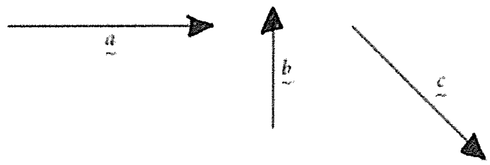
INTRODUCTION TO VECTORS

1 Given three vectors $\underset{\sim}{a}$, $\underset{\sim}{b}$ and $\underset{\sim}{c}$, as shown, construct the following:

(a) $\underset{\sim}{a}+\underset{\sim}{c}$ (b) $\underset{\sim}{c}+\underset{\sim}{b}$

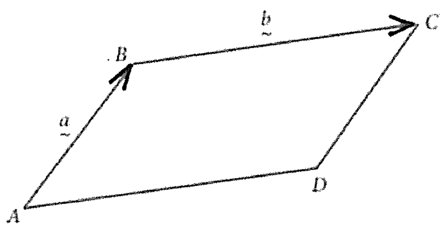
(c) $\underset{\sim}{a}-\underset{\sim}{b}$ (d) $\underset{\sim}{c}-\underset{\sim}{a}$



2 $ABCD$ is a parallelogram. If $\overrightarrow{AB}=\underset{\sim}{a}$ and $\overrightarrow{BC}=\underset{\sim}{b}$, express each of the following vectors in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$.

(a) $\overrightarrow{CD}$ (b) $\overrightarrow{AD}$

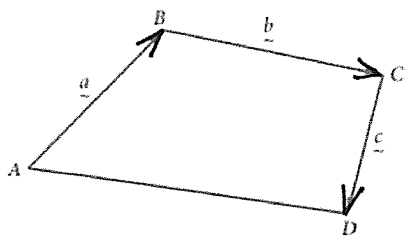
(c) $\overrightarrow{CA}$ (d) $\overrightarrow{DB}$



3 $ABCD$ is a quadrilateral. If $\overrightarrow{AB}=\underset{\sim}{a}$, $\overrightarrow{BC}=\underset{\sim}{b}$ and $\overrightarrow{CD}=\underset{\sim}{c}$, express each of the following vectors in terms of $\underset{\sim}{a}$, $\underset{\sim}{b}$ and $\underset{\sim}{c}$.

(a) $\overrightarrow{AC}$ (b) $\overrightarrow{AD}$

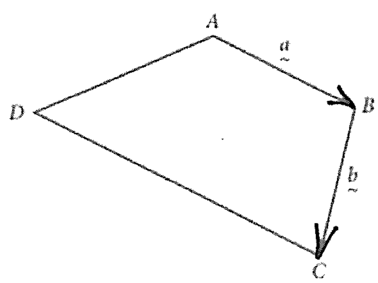
(c) $\overrightarrow{DA}$ (d) $\overrightarrow{DB}$



4 $ABCD$ is a trapezium with $\overrightarrow{DC}$ parallel to $\overrightarrow{AB}$ and one-and-a-half times the length of $\overrightarrow{AB}$. If $\overrightarrow{AB}=\underset{\sim}{a}$ and $\overrightarrow{BC}=\underset{\sim}{b}$, express each of the following vectors in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$.

(a) $\overrightarrow{CD}$ (b) $\overrightarrow{CA}$

(c) $\overrightarrow{AD}$ (d) $\overrightarrow{DB}$

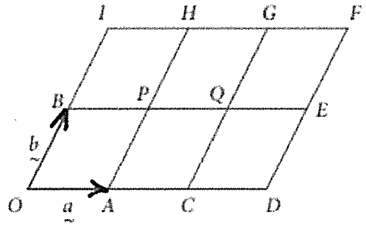


INTRODUCTION TO VECTORS

5 If all the short line segments shown are the same length, express the following in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$.

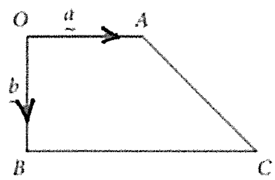
(a) $\overrightarrow{OP}$ (b) $\overrightarrow{OG}$ (c) $\overrightarrow{OQ}$ (d) $\overrightarrow{CE}$

(e) $\overrightarrow{AB}$ (f) $\overrightarrow{DI}$ (g) $\overrightarrow{FQ}$ (h) $\overrightarrow{DE}+\overrightarrow{EO}$



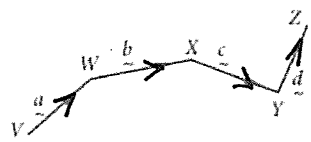
6 $\overrightarrow{BC}$ is parallel to $\overrightarrow{OA}$ and twice its length. Express the following in terms of $\underset{\sim}{a}$ and $\underset{\sim}{b}$.

(a) $\overrightarrow{AB}$ (b) $\overrightarrow{AC}$



7 From the diagram, find the following in terms of $\underset{\sim}{a}$, $\underset{\sim}{b}$, $\underset{\sim}{c}$ and $\underset{\sim}{d}$.

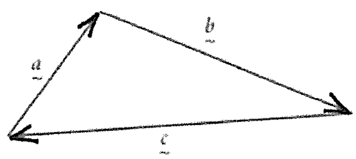
(a) $\overrightarrow{VY}$ (b) $\overrightarrow{VZ}$ (c) $\overrightarrow{WZ}$



8 In ΔABC, $\overrightarrow{AB}=\underset{\sim}{a}$, $\overrightarrow{BC}=\underset{\sim}{b}$ and $\overrightarrow{CA}=\underset{\sim}{c}$. Which *one* of the following statements is true?

A $\underset{\sim}{a}+\underset{\sim}{c}=\underset{\sim}{b}$ B $\underset{\sim}{a}+\underset{\sim}{b}+\underset{\sim}{c}=\underset{\sim}{0}$

C $\underset{\sim}{a}+\underset{\sim}{b}-\underset{\sim}{c}=\underset{\sim}{0}$ D $\underset{\sim}{b}+\underset{\sim}{c}=\underset{\sim}{a}$



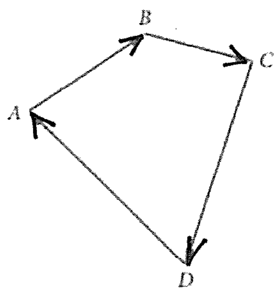
9 In the quadrilateral *ABCD*, which *one* of the following statements is true?

A $\overrightarrow{AB}+\overrightarrow{BC}=\overrightarrow{CD}+\overrightarrow{DA}$

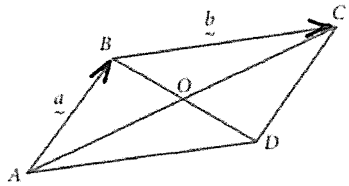
B $\overrightarrow{AB}+\overrightarrow{BC}=\overrightarrow{CD}-\overrightarrow{DA}$

C $\overrightarrow{AB}-\overrightarrow{BC}=\overrightarrow{CD}-\overrightarrow{DA}$

D $\overrightarrow{AB}+\overrightarrow{BC}=-\overrightarrow{CD}-\overrightarrow{DA}$



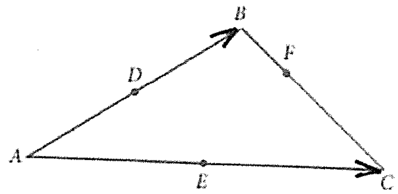
10 In the parallelogram $ABCD$ shown, the point of intersection of the diagonals is O, where O is the midpoint of both $\overrightarrow{AC}$ and $\overrightarrow{BD}$.



The vector $\overrightarrow{OC}$ is equal to:

A $\frac{1}{2}(\underset{\sim}{a}-\underset{\sim}{b})$ **B** $\frac{1}{2}(\underset{\sim}{a}+\underset{\sim}{b})$ **C** $\frac{1}{2}\underset{\sim}{a}-\underset{\sim}{b}$ **D** $\frac{1}{2}\underset{\sim}{b}-\underset{\sim}{a}$

11 ΔABC is a triangle with $\overrightarrow{AB}=\underset{\sim}{a}$ and $\overrightarrow{AC}=\underset{\sim}{c}$. D and E are the midpoints of $\overrightarrow{AB}$ and $\overrightarrow{AC}$ respectively. F is a point on $\overrightarrow{BC}$ such that $\overrightarrow{FC}=2\times\overrightarrow{BF}$.



(a) Express the vectors $\overrightarrow{BC}$ and $\overrightarrow{DE}$ in terms of $\underset{\sim}{a}$ and $\underset{\sim}{c}$.

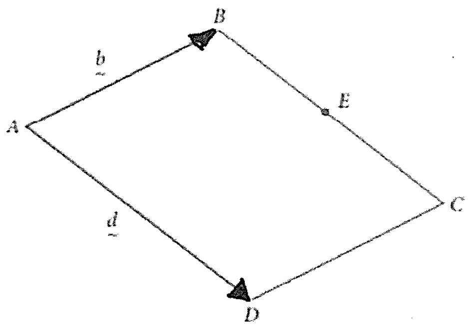
(b) Compare the vectors $\overrightarrow{BC}$ and $\overrightarrow{DE}$.

(c) What geometric property of a triangle does the answer to part **(b)** demonstrate?

(d) Express the vectors $\overrightarrow{BF}$ and $\overrightarrow{FC}$ in terms of $\underset{\sim}{a}$ and $\underset{\sim}{c}$.

(e) Show that $\overrightarrow{AF}=\frac{1}{3}(2\underset{\sim}{a}+\underset{\sim}{c})$.

12 $ABCD$ is a parallelogram in which $\overrightarrow{AB} = \underset{\sim}{b}$ and $\overrightarrow{AD} = \underset{\sim}{d}$ and E is the midpoint of $\overrightarrow{BC}$.



(a) Express $\overrightarrow{AC}$ in terms of $\underset{\sim}{b}$ and $\underset{\sim}{d}$.

(b) Express $\overrightarrow{AE}$ in terms of $\underset{\sim}{b}$ and $\underset{\sim}{d}$.

(c) Express $\overrightarrow{DE}$ in terms of $\underset{\sim}{b}$ and $\underset{\sim}{d}$.

(d) If F is a point on $\overrightarrow{DE}$ and $\overrightarrow{DF} = \frac{2}{3}\overrightarrow{DE}$, express $\overrightarrow{DF}$ in terms of $\underset{\sim}{b}$ and $\underset{\sim}{d}$.

(e) Find $\overrightarrow{AF}$ in terms of $\underset{\sim}{b}$ and $\underset{\sim}{d}$, and hence show that F lies on $\overrightarrow{AC}$.

(f) Find the ratio $\overline{AF} : \overline{FC}$.