QUIZ 9

1. Three identical very small 50 - kg masses are held at the corners of an equilateral triangle, 30 cm on each side. If you double the separation between the particles, how much work is done (a) by the gravitational force between the particles and (b) by you? \((G = 6.67 \times 10^{-11} N \cdot m^2/kg^2)\)

All particles have the same mass \(m = 50 \text{ kg}\) and the same mutual distance \(r = 0.3 \text{ m}\), therefore the initial and final gravitational potential energies are:

\[
U_i = -G \frac{m \times m}{r} - G \frac{m \times m}{r} - G \frac{m \times m}{r} = -3G \frac{m^2}{r}
\]

\[
U_f = -G \frac{m \times m}{2r} - G \frac{m \times m}{2r} - G \frac{m \times m}{2r} = -3G \frac{m^2}{2r}
\]

\[
\Delta U = U_f - U_i = -3G \frac{m^2}{2r} + 3G \frac{m^2}{r} = 3G \frac{m^2}{2r} = 3 \times 6.67 \times 10^{-11} N \cdot m^2/kg^2 \times (50 \text{ kg})^2 = 8.34 \times 10^{-7} J
\]

\(a)\) \(W_g = -\Delta U = -8.34 \times 10^{-7} J\)

\(b)\) \(W_{you} = \Delta U = 8.34 \times 10^{-7} J\)