2 (a) State the relationship between gravitational potential and gravitational field strength.

....

....

.... [2]

(b) A moon of mass M and radius R orbits a planet of mass $3M$ and radius $2R$. At a particular time, the distance between their centres is D, as shown in Fig. 2.1.
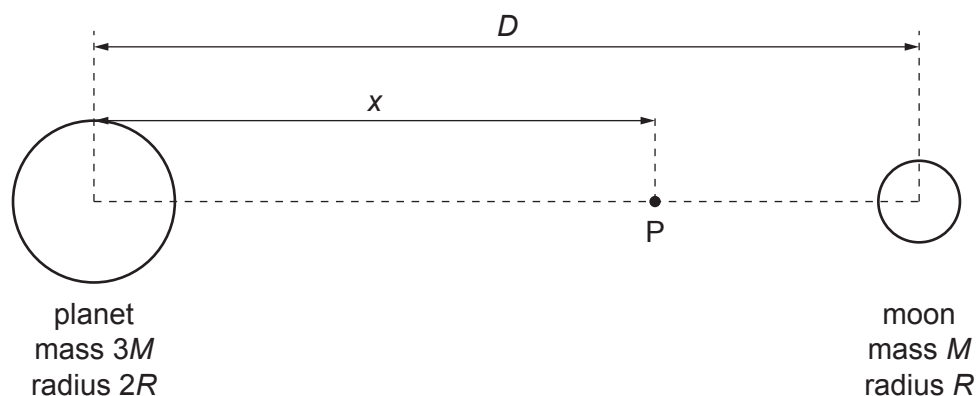

Fig. 2.1

Point P is a point along the line between the centres of the planet and the moon, at a variable distance x from the centre of the planet.

The variation with x of the gravitational potential ϕ at point P, for points between the planet and the moon, is shown in Fig. 2.2.
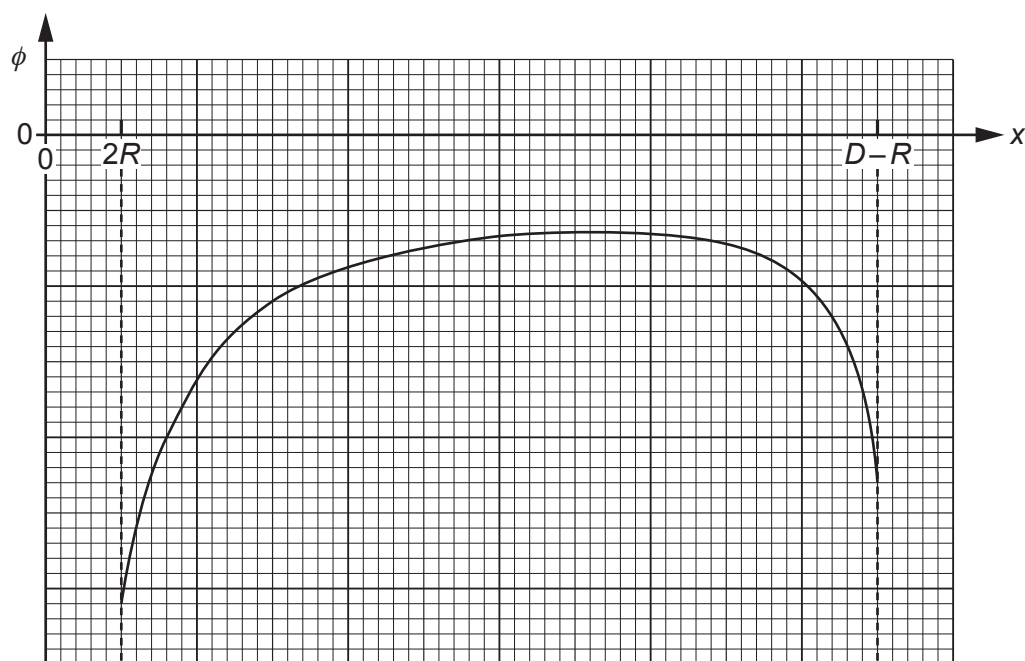

Fig. 2.2

(i) Explain why ϕ is negative throughout the entire range $x = 2R$ to $x = D - R$.

....

....

....

.... [3]

(ii) One of the features of Fig. 2.2 is that ϕ is negative throughout.

Describe **two** other features of Fig. 2.2.

1. ....

....

2. ....

....
[2]

(iii) On Fig. 2.3, sketch the variation with x of the gravitational field strength g at point P between $x = 2R$ and $x = D - R$.
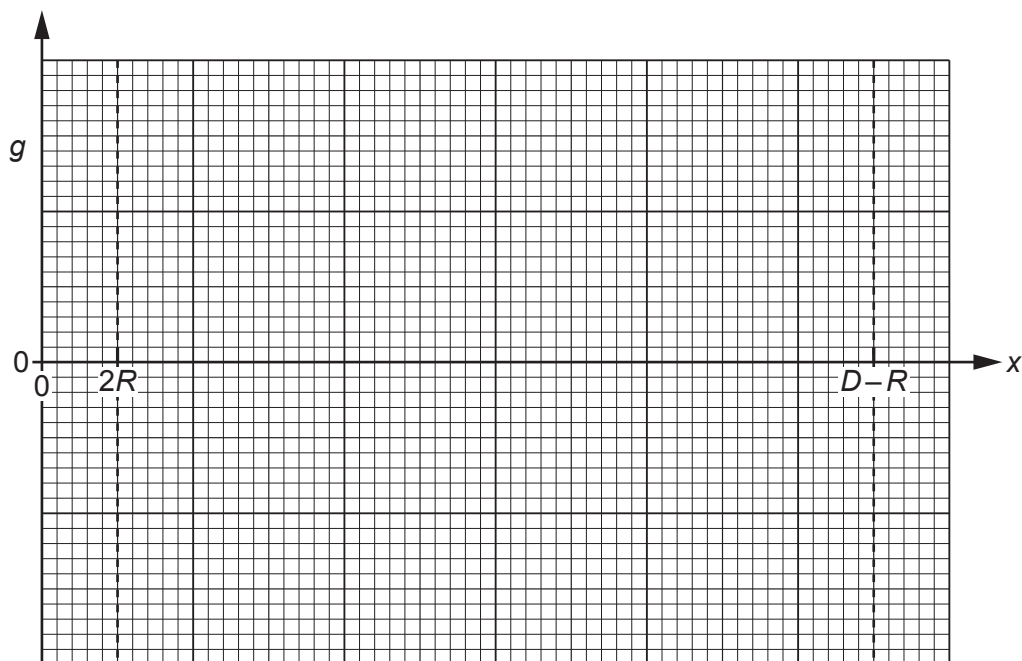

Fig. 2.3

[3]