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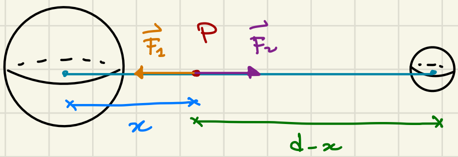

$M = 4{,}27 \cdot 10^{18}\ kg$

$m = 6{,}38 \cdot 10^{17}\ kg$

$d = 5{,}21 \cdot 10^{9}\ m$

Bonus Edoardo

Trova x in modo che $\vec{g}(P) = 0$

(1) Metto massa di prova in P. m_P

$$F_1 = G\frac{m_P \cdot M}{x^2} \qquad F_2 = G\frac{m_P \cdot m}{(d-x)^2}$$

$$F_{TOT} = -F_1 + F_2 = G m_P \left(\frac{m}{(d-x)^2} - \frac{M}{x^2}\right)$$

$$g(P) = \frac{F_{TOT}}{m_P} = G\left(\frac{m}{(d-x)^2} - \frac{M}{x^2}\right)$$

Lo pongo $=0$ poiché è la richiesta del problema e risolvo.

$$\cancel{G}\left(\frac{m}{(d-x)^2} - \frac{M}{x^2}\right) = 0$$

$$x^2 m - d^2 M - x^2 M + 2dMx = 0$$

Raccolto e cambiato di segno.

$$x^2(M-m) - 2dMx + d^2M = 0$$

$$\frac{\Delta}{4} = d^2M^2 - d^2M(M-m) = \cancel{d^2M^2} - \cancel{d^2M^2} + d^2Mm \qquad \sqrt{\Delta/4} = d\sqrt{Mm}$$

$$x_{1/2} = \frac{dM \pm d\sqrt{Mm}}{M-m} = d\,\frac{M \pm \sqrt{Mm}}{M-m} = \dots \qquad 0 \le x \le d$$

$$= d\,\frac{M - \sqrt{Mm}}{M-m} \approx 3{,}76 \cdot 10^{9}\ m$$

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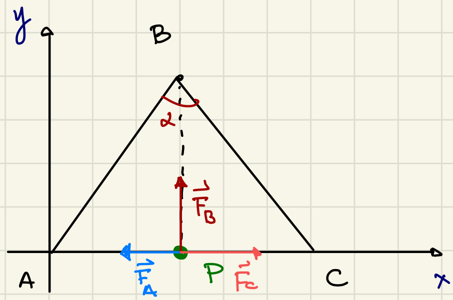

$m_A = 8,3 \; 10^4 \, kg$

$m_B = 2,1 \cdot 10^5 \, kg$

$m_C = 4,2 \cdot 10^4 \, kg$

$r_{BC} = r_{AB} = 372 \, km$

$\alpha = 40°$

$\vec{g}(P) = ?$

Metto massa di prova in P; la massa è m_P

$F_A = G \dfrac{m_P \cdot m_A}{r_{AP}^2}$ $\qquad g_A(P) = G \dfrac{m_A}{r_{AP}^2}$ $\qquad r_{AP} = r_{AB} \cdot \sin \dfrac{\alpha}{2}$

$F_B = G \dfrac{m_P \, m_B}{r_{PB}^2}$ $\qquad g_B(P) = G \dfrac{m_B}{r_{PB}^2}$ $\qquad r_{PB} = r_{AB} \cdot \cos \dfrac{\alpha}{2}$

$F_C = G \dfrac{m_P \cdot m_C}{r_{PC}^2}$ $\qquad g_C(P) = G \dfrac{m_C}{r_{AP}^2}$ $\qquad r_{PC} = r_{AP}$

$\vec{g}_A(P) = \left(-G \dfrac{m_A}{r_{AP}^2} \; ; \; 0 \right)$

$\vec{g}_B(P) = \left(0 \; ; \; G \dfrac{m_B}{r_{PB}^2} \right)$ $\qquad \vec{g}(P) = \vec{g}_A(P) + \vec{g}_B(P) + \vec{g}_C(P)$

$\vec{g}_C(P) = \left(G \dfrac{m_C}{r_{AP}^2} \; ; \; 0 \right)$

$\vec{g}(P) = G \left(\dfrac{m_C - m_A}{r_{AP}^2} \; ; \; \dfrac{m_B}{r_{PB}^2} \right) \approx (-1,69 \; ; \; 1,15) \; 10^{-16} \, \dfrac{m}{s^2}$

$g(P)^2 = g_x(P)^2 + g_y(P)^2 = \ldots \rightsquigarrow g(P) \approx 2,04 \cdot 10^{-16} \, \dfrac{m}{s^2}$