

$$\begin{aligned} \textcircled{2} \quad & (2\vec{a} - 2\vec{b}) \cdot (3\vec{a} + \vec{b}) = \\ & = 6|\vec{a}|^2 - 6\vec{b} \cdot \vec{a} + 2\vec{a} \cdot \vec{b} - 2|\vec{b}|^2 = \\ & = 6 \cdot \frac{7}{4} - 2 \cdot \frac{1}{4} = \frac{21}{2} - \frac{1}{2} = \frac{20}{2} = 10 \end{aligned}$$

$$\begin{aligned} \text{b) } |\vec{a} - \vec{b}| &= \sqrt{(\vec{a} - \vec{b}) \cdot (\vec{a} - \vec{b})} = \\ &= \sqrt{|\vec{a}|^2 - 2\vec{a} \cdot \vec{b} + |\vec{b}|^2} = \\ &= \sqrt{\frac{7}{4} + \frac{1}{4}} = \sqrt{2} \end{aligned}$$

$$\varphi = 45^\circ$$

$$\cos \varphi = \frac{\vec{a} \cdot (\vec{a} - \vec{b})}{|\vec{a}| \cdot |\vec{a} - \vec{b}|} = \frac{|\vec{a}|^2 - \vec{a} \cdot \vec{b}}{|\vec{a}|^2 \cdot |\vec{a} - \vec{b}|} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\textcircled{3} \quad \vec{r}_T = \frac{1}{3}(\vec{r}_A + \vec{r}_B + \vec{r}_C) = \frac{1}{3}(3, 0, 0) = (1, 0, 0)$$

$$\begin{aligned} \text{a) } \underline{T(1, 0, 0)}, \quad d(T, D) &= |\vec{TD}| = |\vec{r}_D - \vec{r}_T| = \\ &= |(-3, 2, 4)| = \sqrt{9 + 4 + 16} = \sqrt{29} \end{aligned}$$

$$\begin{aligned} \text{b) } \vec{r} \perp \vec{r}_B &\Leftrightarrow \vec{r} \cdot \vec{r}_B = 0, (\Rightarrow) (x, 5, 1) \cdot (6, 6, 2) = 0 \\ &\Leftrightarrow 6x + 30 + 2 = 0 \Rightarrow 6x = -32, x = -\frac{16}{3} \end{aligned}$$

$$\begin{aligned} \text{c) } \vec{AM} &= 4\vec{AT} \\ \vec{r}_M - \vec{r}_A &= 4(\vec{r}_T - \vec{r}_A) \\ (x, y, z) - (-3, -2, 4) &= 4((1, 0, 0) - (-3, -2, 4)) \\ x + 3 &= 16 \Rightarrow x = 13 \\ y + 2 &= 8 \Rightarrow y = 6 \\ z - 4 &= -16 \Rightarrow z = -12 \Rightarrow \underline{M(13, 6, -12)} \end{aligned}$$

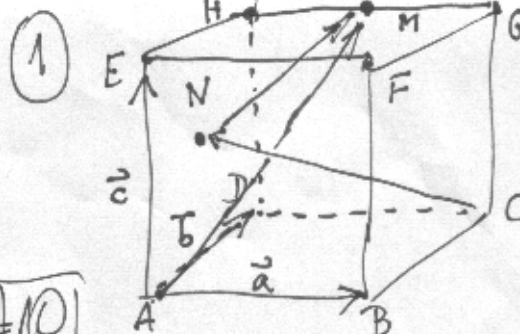
$$\begin{aligned} \textcircled{6} \quad \cos \psi &= \frac{\vec{NM} \cdot \vec{NC}}{|\vec{NM}| \cdot |\vec{NC}|} = \frac{(\frac{1}{2}\vec{a} + \frac{1}{2}\vec{b} + \frac{1}{2}\vec{c}) \cdot (\frac{1}{2}\vec{a} + \frac{1}{2}\vec{b} + \frac{1}{2}\vec{c})}{\sqrt{\frac{1}{4} + \frac{1}{4} + \frac{1}{4}} \cdot \sqrt{\frac{1}{4} + \frac{1}{4} + \frac{1}{4}}} \\ &= \frac{+\frac{1}{2}|\vec{a}|^2 + \frac{1}{4}|\vec{b}|^2 + \frac{1}{4}|\vec{c}|^2}{\frac{\sqrt{3}}{2} \cdot \frac{\sqrt{6}}{2}} = \frac{+\frac{1}{2}}{\frac{\sqrt{18}}{4}} = \frac{+\frac{2}{3\sqrt{2}}}{\frac{\sqrt{2}}{3}} = +\frac{\sqrt{2}}{3} \end{aligned}$$

$$\begin{aligned} \textcircled{1} \quad & \vec{a} \cdot \vec{b} = 0 \\ & \vec{b} \cdot \vec{c} = 0 \\ & \vec{a} \cdot \vec{c} = 0 \end{aligned}$$

$$|\vec{a}| = |\vec{b}| = |\vec{c}| = 1$$

$$\psi = 61^\circ$$

$$|\vec{AS}| : |\vec{SM}| = 8:3$$



$$\vec{AM} = \frac{1}{2}\vec{a} + \vec{b} + \vec{c}$$

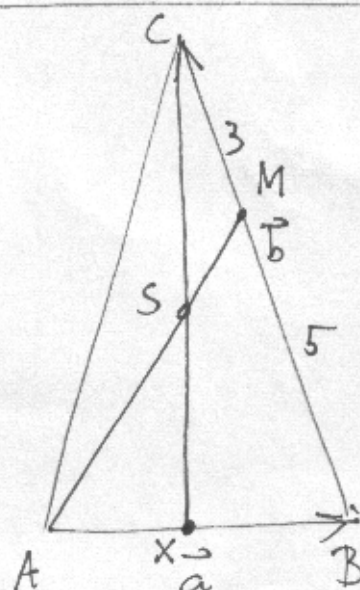
$$\vec{NM} = \frac{1}{2}\vec{a} + \frac{1}{2}\vec{b} + \frac{1}{2}\vec{c}$$

$$\vec{CN} = -\vec{a} - \frac{1}{2}\vec{b} + \frac{1}{2}\vec{c}$$

$$\begin{aligned} \textcircled{4} \quad & \vec{r} = \vec{F}_1 + \vec{F}_2 \\ & |\vec{r}| = |\vec{F}_1 + \vec{F}_2| \\ & |\vec{r}| = \sqrt{(\vec{F}_1 + \vec{F}_2) \cdot (\vec{F}_1 + \vec{F}_2)} = \end{aligned}$$

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$$\begin{aligned} &= \sqrt{F_1^2 + F_2^2 + 2\vec{F}_1 \cdot \vec{F}_2 \cdot \cos 45^\circ} \\ &= \sqrt{100 + 25 + 2 \cdot 10 \cdot 5 \cdot \frac{\sqrt{2}}{2}} \\ &= \underline{14N} \end{aligned}$$



$$\vec{a} = \vec{AB}$$

$$\vec{b} = \vec{BC}$$

$$\vec{AS} = \frac{1}{2}\vec{a} + m\vec{c} = \frac{1}{2}\vec{a} + m(\frac{1}{2}\vec{a} + \frac{5}{8}\vec{b})$$

$$\vec{AS} = m(\vec{a} + \frac{5}{8}\vec{b})$$

$$\begin{aligned} \frac{1}{2}\vec{a} + \frac{m\vec{a}}{2} + m\vec{b} &= m\vec{a} + \frac{5m}{8}\vec{b} \\ \vec{a}(\frac{1}{2} + \frac{m}{2} - m) + \vec{b}(m - \frac{5m}{8}) &= \vec{0} \end{aligned}$$

$$\frac{1}{2} + \frac{m}{2} - m = 0 \Rightarrow \frac{1}{2} + \frac{5m}{16} - m = 0$$

$$m - \frac{5m}{8} = 0 \Rightarrow m = \frac{5m}{8}$$

$$m = 8$$

$$m = 8/11$$