>	90490.19	39.446	247.749



Q1. Use the data for Earth and Mars to illustrate Kepler's third law.

Replier's third law.

$$T_{E} = 365.25 \, d \qquad = \frac{1}{T_{E}^{3}} = \frac{1}{T_{M}^{3}}$$

$$T_{E} = 1.4957 \times 10^{11} \, m \qquad = \frac{1}{T_{E}^{3}} = \frac{1.4957 \times 10^{11} \, m}{(365.25 \, d)^{3}}$$

$$T_{M} = 686.98 \, d m \qquad = 2.50815 \times 10^{11} \, m$$

$$T_{M} = \frac{1}{T_{M}^{3}} = \frac{1.378 \times 10^{11} \, m}{(68698 \, d)^{3}} = 3.5047 \times 10^{3} \, m^{3} \, d^{3}$$

Q2. Use the data in the table to find the period of Neptune (referenced to Earth).

$$T_{E} = 365.25 d \qquad \frac{\Gamma_{E}}{T_{c}^{2}} = \frac{\Gamma_{N}^{3}}{T_{c}^{2}}$$

$$(\varepsilon = 1.4957 \times 10^{11} \text{ m} \qquad T_{N} = \sqrt{\frac{T_{E}^{2} \Gamma_{N}^{3}}{\Gamma_{c}^{2}}}$$

$$T_{N} = \sqrt{\frac{365.25 \text{ d}}{(1.4952 \times 10^{11} \text{ n})^{3}}} = 60275.70 \text{ d}$$

Q3. Use the data in the table to find the period of Pluto (referenced to the Earth).

Q4. Complete the AU and year columns in the table for the remaining planets.

AU = astronomical unit

ratio = 
$$\frac{\Gamma_{body}}{\Gamma_{Earth}}$$
 ratio =  $\frac{\Gamma_{body}}{\Gamma_{Earth}}$