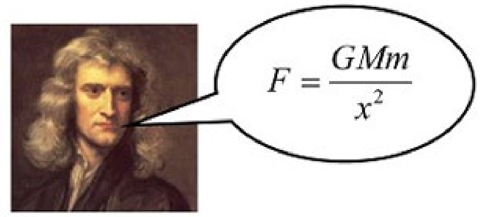
To Infinity and Beyond!



Newton's law of universal gravitation states that
every particle attracts every other particle in the universe
with a force that is directly proportional
to the product of their masses and inversely proportional

We know that the force $F(x)$ on a satellite varies with its distance x from the center of the earth according to

$F(x) = \frac{GMm}{x^2}$, where G is the gravitational constant, i.e., $G = 6.67 \cdot 10^{-11}$ Newtons kg^{-2}m^2,
M is the mass of the earth in kg, i.e., $M = 5.97 \cdot 10^{24}$ kg,
m is the mass of the satellite in kg, and x is the distance in meters between them.

a. As a satellite is lifted off into space and x increases, think about what the graph of $F(x)$ would look like.

i. Make a sketch.

Recall F is the weight of the satellite when it is x meters from the center of the earth.

ii. Suppose a satellite is at the **surface of the earth**. Assume the radius of the earth is $R = 6.371 \cdot 10^6$ m. Calculate the gravitational force, in Newtons, acting on the satellite at the earth's surface.

Report as a multiple of the mass m (in kg) of the satellite.
Round your value in the box to **two** decimal places.

$F \approx$ [ ] $\cdot\, m$ Newtons

iii. Calculate the gravitational force, in Newtons, acting on a satellite when it is an altitude of $d = 1.48 \cdot 10^6$ m above the earth's surface.

Report as a multiple of the mass m (in kg) of the satellite.
Round your value in the box to **two** decimal places

$F \approx$ [ ] $\cdot\, m$ Newtons

b. Set up the integral and evaluate it to find the work required, in Joules, to lift a 1325-kg satellite from the earth's surface to an altitude of $d = 1.48 \cdot 10^6$ m above the earth's surface.
(Round to two decimal places.)

c. Set up the integral and evaluate it to find the work required, in Joules, to lift a 1325-kg satellite from the earth's surface to *outer space*. Use correct limit notation.
(Round to two decimal places.)