

Newton's law of gravitation:

$$F = G \frac{m_1 m_2}{r^2}$$

We compare the gravitational force exerted on a baby by an OB/GYN holding the baby at arm's length with the force exerted by Jupiter on the same baby. When taking the ratio, the baby's mass cancels:

$$\frac{F_J}{F_D} = \frac{M_J/r_J^2}{M_D/r_D^2} = \frac{M_J}{M_D} \left(\frac{r_D}{r_J} \right)^2$$

Assumed values:

$$M_D = 80 \text{ kg} \quad m_b = 3.5 \text{ kg} \quad r_D = 0.60 \text{ m}$$
$$M_J = 1.898 \times 10^{27} \text{ kg}$$

Earth-Jupiter distance:

$$r_J = 6.28 \times 10^{11} \text{ m} \quad (\text{closest})$$

$$r_J = 9.28 \times 10^{11} \text{ m} \quad (\text{farthest})$$

OB/GYN-baby gravitational force:

$$F_D = G \frac{(80)(3.5)}{(0.60)^2} \approx 5.2 \times 10^{-8} \text{ N}$$

Jupiter-baby gravitational force:

Closest approach:

$$F_J = G \frac{(1.898 \times 10^{27})(3.5)}{(6.28 \times 10^{11})^2} \approx 1.1 \times 10^{-6} \text{ N}$$

Farthest separation:

$$F_J \approx 5.2 \times 10^{-7} \text{ N}$$

Force comparison:

$$\left. \frac{F_J}{F_D} \right|_{\text{closest}} \approx \frac{1.1 \times 10^{-6}}{5.2 \times 10^{-8}} \approx 22$$

$$\left. \frac{F_J}{F_D} \right|_{\text{farthest}} \approx \frac{5.2 \times 10^{-7}}{5.2 \times 10^{-8}} \approx 10$$