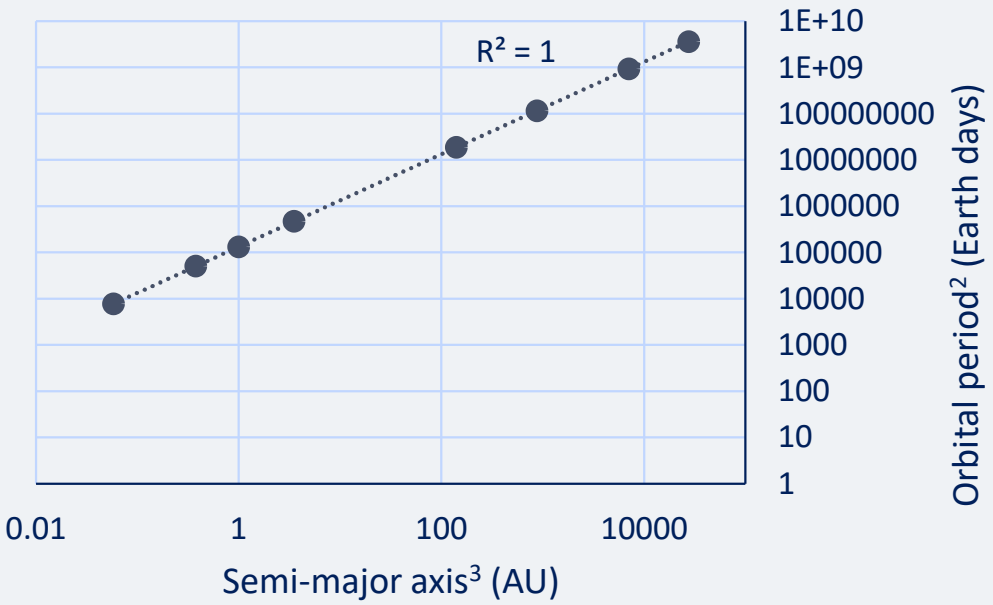
KEPLER'S LAWS ANSWERS

TASK 1: INVESTIGATE KEPLER'S 3RD LAW



- *The data points plot in a straight line.*
- *The line of best fit has an R^2 value of 1. This tells us there is a strong relationship between the 2 variables.*
- *The squares of the orbital periods are directly proportional to the cubes of the semi-major axis.*

TASK 2: APPLY KEPLER'S 3RD LAW

$$T^2 = \frac{4\pi^2}{GM} a^3$$

T = orbital period
a = semi-major axis
G = gravitational constant (G = 6.67 x 10^{-11} m^3 $kg^{-1}s^{-2}$)
M = mass of the Sun

Rearrange the equation to make M the subject:

Step 1

Divide both sides by a^3

$$\frac{T^2}{a^3} = \frac{4\pi^2}{GM}$$

Step 2

Multiply both sides by M

$$M\left(\frac{T^2}{a^3}\right) = \frac{4\pi^2}{G}$$

Step 3

Divide both sides by $\left(\frac{T^2}{a^3}\right)$

$$M = \frac{4\pi^2 a^3}{G\,T^2}$$

Work out the value of M. Express your value to 3 significant figures, using scientific notation:

	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Calculated value of M (kg)	1.99×10^{30}	1.98×10^{30}	1.99×10^{30}	1.98×10^{30}	1.98×10^{30}	2.01×10^{30}	1.99×10^{30}	2.01×10^{30}

The true mass of the Sun is $1.989 \times 10^{30}\ kg$.
All your values for M should be relatively similar and close to this value