Question:

If you triple the distance between two objects without changing the mass of either, the gravitational force of the two objects will be what percentage of the gravitational force between the two objects before moving them?

Solution:

The gravitational force between two objects can be found with the following equation:

gravitational force = $G (m_1 * m_2) / (d^2)$,
where

- ***G*** is the gravitational constant: 6.67×10^{-11} $N*m^2/kg^2$,
- m_1 is the mass of the first object,
- m_2 is the mass of the second object, and
- ***d*** is the distance between the centers of the objects.

Let's keep things simple, and say that each object has a mass of 1 kilogram, and let's also say that, initially, the objects have a separation distance ***d*** of 1 meter. Thus, initially, m_1 = 1 kg, m_2 = 1 kg, and ***d*** = 1 m.

Initial Conditions:

initial gravitational force = $(6.67 \times 10^{-11} N*m^2/kg^2) (1 kg * 1 kg) / [(1 m)^2]$
initial gravitational force = 6.67×10^{-11} N

Now, let's triple the separation distance ***d*** between the two objects without changing the mass of either object. Thus, m_1 = 1 kg, m_2 = 1 kg, and ***d*** = 3 m.

Final Conditions:

final gravitational force = $(6.67 \times 10^{-11} N*m^2/kg^2) (1 kg * 1 kg) / [(3 m)^2]$
final gravitational force = **$(6.67 \times 10^{-11} N) / 9$**
final gravitational force = 7.41×10^{-12} N

To find the percentage of the gravitational force between the two objects before moving them, we need to take the final gravitational force and divide it by the initial gravitational force (the numbers in red above), and finally multiply by 100.

percentage = (final gravitational force / initial gravitational force) x 100
percentage = $(7.41 \times 10^{-12} N / 6.67 \times 10^{-11} N) \times 100$
percentage = 11.11 %