3 **(a)** Define *gravitational field strength*.

……………………………………………………………………………2025 JC2 Preliminary Examination…………………

……………………………………………………………………………..................... [1]

(b) Explain why for a satellite in orbit around a planet, the gravitational field strength *g* at the position of the satellite must have the same magnitude and direction as the centripetal acceleration *a* of the satellite.

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……………………………………………………………………………..................... [2]

(c) At a distance r away from the centre of a planet X, the gravitational field strength due to the planet is given by g.

It is given that g obeys the inverse square law, where $g \propto \dfrac{1}{r^2}$.
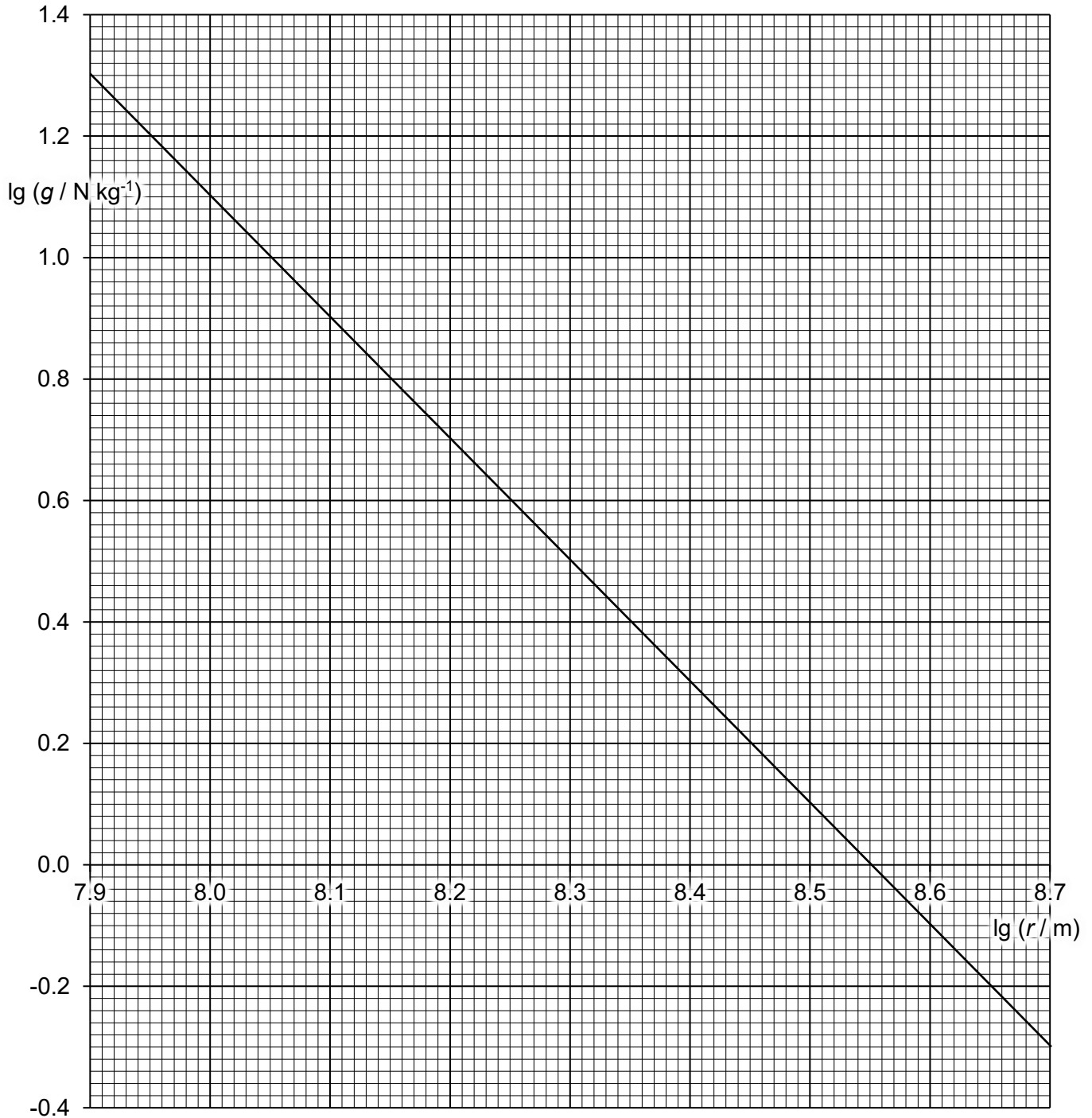
Fig. 3.1 shows the variation with lg r of lg g.

Fig. 3.1

(i) Use data from Fig. 3.1 to show that the gravitational field strength of the planet obeys the inverse square law.

[2]

(ii) A satellite is in an orbit of radius 4.18×10^8 m around the planet.

Using Fig. 3.1, determine the speed of the satellite.

speed = …………..……… m s^{-1} [3]

(iii) Another planet Y has a smaller mass than planet X.

On Fig. 3.1, sketch the graph for planet Y.

[1]