

8. The n th term of a sequence is $n^2 + 6n - 8$



Work out the position of the first term in the sequence with a value greater than 100.

$$1^{\text{st}} \text{ term} = -1$$

$$5^{\text{th}} \text{ term} = 47$$

$$7^{\text{th}} \text{ term} = 83$$

$$8^{\text{th}} \text{ term} = 104$$

8th term.

(2)

9. A sequence has an n th term of $n^2 - 6n + 7$



Work out which term in the sequence has a value of 23

$$n^2 - 6n + 7 = 23$$

$$n^2 - 6n - 16 = 0$$

$$(n-8)(n+2) = 0$$

$$n = 8$$

✓

$$n = -2$$

x

8th term.

(3)

10. A sequence has an n th term of $n^2 + n - 3$



Work out which term in the sequence has a value of 87

$$n^2 + n - 3 = 87$$

$$n^2 + n - 90 = 0$$

$$(n+10)(n-9) = 0$$

$$n = -10$$

x

$$n = 9$$

✓

9th term.

(3)

15. Here are the first 5 terms of a quadratic sequence



-3 -2 1 6 13

Find an expression, in terms of n , for the n th term of this quadratic sequence.

$$\begin{array}{cccccc}
 & & -3 & -2 & 1 & 6 & 13 \\
 a+b+c & \rightarrow & & & & & \\
 & & 1 & 3 & 5 & 7 & \\
 3a+b & \rightarrow & & 2 & 2 & 2 & \\
 & & & & & & \\
 2a & \rightarrow & & & & & \\
 a=1 & & b=-2 & & c=-2 & &
 \end{array}$$

$$\frac{n^2 - 2n - 2}{(3)}$$

16. Here are the first 4 terms of a quadratic sequence



10 20 38 64

Find an expression, in terms of n , for the n th term of this quadratic sequence.

$$\begin{array}{cccc}
 a+b+c & \rightarrow & 10 & 20 & 38 & 64 \\
 & & 10 & 18 & 26 & \\
 3a+b & \rightarrow & & 8 & 8 & \\
 & & & & & \\
 2a & \rightarrow & & & & \\
 a=4 & & b=-2 & & c=8 &
 \end{array}$$

$$\frac{4n^2 - 2n + 8}{(3)}$$

21. Here is a tile.



Here is a sequence of patterns made from these tiles.



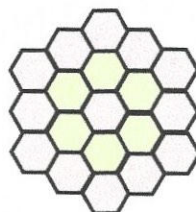
Pattern 1

1



Pattern 2

7



Pattern 3

19

How many of these tiles are needed to make Pattern number 10?

$$a+b+c \rightarrow 1 \quad 7 \quad 19 \quad 37$$

$$3a+b \rightarrow \quad 6 \quad 12 \quad 18$$

$$3a+b \rightarrow \quad 6 \quad 6$$

$$2a$$

$$a=3 \quad b=-3 \quad c=1$$

$$3n^2 - 3n + 1$$

$$3 \times 10^2 - 3 \times 10 + 1$$

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(5)

22. The n th term of a quadratic sequence is $an^2 + c$ where a and c are integers.



The second term is 16 and the fifth term is 163.

Find the values of a and c .

2nd $a \times 2^2 + c$
 $4a + c = 16$

5th term $a \times 5^2 + c$
 $25a + c = 163$

$$\begin{array}{r} 25a + c = 163 \\ 4a + c = 16 \\ \hline 21a = 147 \end{array}$$

$$a = 7$$

$$\begin{array}{l} 4 \times 7 + c = 16 \\ 28 + c = 16 \end{array} \quad c = -12$$

$$\begin{array}{l} a = 7 \text{ and } c = -12 \\ \hline (4) \end{array}$$

23. The n th term of a quadratic sequence is $an^2 + bn$ where a and b are integers.



The second term is -4 and the sixth term is 60

Find the values of a and b .

2nd ~~$18a + 12b = 60$~~
 $4a + 2b = -4$

6th term $36a + 6b = 60$

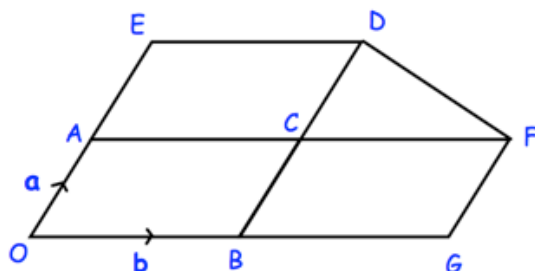
$$\begin{array}{r} 36a + 6b = 60 \\ 12a + 6b = -12 \\ \hline 24a = 72 \\ a = 3 \end{array}$$

$$\begin{array}{l} 12 + 2b = -4 \\ 2b = -16 \\ b = -8 \end{array}$$

$$\begin{array}{l} a = 3 \text{ and } b = -8 \\ \hline (4) \end{array}$$

1. In the diagram OBDE and OAFG are parallelograms.
 B is the midpoint of OG.
 A is the midpoint of OE.

$\vec{OA} = \mathbf{a}$ and $\vec{OB} = \mathbf{b}$



- (a) Express, in terms of $\mathbf{a}$ and $\mathbf{b}$, the following vectors.
 Give your answers in their simplest form.

(i) $\vec{OC}$

$\underline{\underline{\mathbf{a} + \mathbf{b}}}$
 (1)

(ii) $\vec{BA}$

$\underline{\underline{\mathbf{a} - \mathbf{b}}}$
 (1)

(iii) $\vec{DF}$

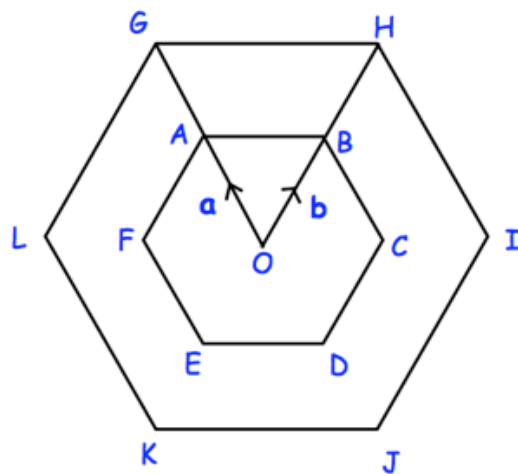
$\underline{\underline{\mathbf{b} - \mathbf{a}}}$
 (1)

- (b) Show $\vec{EG}$ and $\vec{DF}$ are parallel.

$\vec{EG} = 2\mathbf{b} - 2\mathbf{a}$
 $\vec{DF} = \mathbf{b} - \mathbf{a}$

$\vec{EG} = 2\vec{DF}$
 $\therefore$ they are parallel
 (2)

2.



ABCDEF and GHIJKL are regular hexagons with centre O.
GHIJKL is an enlargement of ABCDEF, with scale factor 2.

$$\overrightarrow{OA} = \mathbf{a} \quad \text{and} \quad \overrightarrow{OB} = \mathbf{b}$$

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

$$\underline{\underline{\mathbf{b} - \mathbf{a}}} \quad (1)$$

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

$$\underline{\underline{2\mathbf{a}}} \quad (1)$$

(c) Write the vector $\overrightarrow{OE}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

$$\underline{\underline{-\mathbf{b}}} \quad (1)$$

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

$$\frac{2b - 2a}{(1)}$$

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

$$\frac{2a - 4b}{(1)}$$

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

$$\frac{4b - 4a}{(1)}$$

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

$$\frac{2b}{(1)}$$

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

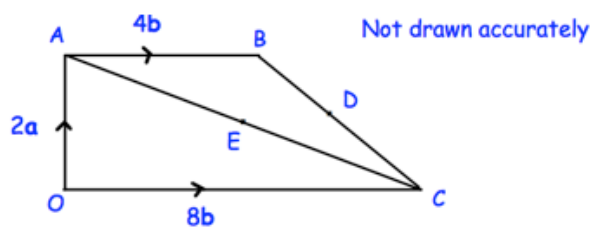
$$\frac{4a}{(1)}$$

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

$$\frac{3a - 2b}{(1)}$$

3. OABC is a trapezium.
Point D is the midpoint of BC.
Point E is the midpoint of AC.

$$\overrightarrow{OA} = 2\mathbf{a} \quad \overrightarrow{AB} = 4\mathbf{b} \quad \text{and} \quad \overrightarrow{OC} = 8\mathbf{b}$$



- (a) Write these vectors in terms of $\mathbf{a}$ and $\mathbf{b}$.

(i) $\overrightarrow{OB}$

$$\underline{2\mathbf{a} + 4\mathbf{b}} \quad (1)$$

(ii) $\overrightarrow{AC}$

$$\underline{8\mathbf{b} - 2\mathbf{a}} \quad (1)$$

(iii) $\overrightarrow{AE}$

$$\underline{4\mathbf{b} - \mathbf{a}} \quad (1)$$

- (b) Show $\overrightarrow{ED}$ and $\overrightarrow{OC}$ are parallel.

$$\overrightarrow{OC} = 8\mathbf{b}$$

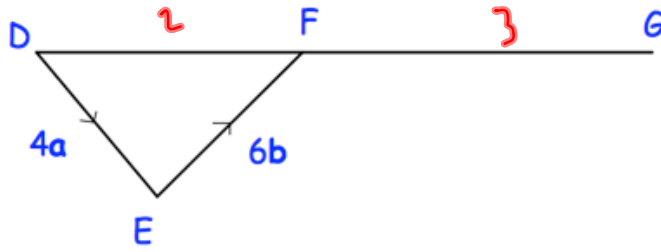
$$\overrightarrow{ED} = \mathbf{a} - 4\mathbf{b} + 4\mathbf{b} + \frac{1}{2}(-4\mathbf{b} - 2\mathbf{a} + 8\mathbf{b})$$

$$\overrightarrow{ED} = \mathbf{a} - 4\mathbf{b} + 4\mathbf{b} - 2\mathbf{b} - \mathbf{a} + 4\mathbf{b} \quad (3)$$

$$\overrightarrow{ED} = 2\mathbf{b} \quad \overrightarrow{OC} = 4\overrightarrow{ED} \quad \therefore \text{parallel}$$

4. DFG is a straight line.

$\overrightarrow{DE} = 4\mathbf{a}$ and $\overrightarrow{EF} = 6\mathbf{b}$



- (a) Write down the vector $\overrightarrow{DF}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

$$\underline{4\mathbf{a} + 6\mathbf{b}}$$

(1)

- (b) $DF : FG = 2:3$

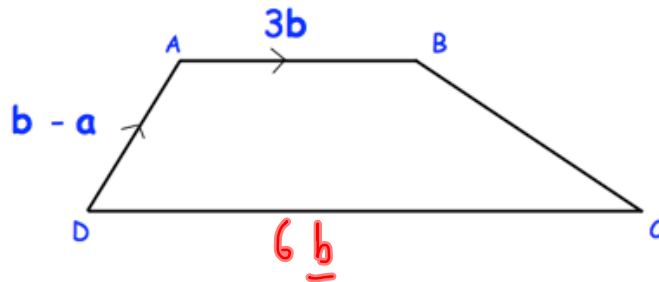
Work out the vector $\overrightarrow{DG}$ in terms of $\mathbf{a}$ and $\mathbf{b}$
Give your answer in its simplest form.

$$(\underline{2\mathbf{a}} + \underline{3\mathbf{b}}) \times 5$$

$$10\mathbf{a} + 15\mathbf{b}$$

.....
(2)

5. ABCD is a trapezium



AB and DC are parallel.
 $DC = 2AB$

- (a) Write down the vector $\overrightarrow{DC}$ in terms of $\mathbf{a}$ and $\mathbf{b}$

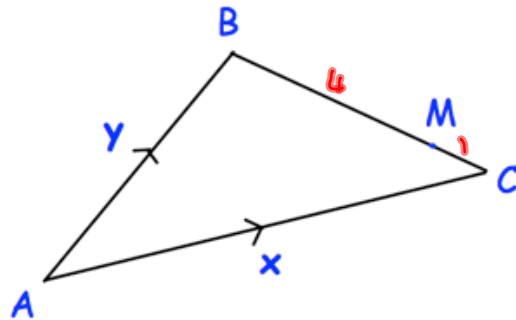
$$\underline{6b} \quad (1)$$

- (b) Work out the vector $\overrightarrow{BC}$ in terms of $\mathbf{a}$ and $\mathbf{b}$
 Give your answer in its simplest form.

$$-3b - b + a + 6b$$

$$\underline{2b + a} \quad (2)$$

6.



ABC is a triangle.

M lies on BC such that $BM = \frac{4}{5} BC$

Express these vectors in terms of x and y

(a) $\overrightarrow{BC}$

$$\underline{-y + x} \quad (1)$$

(b) $\overrightarrow{BM}$

$$\underline{-\frac{4}{5}y + \frac{4}{5}x} \quad (1)$$

(c) $\overrightarrow{AM}$

$$\underline{y - \frac{4}{5}y + \frac{4}{5}x}$$

$$\underline{\frac{1}{5}y + \frac{4}{5}x} \quad (1)$$