Maths

Prove that Two Vectors are Parallel

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Please note this downloadable resource contains some colored font

Prove that two vectors are parallel

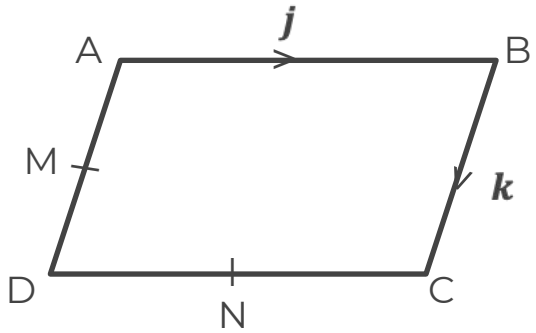
1. Decide whether each statement is true or false.

a) $\begin{pmatrix}5\\7\end{pmatrix}$ is parallel to $\begin{pmatrix}15\\21\end{pmatrix}$

b) $\boldsymbol{a}+\boldsymbol{b}$ is parallel to $2\boldsymbol{a}+\boldsymbol{b}$

c) $3\boldsymbol{c}-\boldsymbol{d}$ is parallel to $\frac{3}{2}\boldsymbol{c}-\frac{1}{2}\boldsymbol{d}$

2. ABCD is a parallelogram. M and N are the midpoints of AD and CD respectively.



a) Write each vector in terms of $\boldsymbol{j}$ and $\boldsymbol{k}$.

i) $\overrightarrow{AC}$ ii) $\overrightarrow{MN}$

b) Are $\overrightarrow{AC}$ and $\overrightarrow{MN}$ parallel? How do you know?

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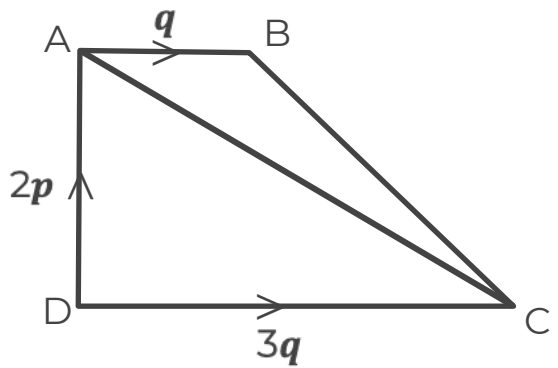
3. ABCD is a trapezium.

E is the midpoint of BC. F is the midpoint of AC.

Show that $\overrightarrow{EF}$ is parallel to $\overrightarrow{DC}$



Answers

Prove that two vectors are parallel

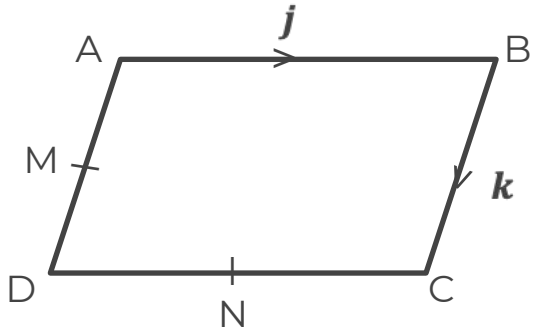
1. Decide whether each statement is true or false.

a) $\begin{pmatrix}5\\7\end{pmatrix}$ is parallel to $\begin{pmatrix}15\\21\end{pmatrix}$ True

b) $\boldsymbol{a}+\boldsymbol{b}$ is parallel to $2\boldsymbol{a}+\boldsymbol{b}$ False

c) $3\boldsymbol{c}-\boldsymbol{d}$ is parallel to $\frac{3}{2}\boldsymbol{c}-\frac{1}{2}\boldsymbol{d}$ True

2. ABCD is a parallelogram. M and N are the midpoints of AD and CD respectively.



a) Write each vector in terms of $\boldsymbol{j}$ and $\boldsymbol{k}$.

i) $\overrightarrow{AC}$ $\boldsymbol{j}+\boldsymbol{k}$ ii) $\overrightarrow{MN}$ $\frac{1}{2}\boldsymbol{j}+\frac{1}{2}\boldsymbol{k}$

b) Are $\overrightarrow{AC}$ and $\overrightarrow{MN}$ parallel? How do you know? Yes, $\overrightarrow{AC}=2\times\overrightarrow{MN}$

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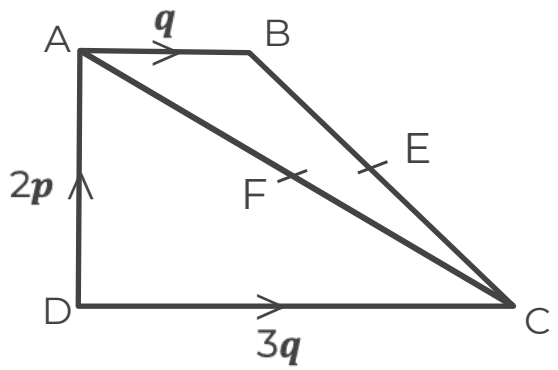
3. ABCD is a trapezium.

E is the midpoint of BC. F is the midpoint of AC.

Show that $\overrightarrow{EF}$ is parallel to $\overrightarrow{DC}$



$\overrightarrow{DC} = 3\boldsymbol{q}$

$\overrightarrow{EF} = \frac{1}{2}\overrightarrow{BC} + \frac{1}{2}\overrightarrow{CA}$

$\overrightarrow{EF} = \frac{1}{2}(-\boldsymbol{q} - 2\boldsymbol{p} + 3\boldsymbol{q}) + \frac{1}{2}(-3\boldsymbol{q} + 2\boldsymbol{p})$

$\overrightarrow{EF} = \frac{1}{2}(2\boldsymbol{q} - 2\boldsymbol{p}) + \frac{1}{2}(-3\boldsymbol{q} + 2\boldsymbol{p})$

$\overrightarrow{EF} = \boldsymbol{q} - \boldsymbol{p} - \frac{3}{2}\boldsymbol{q} + \boldsymbol{p} = -\boldsymbol{q}$

$\overrightarrow{EF} = -\frac{1}{3} \times \overrightarrow{DC}$ therefore $\overrightarrow{DC}$ and $\overrightarrow{EF}$ are parallel.