Vectors and Ratio

(a)

In the triangle OAB, $\overrightarrow{OA} = 3\boldsymbol{a}$ and $\overrightarrow{AB} = 6\boldsymbol{b}$. The point C divides the line OB in the ratio $2 : 1$.
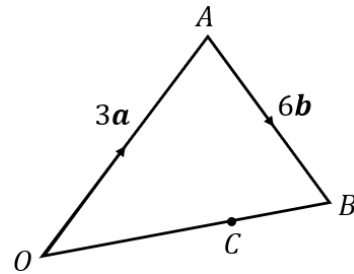
Express the following in terms of $\boldsymbol{a}$ and $\boldsymbol{b}$:

(a) $\overrightarrow{OB}$ $3\boldsymbol{a} + 6\boldsymbol{b}$

(b) $\overrightarrow{OC}$ $2\boldsymbol{a} + 4\boldsymbol{b}$

(c) $\overrightarrow{BC}$ $-\boldsymbol{a} - 2\boldsymbol{b}$

(d) $\overrightarrow{AC}$ $-\boldsymbol{a} + 4\boldsymbol{b}$

(b)

$OABC$ is a trapezium, where $\overrightarrow{OA} = \boldsymbol{a}$ and $\overrightarrow{AB} = \boldsymbol{b}$. $\overrightarrow{OC} = 2\overrightarrow{AB}$ and D splits the line BC in the ratio $1 : 3$.
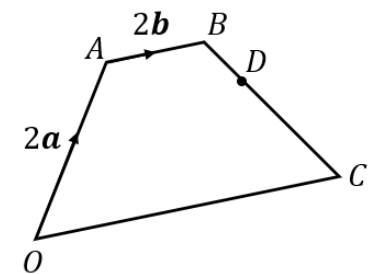
Express the following in terms of $\boldsymbol{a}$ and $\boldsymbol{b}$:

(a) $\overrightarrow{BO}$ $-2\boldsymbol{a} - 2\boldsymbol{b}$

(b) $\overrightarrow{BC}$ $-2\boldsymbol{a} + 2\boldsymbol{b}$

(c) $\overrightarrow{BD}$ $-\frac{1}{2}\boldsymbol{a} + \frac{1}{2}\boldsymbol{b}$

(d) $\overrightarrow{DO}$ $-\frac{3}{2}\boldsymbol{a} - \frac{5}{2}\boldsymbol{b}$

(c)

In the parallelogram $OABC$, $\overrightarrow{OA} = \boldsymbol{a}$ and $\overrightarrow{OC} = \boldsymbol{b}$. The point X divides the line OB in the ratio $3 : 2$.
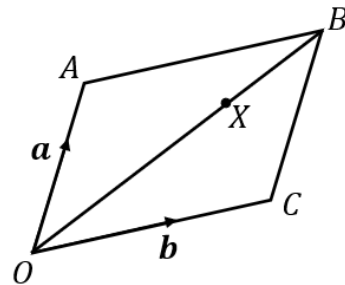
Express the following in terms of $\boldsymbol{a}$ and $\boldsymbol{b}$:

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

(b) $\overrightarrow{OB}$ $\boldsymbol{a} + \boldsymbol{b}$

(c) $\overrightarrow{OX}$ $\frac{3}{5}\boldsymbol{a} + \frac{3}{5}\boldsymbol{b}$

(d) $\overrightarrow{BX}$ $-\frac{2}{5}\boldsymbol{a} - \frac{2}{5}\boldsymbol{b}$

(e) $\overrightarrow{AX}$ $-\frac{2}{5}\boldsymbol{a} + \frac{3}{5}\boldsymbol{b}$

(f) $\overrightarrow{XC}$ $-\frac{3}{5}\boldsymbol{a} + \frac{2}{5}\boldsymbol{b}$

(d)

$OABC$ is a quadrilateral. $\overrightarrow{OA} = \boldsymbol{a}$, $\overrightarrow{OC} = \boldsymbol{b}$ and $\overrightarrow{CB} = \boldsymbol{c}$. The point X divides the line OC in the ratio $2 : 1$. The point Y divides the line AB in the ratio $3 : 1$.
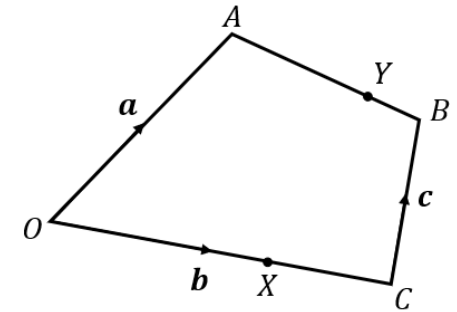
Express the following in terms of $\boldsymbol{a}, \boldsymbol{b}$ and $\boldsymbol{c}$:

(a) $\overrightarrow{OX}$ $\frac{2}{3}\boldsymbol{b}$

(b) $\overrightarrow{XC}$ $\frac{1}{3}\boldsymbol{b}$

(c) $\overrightarrow{AB}$ $-\boldsymbol{a} + \boldsymbol{b} + \boldsymbol{c}$

(d) $\overrightarrow{AY}$ $-\frac{3}{4}\boldsymbol{a} + \frac{3}{4}\boldsymbol{b} + \frac{3}{4}\boldsymbol{c}$

(e) $\overrightarrow{AX}$ $-\boldsymbol{a} + \frac{2}{3}\boldsymbol{b}$

(f) $\overrightarrow{XY}$ $\frac{1}{4}\boldsymbol{a} + \frac{1}{12}\boldsymbol{b} + \frac{3}{4}\boldsymbol{c}$