4 **(a)** Derive, from Newton's law of gravitation and the definition of gravitational field strength, an expression for the gravitational field strength g at a distance r from a point mass M.

[1]

(b) A satellite is in a circular orbit about the Earth with a period of 110 minutes.

For this satellite, the Earth may be considered to be a point mass of 6.0×10^{24} kg situated at its centre.

Determine the gravitational field strength g at the location of the satellite. Show your working.

g = ... $N kg^{-1}$ [4]

(c) Explain why, near the surface of the Earth, the gravitational field strength is equal to the acceleration of free fall.

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..... [3]

[Total: 8]