



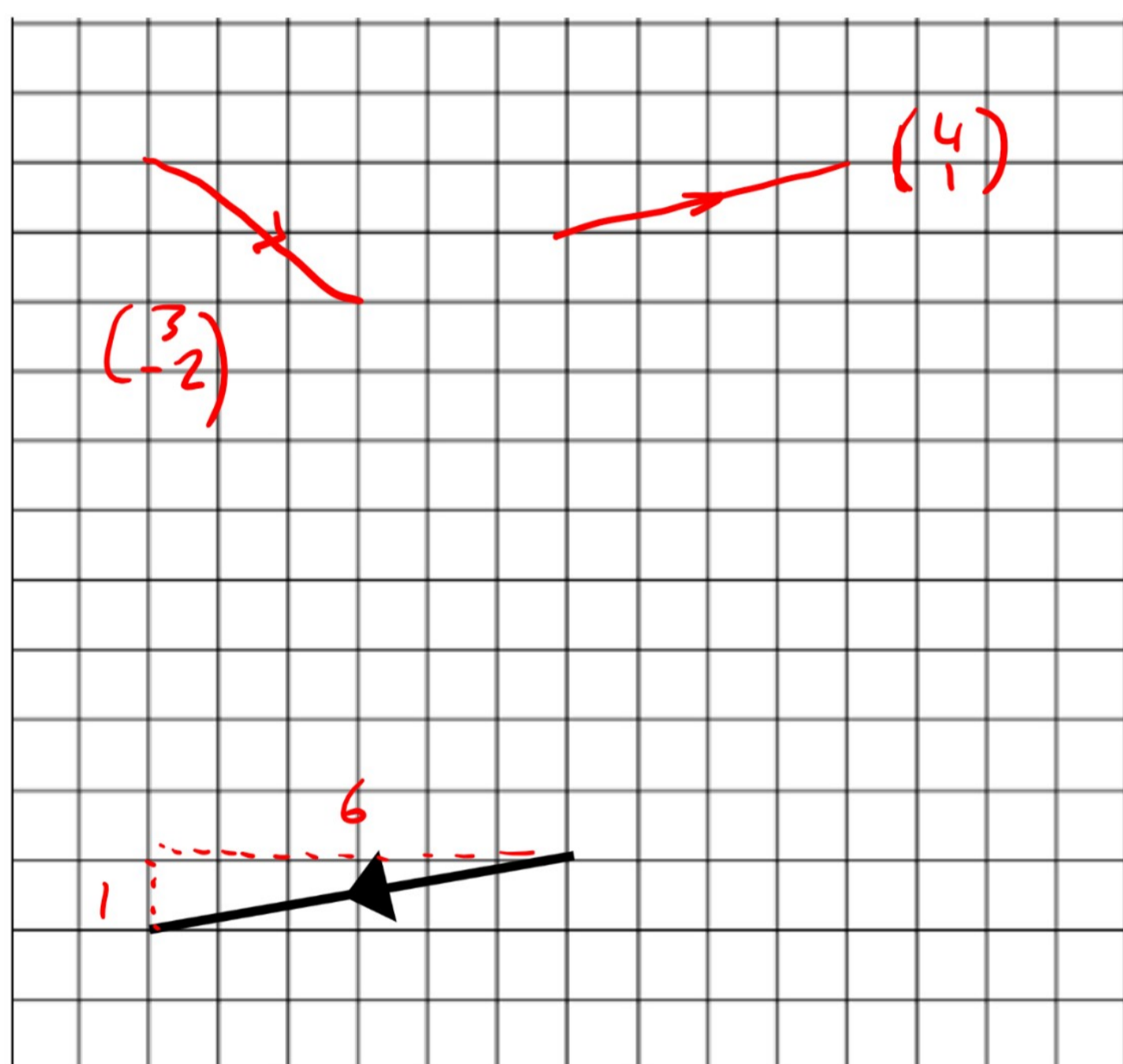
## Basic Vectors Exam Practice

Q1. a) On the grid below draw the following vectors:

i)  $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$       (ii)  $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$

Answer: \_\_\_\_\_

(2 marks)



b) Write down the vector which has been already draw on the grid

$$\begin{pmatrix} -6 \\ -1 \end{pmatrix}$$

Answer:  $\begin{pmatrix} -6 \\ -1 \end{pmatrix}$  \_\_\_\_\_

(2 marks)



Q2. We define the following column vectors as follows:

$$\mathbf{a} = \begin{pmatrix} 14 \\ -9 \end{pmatrix} \quad \mathbf{b} = \begin{pmatrix} -5 \\ 11 \end{pmatrix}$$

a) Work out  $-2\mathbf{b}$

$$-2 \begin{pmatrix} -5 \\ 11 \end{pmatrix} = \begin{pmatrix} 10 \\ -22 \end{pmatrix}$$

Answer:  $\begin{pmatrix} 10 \\ -22 \end{pmatrix}$   
(2 marks)

b) Work out  $2\mathbf{a} - 4\mathbf{b}$

$$\begin{aligned} & 2 \begin{pmatrix} 14 \\ -9 \end{pmatrix} - 4 \begin{pmatrix} -5 \\ 11 \end{pmatrix} \\ &= \begin{pmatrix} 28 \\ -18 \end{pmatrix} - \begin{pmatrix} -20 \\ 44 \end{pmatrix} \\ &= \begin{pmatrix} 48 \\ -62 \end{pmatrix} \end{aligned}$$

Answer:  $\begin{pmatrix} 48 \\ -62 \end{pmatrix}$   
(3 marks)

c) Find the vector  $\mathbf{c}$  which has length 1.5 times that of vector  $\mathbf{a}$ , and is in the opposite direction to  $\mathbf{a}$

Required vector is  $-1.5\mathbf{a}$ , so  $-1.5 \begin{pmatrix} 14 \\ -9 \end{pmatrix} = \begin{pmatrix} -21 \\ 13.5 \end{pmatrix}$

Answer:  $\begin{pmatrix} -21 \\ 13.5 \end{pmatrix}$   
(2 marks)



Q3. Let P be the point (12, -14) and Q be the point (27, -3).

(a) Write down as a column vector  $\overrightarrow{QP}$

$$\begin{aligned}\overrightarrow{QP} &= \begin{pmatrix} 12 - 27 \\ -14 - (-3) \end{pmatrix} \\ &= \begin{pmatrix} -15 \\ -11 \end{pmatrix}\end{aligned}$$

Answer:  $\begin{pmatrix} -15 \\ -11 \end{pmatrix}$   
(2 marks)

(b) A ship sets off from port, which has co-ordinates (-4, 12), and then sets sail on a vector  $\begin{pmatrix} 20 \\ -11 \end{pmatrix}$  in order to reach an oil rig.

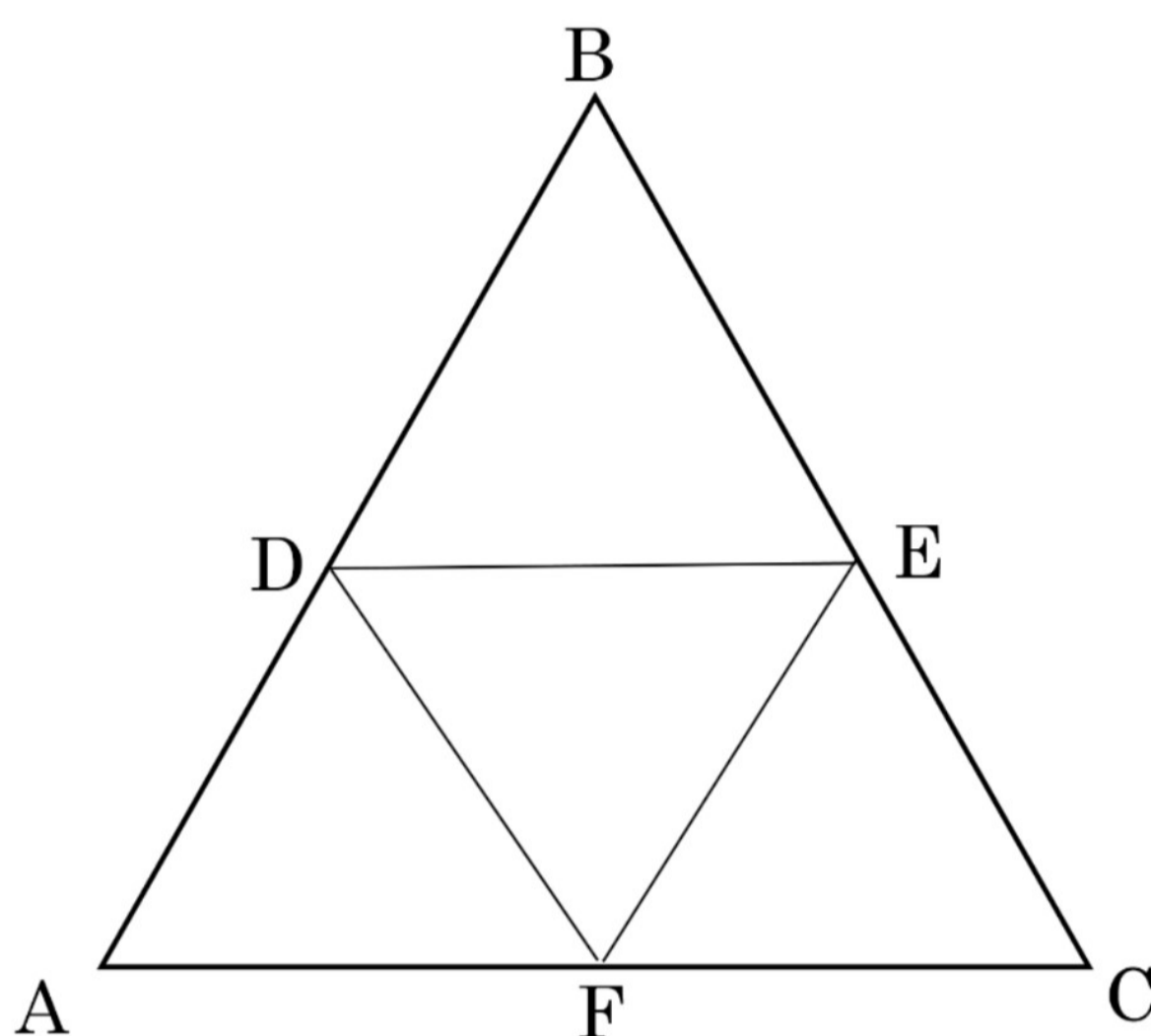
Write down the co-ordinates of the oil rig.

$$\begin{pmatrix} 16 \\ 1 \end{pmatrix}$$

Answer:  $\begin{pmatrix} 16 \\ 1 \end{pmatrix}$   
(2 marks)



- Q4. ABC is an equilateral triangle containing 4 equilateral triangles.  
D is a mid-point of AB, E is a mid-point of BC, and F is a mid-point of AC.



Let  $\overrightarrow{AB} = \mathbf{a}$  and  $\overrightarrow{AC} = \mathbf{c}$ .

- (i) Find in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , an expression for  $\overrightarrow{BD}$

$$\begin{aligned}\overrightarrow{BD} &= -\frac{1}{2}\overrightarrow{BA} \\ &= -\frac{1}{2}\mathbf{a}\end{aligned}$$

Answer:  $-\frac{1}{2}\mathbf{a}$   
(1 mark)

- (ii) Find in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , a factorised expression for  $\overrightarrow{AE}$

$$\begin{aligned}\overrightarrow{AE} &= \overrightarrow{AF} + \overrightarrow{FE} \text{ (for example)} \\ &= \frac{1}{2}\mathbf{c} + \frac{1}{2}\mathbf{a} \\ &= \frac{1}{2}(\mathbf{c} + \mathbf{a})\end{aligned}$$

Answer:  $\frac{1}{2}(\mathbf{c} + \mathbf{a})$   
(2 marks)

- (iii) Let P be the mid-point of BE. Find in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , an expression for  $\overrightarrow{PF}$ , simplifying your answer

$$\begin{aligned}\overrightarrow{PF} &= \overrightarrow{AB} + \frac{1}{4}\overrightarrow{BC} \text{ (for example)} \\ &= \mathbf{a} + \frac{1}{4}(-\mathbf{a} + \mathbf{c}) \\ &= \frac{3}{4}\mathbf{a} + \frac{1}{4}\mathbf{c}\end{aligned}$$

Answer:  $\frac{3}{4}\mathbf{a} + \frac{1}{4}\mathbf{c}$   
(2 marks)