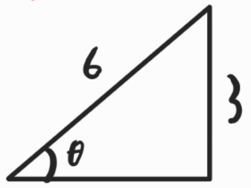
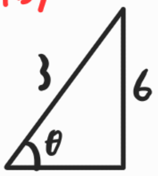
1a)



$\theta = \operatorname{asin}\left(\frac{3}{6}\right) = \boxed{0.524 \text{ rad}}$

1b)



there exists no θ that can satisfy this.

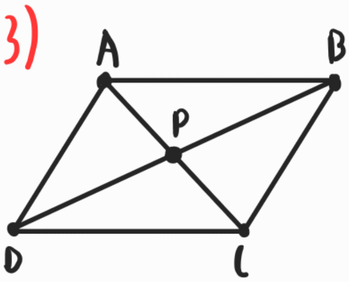
2)

$\vec{r} = 2\hat{\imath} + 3\hat{\jmath}$

$|\vec{r}| = (2^2 + 3^2)^{1/2} = \sqrt{13}$

$$\boxed{\vec{r}_u = \frac{2}{\sqrt{13}}\hat{\imath} + \frac{3}{\sqrt{13}}\hat{\jmath}}$$

3)



with origin O at some arbitrary position, prove:

1) $\vec{AP} = \frac{1}{2}\vec{AC} = \frac{1}{4}(\vec{OA} + \vec{OC}) \Rightarrow 4\vec{AP} = \vec{OA} + \vec{OC}$

2) $\vec{BP} = \frac{1}{2}\vec{BD} = \frac{1}{4}(\vec{OB} + \vec{OD}) \Rightarrow 4\vec{BP} = \vec{OB} + \vec{OD}$

$\vec{AP} = \frac{1}{2}(\vec{OA} + \vec{OP}) \Rightarrow 4\vec{AP} = 2\vec{OA} + 2\vec{OP}$

$= \vec{OA} + \vec{OC} \} 1$

$\Downarrow$

$\vec{OP} = 2\vec{AP} - \vec{OA}$

$\Downarrow$

$\vec{OA} = \vec{OC} - 2\vec{OP}$

$$\begin{aligned}
\vec{AC} &= \frac{1}{2}(\vec{OA} + \vec{OC}) \\
&= \vec{OC} - \vec{OP} \\
&= \vec{OC} + \vec{OA} - 2\vec{AP} \\
&= \underbrace{4\vec{AP}}_{1} - 2\vec{AP} = 2\vec{AP} \Rightarrow \boxed{\vec{AP} = \frac{1}{2}\vec{AC}}
\end{aligned}$$

✓

$$\overrightarrow{BP} = \frac{1}{2}\left(\overrightarrow{OB} + \overrightarrow{OP}\right) \Rightarrow 4\overrightarrow{BP} = 2\overrightarrow{OB} + 2\overrightarrow{OP}$$

$$= \left.\overrightarrow{OB} + \overrightarrow{OD}\right\} 2$$

$$\Downarrow$$

$$\overrightarrow{OB} = \overrightarrow{OD} - 2\overrightarrow{OP}$$

$$\Downarrow$$

$$\overrightarrow{OP} = 2\overrightarrow{BP} - \overrightarrow{OB}$$

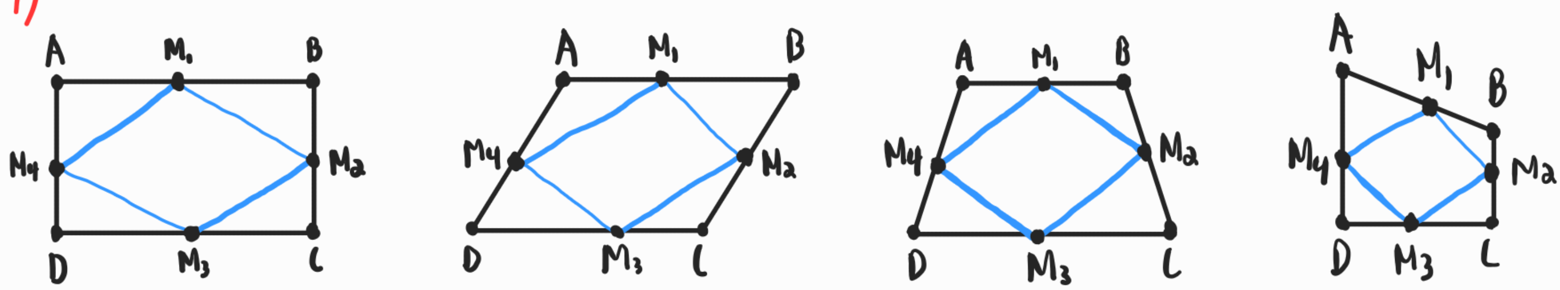
$$\overrightarrow{BD} = \frac{1}{2}\left(\overrightarrow{OB} + \overrightarrow{OD}\right)$$

$$= \overrightarrow{OD} - \overrightarrow{OP}$$

$$= \overrightarrow{OD} + \overrightarrow{OB} - 2\overrightarrow{BP}$$

$$= \underbrace{4\overrightarrow{BP}}_{2} - 2\overrightarrow{BP} = 2\overrightarrow{BP} \Rightarrow \boxed{\overrightarrow{BP} = \frac{1}{2}\overrightarrow{BD}} \checkmark$$

4)



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