VECTORS – PRACTICE QUESTIONS

1. ABC is a triangle.
   \[ \overrightarrow{AB} = \mathbf{a} \]
   \[ \overrightarrow{CB} = \mathbf{b} \]

   \[ \text{(a) Label the vectors on the diagram above, using arrows to show the direction.} \]
   \[ \text{(b) Find the vector } \overrightarrow{AC} \text{ in terms of } \mathbf{a} \text{ and } \mathbf{b}. \]

2. WXYZ is a quadrilateral.
   \[ \overrightarrow{WX} = \mathbf{c} + \mathbf{d} \]
   \[ \overrightarrow{XY} = 2\mathbf{c} - \mathbf{d} \]
   \[ \overrightarrow{YZ} = 2\mathbf{c} + \mathbf{d} \]

   \[ \text{(a) Label the vectors on the diagram above, using arrows to show the direction.} \]
   \[ \text{(b) Find the vector } \overrightarrow{WZ} \text{ in terms of } \mathbf{c} \text{ and } \mathbf{d}. \]
3. 
**DEFG** is a quadrilateral.

\[
\begin{align*}
\overrightarrow{DE} &= 2a \\
\overrightarrow{EF} &= 3a - b \\
\overrightarrow{FG} &= 4b
\end{align*}
\]

(a) Label the vectors on the diagram above, using arrows to show the direction.

(b) Find the vector \(\overrightarrow{DG}\) in terms of \(a\) and \(b\).

(c) \(X\) is the midpoint of \(\overrightarrow{DG}\).

Find the vector \(\overrightarrow{DX}\) in terms of \(a\) and \(b\).

4. 
**HIJ** is a triangle.

\[
\begin{align*}
\overrightarrow{HI} &= 3a + 2b \\
\overrightarrow{IJ} &= 4a - b
\end{align*}
\]

(a) Find the vector \(\overrightarrow{HI}\) in terms of \(a\) and \(b\).

(b) \(M\) is the midpoint of \(\overrightarrow{HI}\).

Find the vector \(\overrightarrow{MJ}\) in terms of \(a\) and \(b\).
5. CDE is a triangle.
\[ \overrightarrow{EN} = 2\mathbf{c} \]
\[ \overrightarrow{ND} = 3\mathbf{c} \]
\[ \overrightarrow{CD} = \mathbf{d} \]
D is the midpoint of CF.

(a) Find the vector \( \overrightarrow{CE} \) in terms of \( \mathbf{c} \) and \( \mathbf{d} \).

(b) Find the vector \( \overrightarrow{EF} \) in terms of \( \mathbf{c} \) and \( \mathbf{d} \).

6. OPQ is a triangle.
\[ \overrightarrow{OP} = \mathbf{a} \]
\[ \overrightarrow{PQ} = \mathbf{b} \]
M is the point on OQ such that OM : MQ = 2 : 1.

Find the vector \( \overrightarrow{MQ} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).
7.
JKLM is a quadrilateral.
\[ \overrightarrow{JK} = \mathbf{a} + 3\mathbf{b} \]
\[ \overrightarrow{LK} = 2\mathbf{a} - \mathbf{b} \]
\[ \overrightarrow{ML} = 4\mathbf{a} + 3\mathbf{b} \]
N is the point on MJ such that MN : NJ = 1 : 3.

(a) Find the vector \( \overrightarrow{MJ} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).

(b) Find the vector \( \overrightarrow{NJ} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).

(c) Find the vector \( \overrightarrow{NL} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).

8.
RST is a triangle.
\[ \overrightarrow{RS} = 7\mathbf{c} - 4\mathbf{d} \]
\[ \overrightarrow{ST} = 5\mathbf{d} - 2\mathbf{c} \]
U is the point on TR such that TU : UR = 2 : 3.

Find the vector \( \overrightarrow{RU} \) in terms of \( \mathbf{c} \) and \( \mathbf{d} \).
9. VWXY is a parallelogram.

\[ \overrightarrow{VM} \]

M is the point on YX such that YM : MX = 3 : 4.

Find the vector \( \overrightarrow{MW} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).

10. XYZ is a triangle.

\[ \overrightarrow{XY} = \mathbf{a} \]
\[ \overrightarrow{YZ} = \mathbf{b} \]

M is the midpoint of XY.
N is the point on YZ such that YN : NZ = 1 : 2.

Find the vector \( \overrightarrow{MN} \) in terms of \( \mathbf{a} \) and \( \mathbf{b} \).
11. ABCD is a trapezium.

Q is the point on BC such that BQ : QC = 3 : 2.

Find the vector $\vec{QC}$ in terms of $x$ and $y$.

12. ABC is a triangle.

P is the point on BC such that BP : PC = 1 : 3.

Show that the vector $\vec{AP}$ is parallel to the vector $3\mathbf{a} + \mathbf{b}$.
13. ABCD is a quadrilateral and XYZ is a triangle. 

Show that CB and ZY are parallel.

14. EFGHI is a pentagon. 

Show that HE and GF are parallel.
15. JKM is a polygon.

\[ \overrightarrow{MJ} = e + f \]
\[ \overrightarrow{JK} = 5e - 4f \]
\[ \overrightarrow{LJ} = 2f - e \]

Show that MLK is a straight line.

16. NOPR is a polygon.

Is RQP a straight line? Explain your answer.
17. ABC is a triangle, and BD is a straight line. Q is the midpoint of the line BC.

Is AQD a straight line? Explain your answer.

18. ABCDEF is a regular hexagon.

\[ \overrightarrow{FG} = 3\overrightarrow{AF} \quad \overrightarrow{CD} = \text{b} \quad \overrightarrow{DE} = \text{a + b} \quad \overrightarrow{EF} = \text{a - b} \]

Show that CEG is a straight line.
19.
STU is a triangle.
\[ \overrightarrow{ST} = 3\mathbf{x} + \mathbf{y} \]
\[ \overrightarrow{SU} = 4\mathbf{x} \]
M is the point on ST such that SM : MT = 2 : 1.
N is the point on TU such that TN : NU = 3 : 4.

Find the vector \( \overrightarrow{MN} \) in terms of \( \mathbf{x} \) and \( \mathbf{y} \).
20.
WXYZ and XYZ are triangles.
M is the point on XY such that XM : MY = 1 : 2.

Show that WMZ is a straight line.
21.
ABCD is a quadrilateral and CEF is a triangle.
BE is a straight line with BC : CE = 3 : 5.

Find the vector $\overrightarrow{EF}$ in terms of $a$ and $b$. 

![Diagram showing vector relationships in a quadrilateral and triangle with given ratios and vector expressions.](image-url)