

Module 7: Developing the personal maths skills of teachers and assessors

Developmental task

Number

Academic context

The solar system

Eight planets rotate the Sun in our solar system – our Earth being the third planet from the Sun. The planets vary in size – the smallest, Mercury, has a radius of only 2 439 km, whereas the largest planet, Jupiter, has a radius more than 70 000 km at its equator.

1. Using the data sheet and the formulae below, calculate the diameter and mass of each planet relative to the Earth. State any assumptions you've made in your calculations.
2. The speed of light is approximately 300 000 km/s. Use this to compare how long it takes light to travel from each of the planets to an observatory on Earth. State any assumptions that you've made.

Data sheet

	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune
Mean Distance from Sun (AU*)	0.3871	0.7233	1	1.524	5.203	9.539	19.19	30.06
Sidereal period of orbit (years)	0.24	0.62	1	1.88	11.86	29.46	84.01	164.79
Mean Orbital Velocity (km/sec)	47.89	35.04	29.79	24.14	13.06	9.64	6.81	5.43
Orbital Eccentricity	0.206	0.007	0.017	0.093	0.048	0.056	0.046	0.010
Inclination to ecliptic (degrees)	7.00	3.40	0	1.85	1.30	2.49	0.77	1.77
Equatorial Radius (km)	2439	6052	6378	3397	71490	60268	25559	25269
Polar Radius (km)	same	same	6357	3380	66854	54360	24973	24340
Mass of planet (Earth=1)	0.06	0.82	1	0.11	317.89	95.18	14.53	17.14
Mean density (g/cm ³)	5.43	5.25	5.52	3.95	1.33	0.69	1.29	1.64
Body rotation period (hours)	1408	5832	23.93	24.62	9.92	10.66	17.24	16.11
Tilt of equator to orbit (degrees)	2	177.3	23.45	25.19	3.12	26.73	97.86	29.6
Number of observed satellites	0	0	1	2	>28	30	24	8

(*AU = Astronomical Units. One AU = 1.5×10^8 km)

Useful formulae:

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$