

- 9 The table below shows information about four of the moons of the planet Jupiter. The semi-major axis is the greatest distance that each moon reaches from the centre of its orbit around Jupiter. The orbital period is the time in Earth days that it takes to orbit the planet.

Moon	Semi-major axis (km)	Orbital period (Earth days)
Io	421 800	1.7627
Europa	671 100	3.5255
Ganymede	1 070 400	7.1556
Callisto	1 882 700	16.690

A student uses the equation $T = kd^n$ to model the orbital period of Jupiter's moons, where T is the orbital period in Earth days, d is the semi-major axis in km, and k and n are constants.

- (a) Show that the equation $T = kd^n$ can be rewritten in the form $\log_{10} T = \log_{10} k + n \log_{10} d$. [1]

The student uses graph drawing software to plot $\log_{10} T$ against $\log_{10} d$. They find that the line of best fit for the data has gradient 1.504 and intercepts the $\log_{10} T$ axis at -8.215 .

- (b) Determine values of k and n that are consistent with this information. [3]

The student uses their equation to predict the orbital period for another moon of Jupiter called Thebe which has a semi-major axis of 221 900 km. They look up the value in an online encyclopedia and find it is 0.6761 Earth days.

- (c) Comment on the suitability of the student's equation to model the orbital period of Thebe. [2]