**Gravity**

1. Any two objects attract each other with a force that is proportional to the square of the distance between them.
   
a) Pick any two objects.
   
b) So if the distance between two objects is doubled, the gravitational force between them decreases by a factor of 4.
   
c) So if the distance between two objects is tripled, the gravitational force between them decreases by a factor of 9.
   
d) So if the distance between two objects is quadrupled, the gravitational force between them decreases by a factor of 16.
   
e) So if the distance between the two objects is halved, the gravitational force between them increases by a factor of 4.
   
f) This is an example of an inverse square law - they are very common in Physics.

f) Now keep the distance fixed and vary the mass of the two objects.

  
g) If the mass of one object is doubled, but the distance between the two objects is kept fixed, the gravitational force between them increases by a factor of two.
   
h) If the mass of one object is tripled, but the distance between the two objects is kept fixed, the gravitational force between them increases by a factor of three.
   
i) If the mass of both objects is doubled, but the distance between the two objects is kept fixed, the gravitational force between them increases by a factor of four.
   
j) If the mass of one object is doubled, the mass of the other object is tripled, but the distance between them is kept fixed, the gravitational force between the two objects goes up by a factor of six.
   
k) If the mass of one object is tripled, the mass of the other object is quadrupled, but the distance between them is kept fixed, the gravitational force between the two objects goes up by a factor of 12.

l) This is is expressed in the formula

\[ F = \frac{GM_1M_2}{R^2}, \]

where \(M_1, M_2\) are the two masses, \(R\) is the distance between the two objects and \(G\) is a constant, the gravitational constant, one of the most fundamental constants in nature.

m) Mass is measured in kilograms, \(R\) in meters and the force is measured in Newtons, \(mkg/s^2\).

**Questions**

1) If the distance between two objects is tripled, what happens to the gravitational force between them?

2) If the distance between two objects increases by a factor of five, what happens to the gravitational force between them?

3) If the distance between two objects increases by a factor of 4 and the mass of one object is doubled, what happens to the gravitational force between them?
4) If the distance between two objects increases by a factor of 10 and the mass of one object increases by a factor 5 and the mass of the other object increases by a factor of 10, what happens to the gravitational force between them?