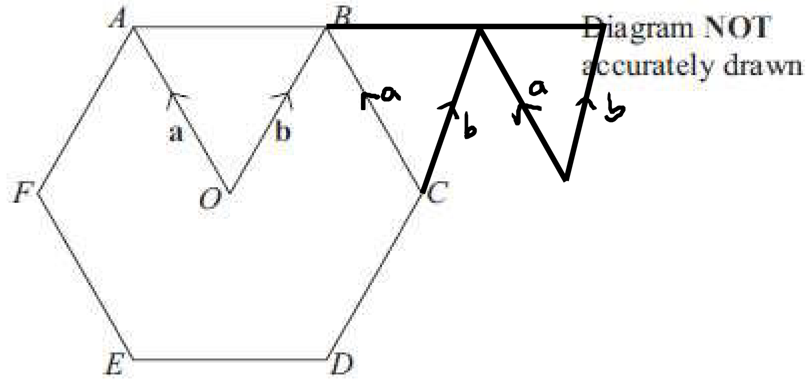
**1.**




*ABCDEF* is a regular hexagon, with centre *O*.

$\overrightarrow{OA} = \mathbf{a}$ , $\overrightarrow{OB} = \mathbf{b}$.

(a) Write the vector $\overrightarrow{AB}$ in terms of **a** and **b**.

$-a+b$

..................................... **(1)**

The line *AB* is extended to the point *K* so that *AB* : *BK* = 1 : 2

(b) Write the vector $\overrightarrow{CK}$ in terms of **a** and **b**.
Give your answer in its simplest form.

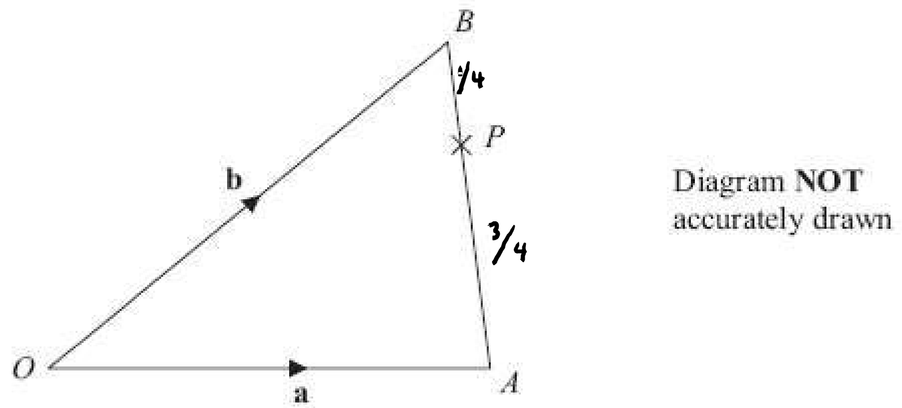
$b - a + b$

$2b-a$

..................................... **(3)**

**(4 marks)**

**2.**




*OAB* is a triangle.

$\overrightarrow{OA} = \mathbf{a}$
$\overrightarrow{OB} = \mathbf{b}$

(a) Find $\overrightarrow{AB}$ in terms of **a** and **b**.

$-a + b$
..............................................
**(1)**

*P* is the point on *AB* such that *AP* : *PB* = 3 : 1

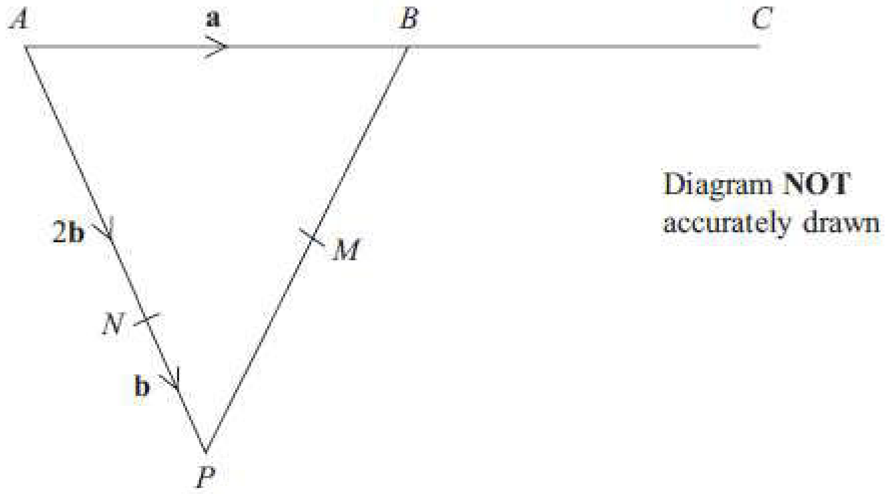
(b) Find $\overrightarrow{OP}$ in terms of **a** and **b**.
Give your answer in its simplest form.

$$\vec{OP} = \vec{OA} + \frac{3}{4}(\vec{AB})$$
$$= a + \frac{3}{4}(-a+b)$$
$$= a - \frac{3}{4}a + \frac{3}{4}b$$
$$= \frac{1}{4}a + \frac{3}{4}b$$

$\frac{1}{4}a + \frac{3}{4}b$
..............................................
**(3)**

**(4 marks)**

**3.**




*APB* is a triangle.
*N* is a point on *AP*.

$\overrightarrow{AB} = \mathbf{a}$ $\overrightarrow{AN} = 2\mathbf{b}$ $\overrightarrow{NP} = \mathbf{b}$

(a) Find the vector $\overrightarrow{PB}$, in terms of **a** and **b**.

$-3b + a$

..................................................... **(1)**

*B* is the midpoint of *AC*.
*M* is the midpoint of *PB*.

*(b) Show that *NMC* is a straight line.

$\overrightarrow{NM} = b + \frac{1}{2}(-3b + a)$
$= b - \frac{3}{2}b + \frac{1}{2}a$
$= -\frac{1}{2}b + \frac{1}{2}a$
$\overrightarrow{NC} = -2b + 2a$

$\overrightarrow{NM} = \frac{1}{2}(-b + a)$
$\overrightarrow{NC} = 2(-b + a)$

The lines a parallel and both go through N. NMC is therefore a straight line

**(4)**

**(5 marks)**

**4.**

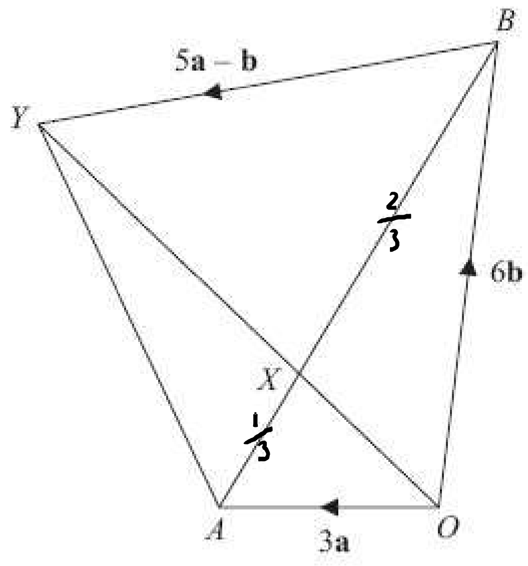



Diagram **NOT** accurately drawn

$OAYB$ is a quadrilateral.

$\overrightarrow{OA} = 3\mathbf{a}$

$\overrightarrow{OB} = 6\mathbf{b}$

(a) Express $\overrightarrow{AB}$ in terms of **a** and **b**.

$\overrightarrow{AB} = -3a + 6b$

$-3a + 6b$

**(1)**

$X$ is the point on $AB$ such that $AX : XB = 1 : 2$

and $\overrightarrow{BY} = 5\mathbf{a} - \mathbf{b}$

* (b) Prove that $\overrightarrow{OX} = \frac{2}{5}\ \overrightarrow{OY}$

$\overrightarrow{OX} = 3a + \frac{1}{3}(-3a + 6b)$

$3a - a + 2b$

$2a + 2b$

$2a + 2b = \frac{2}{5}(5a + 5b)$

$\overrightarrow{OY} = 6b + 5a - b$

$= 5a + 5b$

**(4)**

**(5 marks)**

**5.**

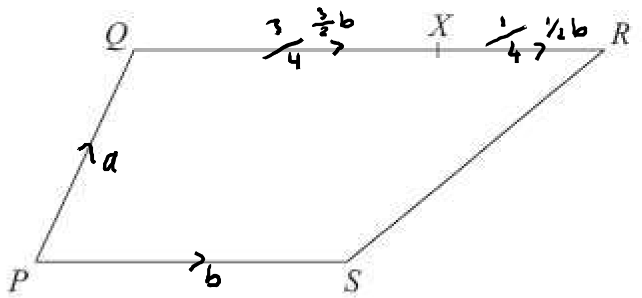



Diagram **NOT** accurately drawn

*PQRS* is a trapezium.
*PS* is parallel to *QR*.
$QR = 2PS$

$\overrightarrow{PQ} = \mathbf{a}$ $\overrightarrow{PS} = \mathbf{b}$

*X* is the point on *QR* such that $QX : XR = 3 : 1$

Express in terms of **a** and **b**.

(i) $\overrightarrow{PR}$

**(2)**

$a + 2b$

(ii) $\overrightarrow{SX}$

**(3)**

$-b + a + \frac{3}{2}b$

$a + \frac{1}{2}b$

$a + \frac{1}{2}b$

**(5 marks)**

**6.**

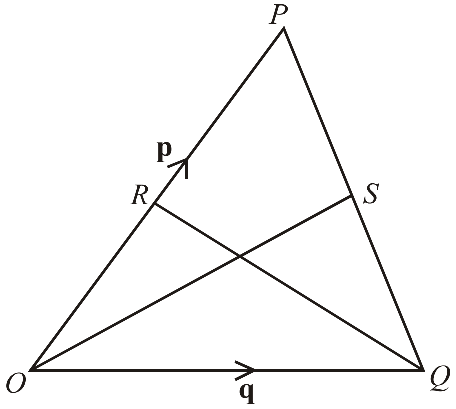



Diagram **NOT** accurately drawn

$OPQ$ is a triangle.

$R$ is the midpoint of $OP$.

S is the midpoint of $PQ$.

$\overrightarrow{OP} = p$ and $\overrightarrow{OQ} = q$

(i) Find $\overrightarrow{OS}$ in terms of $p$ and $q$.

$\overrightarrow{QP} = -q + p$

$\overrightarrow{OS} = q + \frac{1}{2}(-q + p)$

$\overrightarrow{OS} = \frac{1}{2}q + \frac{1}{2}p$

(ii) Show that $RS$ is parallel to $OQ$.

$\overrightarrow{RS} = -\frac{1}{2}p + \frac{1}{2}q + \frac{1}{2}p \quad (\overrightarrow{RO} + \overrightarrow{OS})$

$= \frac{1}{2}q$

$\overrightarrow{OQ} = q$

$2\overrightarrow{RS} = \overrightarrow{OQ}$ $\therefore$ they are parallel

**(5 marks)**

**6.**

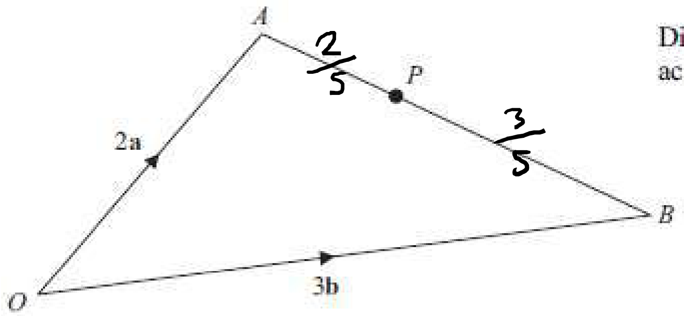



Diagram **NOT** accurately drawn

*OAB* is a triangle.

$\overrightarrow{OA} = 2\mathbf{a}$

$\overrightarrow{OB} = 3\mathbf{b}$

(*a*) Find *AB* in terms of **a** and **b**.

$\overrightarrow{AB}$ = $-2a + 3b$

**(1)**

*P* is the point on *AB* such that *AP* : *PB* = 2 : 3

(*b*) Show that $\overrightarrow{OP}$ is parallel to the vector **a** + **b**.

$\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$

$= 2a + \frac{2}{5}(-2a + 3b)$

$= 2a - \frac{4}{5}a + \frac{6}{5}b$

$= \frac{6}{5}a + \frac{6}{5}b$

$= \frac{6}{5}(a + b)$

**(3)**

**(4 marks)**