





















**Q7 (a)** Assuming the planets are in circular motion around the Sun, with radius  $R$  and period  $T$ , use the data in Table 7.1 to test, graphically, the hypothesis that  $T$  is proportional to  $R^\alpha$ , where  $\alpha$  is a constant. Obtain from the graph:

- (i) a value for  $\alpha$  and give its accuracy
- (ii) the constant of proportionality in SI units

[10]

PLANET	$R / 10^8 \text{ km}$	$T / \text{days}$
Earth	1.49	365
Mars	2.28	687
Jupiter	7.78	4333
Uranus	28.7	30690

Table 7.1

- (b) (i) Derive, using mechanics, the relation between  $T$  and  $R$  in terms of the mass of the Sun,  $M_S$ .
- (ii) Determine  $M_S$  using the data in (a).
- (iii) The distance of the Moon from the Earth is  $3.8 \times 10^5 \text{ km}$  and its period is 27.3 days. Deduce the ratio  $(M_S/M_E)$ , where  $M_E$  is the mass of the Earth.

[10]