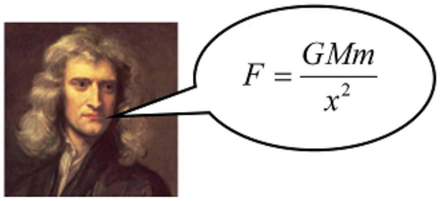
To Infinity and Beyond!

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 to the square of the distance between their centers.



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,
what does the graph of $F(x)$ look like?
Recall F is the weight of the satellite
when it is x meters from the center of the earth.

b. Suppose a satellite is at the surface of the earth. Assume the radius of the earth is $R = 6.371 \cdot 10^6$ m.
What is the gravitational force, in Newtons, of the satellite at this value of x?
Report as a multiple of the mass (in kg) of the satellite.
Round your value in the box to <u>**two**</u> decimal places.

F = (mass of satellite) · [ ] Newtons

c. Report the gravitational force on a satellite when it is at an altitude of $d = 1.48 \cdot 10^6$ m above the earth's surface. Report as a multiple of the mass (in kg) of the satellite.
Round your value in the box to <u>**two**</u> decimal places.

F = (mass of satellite) · [ ] Newtons

d. Report the work required 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.)

e. Report the work required to lift a 1325-kg satellite from the earth's surface to *outer space*.
(Round to two decimal places.)