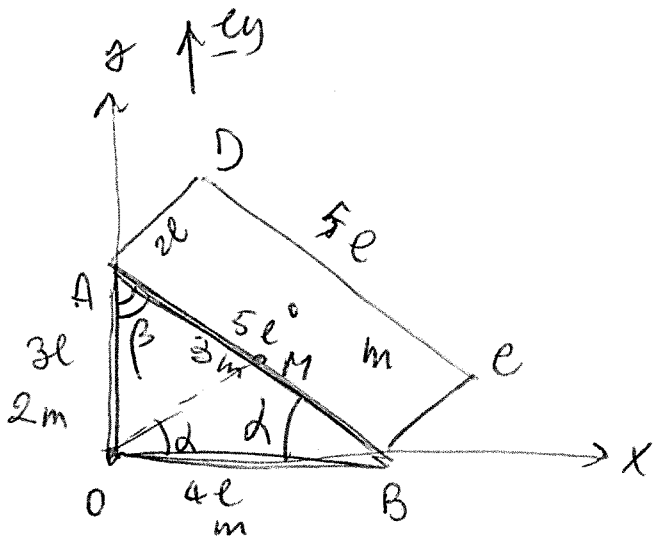


Es. 2



$$\sin \alpha = \frac{3}{5} = \sin \beta$$

$$\cos \alpha = \frac{4}{5} = \sin \beta$$

$$\begin{aligned} \underline{e}_{AB} &= -\cos \alpha \underline{e}_x + \sin \alpha \underline{e}_y \\ &= -\frac{4}{5} \underline{e}_x + \frac{3}{5} \underline{e}_y \end{aligned}$$

a) asta OA:
$$[\underline{I}_O^{OA}] = \begin{pmatrix} 6 & 0 \\ 0 & 0 \end{pmatrix} ml^2$$

([]_{2x2})

$$\frac{1}{3} 2m (3l)^2 = \frac{6}{3} ml^2$$

b) asta OB:
$$[\underline{I}_O^{OB}] = \begin{pmatrix} 0 & 0 \\ 0 & \frac{16}{3} \end{pmatrix} ml^2$$

$$\frac{1}{3} 4m (4l)^2 = \frac{16}{3} ml^2$$

c) asta AB:
$$[\underline{I}_O^{AB}] = \begin{pmatrix} 9 & -6 \\ -6 & 16 \end{pmatrix} ml^2$$

$$I_{xx} = \frac{1}{3} 3m (5l)^2 \sin^2 \alpha = \frac{25 \cdot 9}{3} ml^2$$

$$I_{yy} = \frac{1}{3} 3m (5l)^2 \sin^2 \beta = \frac{25 \cdot 16}{3} ml^2$$

$$I_{xy} = \underline{e}_x \cdot \underline{I}_O \underline{e}_y = \underline{e}_x \cdot \underline{I}_O \underline{e}_y + OM^2 \cdot 3m \underline{e}_x \cdot (\underline{1} - \underline{e}_{OM} \otimes \underline{e}_{OM})$$

$$OM^2 = \overline{MB}^2 = \left(\frac{5}{2}l\right)^2 = \frac{25}{4}l^2$$

$$\begin{aligned} \underline{e}_{OM} &= \cos \alpha \underline{e}_x + \sin \alpha \underline{e}_y \\ &= \frac{4}{5} \underline{e}_x + \frac{3}{5} \underline{e}_y \end{aligned}$$

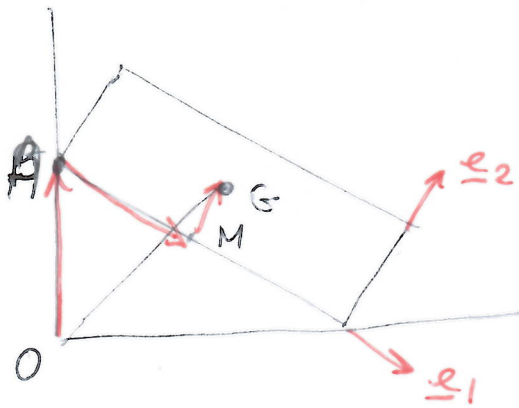
$$\underline{I}_G = \frac{1}{12} 3m (5l)^2 (\underline{1} - \underline{e}_{AB} \otimes \underline{e}_{AB})$$

$$I_{xy} = -\frac{25}{4} ml^2 (\underline{e}_{AB} \cdot \underline{e}_x)(\underline{e}_{AB} \cdot \underline{e}_y) - \frac{75}{4} ml^2 (\underline{e}_{OM} \cdot \underline{e}_x)(\underline{e}_{OM} \cdot \underline{e}_y) =$$

$$= \left[-\frac{28}{4} \left(-\frac{4}{5}\right) \left(+\frac{3}{5}\right) - \frac{75}{4} \left(\frac{4}{5}\right) \left(\frac{3}{5}\right) \right] ml^2 =$$

$$= (3 - 9) ml^2 = -6 ml^2$$

Rettagolo



$$\underline{e}_1 = \underline{e}_{AB} = \frac{4}{5} \underline{e}_x - \frac{3}{5} \underline{e}_y$$

$$\underline{e}_2 = \frac{3}{5} \underline{e}_x + \frac{4}{5} \underline{e}_y$$

$$\underline{G} - \underline{O} = (\underline{G} - \underline{M}) + (\underline{M} - \underline{A}) + (\underline{A} - \underline{O})$$

$$= l \frac{\underline{e}_2}{2} + \frac{5l}{2} \underline{e}_1 + 3l \underline{e}_y$$

$$x_G = \underline{e}_x \cdot (\underline{G} - \underline{O}) = \frac{5}{2} \cdot \frac{4}{5} l + l \frac{3}{5} = \frac{13}{5} l$$

$$y_G = \underline{e}_y \cdot (\underline{G} - \underline{O}) = \cancel{3l} l \cdot \frac{4}{5} + \frac{5l}{2} \left(-\frac{3}{5}\right) + 3l = \frac{8 - 15 + 30}{10} l = \frac{23l}{10}$$

$$d_{GO}^2 = x_G^2 + y_G^2 = \left(\left(\frac{26}{10}\right)^2 + \left(\frac{23}{10}\right)^2 \right) l^2 = (26^2 + 23^2) \frac{l^2}{100}$$

$$\underline{e}_{GO} = \frac{x_G}{d_{GO}} \underline{e}_x + \frac{y_G}{d_{GO}} \underline{e}_y$$

$$\underline{I}_{GO}^r = \underline{I}_G^r + m \cdot d_{GO}^2 \left(\frac{1}{m} - \underline{e}_{GO} \otimes \underline{e}_{GO} \right)$$

$$\underline{I}_G^r = \frac{1}{12} m (2l)^2 \underline{e}_1 \otimes \underline{e}_1 + \frac{1}{12} m (5l)^2 \underline{e}_2 \otimes \underline{e}_2 + \underline{I}_{zz} \underline{e}_3 \otimes \underline{e}_3$$

$$= \frac{1}{3} ml^2 \underline{e}_1 \otimes \underline{e}_1 + \frac{25}{12} ml^2 \underline{e}_2 \otimes \underline{e}_2 + \underline{I}_{zz} \underline{e}_3 \otimes \underline{e}_3$$

$$I_{xx} = \frac{1}{3} ml^2 (\underline{e}_1 \cdot \underline{e}_x)^2 + \frac{25}{12} ml^2 (\underline{e}_2 \cdot \underline{e}_x)^2 + m d_{GO}^2 (1 - (\underline{e}_{GO} \cdot \underline{e}_x)^2)$$

$$= \left(\frac{1}{3} \cdot \frac{16}{25} + \frac{25}{12} \cdot \frac{9}{75} \right) ml^2 + m d_{GO}^2 \left(1 - \frac{x_G^2}{d_{GO}^2} \right) =$$

$$= \left(\frac{16}{75} + \frac{3}{4} \right) ml^2 + m d_{GO}^2 \left(\frac{x_G^2 + y_G^2 - x_G^2}{d_{GO}^2} \right) = \left(\frac{16}{75} + \frac{3}{4} \right) ml^2 + m y_G^2$$

$$= \left(\frac{16}{75} + \frac{3}{4} + \frac{(23)^2}{100} \right) \text{ml}^2 = \text{ml}^2 \frac{64 + 225 + 1587}{300} = \frac{1876}{300} \text{ml}^2$$

$$= \frac{469}{75} \text{ml}^2$$

$$\begin{array}{r} 23 \times \\ 23 \\ \hline 69 \\ 46 \\ \hline 529 \end{array}$$

$$\begin{array}{r} 529 \times \\ 3 \\ \hline 1587 \end{array}$$

$$\begin{array}{r} 1587 \\ 225 \\ 64 \\ \hline 1876 \end{array}$$

$$\begin{array}{r} 1876 \mid 4 \\ 27 \mid 469 \\ 36 \end{array}$$

$$I_{yy} = \frac{1}{3} \text{ml}^2 (\underline{e}_2 \cdot \underline{e}_y)^2 + \frac{25}{12} \text{ml}^2 (\underline{e}_2 \cdot \underline{e}_y)^2 + m x_G^2$$

#

$$= \frac{616}{75} \text{ml}^2$$

$$I_{xz} = \frac{1}{3} \text{ml}^2 (\underline{e}_1 \cdot \underline{e}_x)(\underline{e}_1 \cdot \underline{e}_y) +$$

$$\frac{25}{12} \text{ml}^2 (\underline{e}_2 \cdot \underline{e}_x)(\underline{e}_2 \cdot \underline{e}_y) +$$

$$+ m d_{G0}^2 (-(\underline{e}_{G0} \cdot \underline{e}_x)(\underline{e}_{G0} \cdot \underline{e}_y)) = -m x_G y_G$$

$$= \left(\frac{1}{3} \cdot \frac{4}{5} \left(\frac{3}{5} \right) + \frac{25}{12} \left(\frac{3}{5} \right) \left(\frac{4}{5} \right) - m \frac{13}{5} \cdot \frac{23}{10} \right) \text{ml}^2 = -\frac{257}{50} \text{ml}^2$$

$$\frac{478}{300}$$

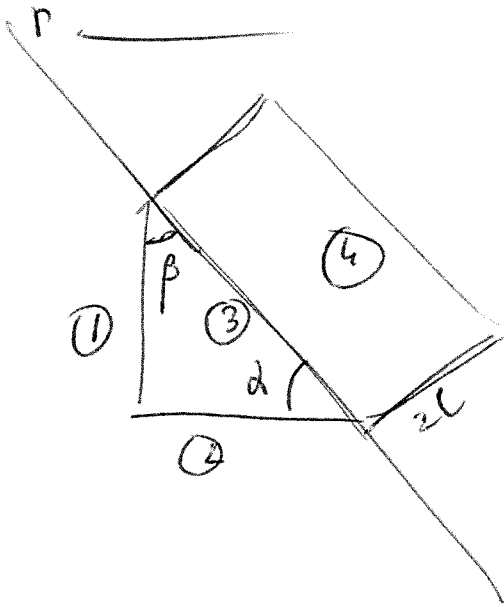
$$\frac{-24 + 150 - 897}{150} = -\frac{257}{50}$$

$$\begin{array}{r} 23 \\ 13 \\ \hline 69 \\ 23 \\ \hline 299 \end{array}$$

$$\begin{array}{r} 299 \times \\ 3 \\ \hline 897 \end{array}$$

$$\begin{array}{r} 747 \\ 24 \\ \hline 771 \mid 3 \\ 17 \mid 257 \end{array}$$

Punto 2



$$\begin{aligned}
 I_r &= \frac{1}{3} 2m (3l)^2 \sin^2 \beta + \\
 &\quad \frac{1}{3} m (4l)^2 \sin^2 \alpha + \\
 &\quad 0 + \\
 &\quad \frac{1}{3} m (2l)^2 = \\
 &= 6ml^2 \frac{16}{25} + \frac{16}{3} ml^2 \frac{9}{25} + 0 + \frac{4}{3} ml^2 \\
 &= \frac{288 + 144 + 100}{75} ml^2 = \frac{532}{75} ml^2
 \end{aligned}$$

$\begin{array}{r} 96x \\ 3 \\ \hline 288 \end{array}$	$\begin{array}{r} 16x \\ 9 \\ \hline 144 \end{array}$	$\begin{array}{r} 288 \\ 144 \\ 100 \\ \hline 532 \end{array}$
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Atto