WOODSIDE HIGH SCHOOL
TASK GRID 6: YEAR 10

WHAT TO STUDY AT HOME?

Using your school timetable as a guide, work through the tasks outlined below. Use the 'how to study at home' sheet to help you plan your time and approach to self study.

SUBJECT	TASK

ENGLISH

These tasks should take you:

45 minutes each

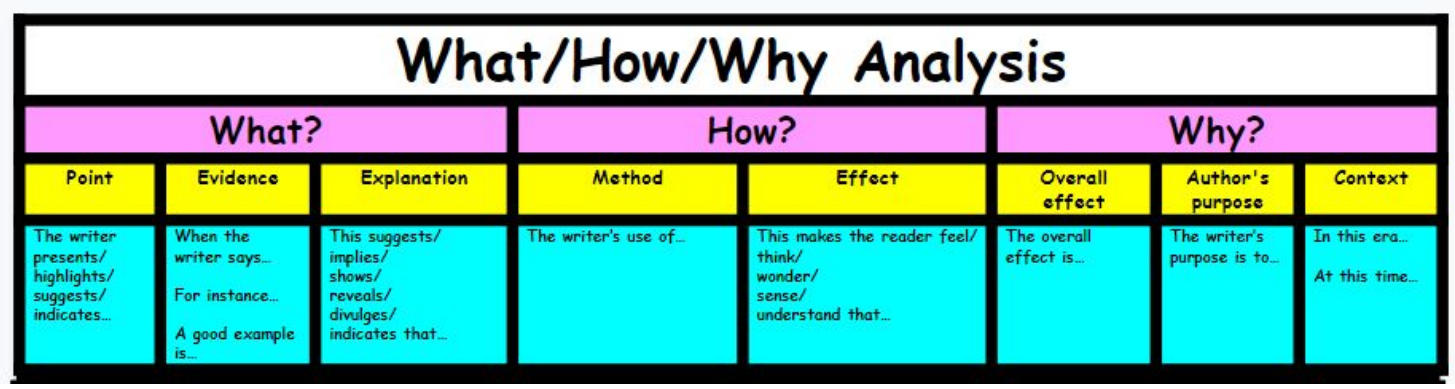
AQA Power and Conflict Poetry Revision and Unseen Poetry Revision skills

Question 1: 24 marks, 25-30 minutes

- **You will be given a fairly short, modern poem to read.**
- **The question will ask you to identify and comment on the meaning of the poem (AO1 - WHAT).**
- **The question will also ask you to identify and analyse the methods the poet uses (AO2 - HOW).**
- **You should aim to write at least 3 analytical paragraphs which focus on the beginning, middle and end of the poem.**

Question 2: 8 marks, 10-15 minutes

- **You will be given another fairly short, modern poem to read. It will be linked to the first poem.**
- **The question will ask you to identify, comment and compare the methods that both poets use.**
- **The question will ask you to identify some similarities and differences between the ways the 2 poets present their ideas (AO2 - HOW)**
- **You should aim to write 3 brief analytical paragraphs comparing the two poems which focus on the beginning, middle and end of the poems.**



What/How/Why Analysis

What?			How?		Why?		
Point	Evidence	Explanation	Method	Effect	Overall effect	Author's purpose	Context
The writer presents/ highlights/ suggests/ indicates…	When the writer says… For instance… A good example is…	This suggests/ implies/ shows/ reveals/ divulges/ indicates that…	The writer's use of…	This makes the reader feel/ think/ wonder/ sense/ understand that…	The overall effect is…	The writer's purpose is to…	In this era… At this time…

Mark scheme (24 mark question)

AO1 Read, understand and respond to texts. Students should be able to: • maintain a critical style and develop an informed personal response • use textual references, including quotations, to support and illustrate interpretations AO2 Analyse the language, form and structure used by a writer to create meanings and effects, using relevant subject terminology where appropriate.					
Level Band	**Q1 24 mark question**	**AO1 Use of comparison and quotations**	**AO2 Use of terminology and effect of techniques**	**Q2 8 mark question**	**AO2 Use of terminology and effect of techniques**
6 Top	21-24	Critical, exploratory, conceptualised; Judicious, precise.	Judicious, analysed	7-8 Band 4 Top	Exploratory, convincing
5 High	17-21	Thoughtful, developed; Apt, integrated	Examined, effective		
4 Mid	13-16	Clear, explained; Effective, supportive	Clear, understanding	5-6 Band 3 Mid	Thoughtful, comparative
3 Low mid	9-12	Some explained; References to support, range	Explained, identified effects		
2 Low	5-8	Supported, relevant; Comments on references	Some references terminology, Identifies methods	3-4 Band 2 Low	Relevant, some comparison
1 Bottom	1-4	Simple, relevant; Reference to relevant detail(s)	Possibly uses terminology, awareness of choices	1-2 Band 1 Bottom	Some links between text and reader
0	0	No work worthy of any marks			

TOP TIPS!

PERSONIFICATION METAPHOR SIMILE ALLITERATED SOUND REPETITION CONTRAST ONOMATOPOEIA ASSONANCE	Look out for words that can have more than one meaning. What further ideas or images could they create?	Which specific emotion are you encouraged to feel as a result of the words used?
Identify the specific techniques that have been used in the text. Consider what impact they have upon the tone?	**Analysing LANGUAGE could be...**	Choose adjectives, adverbs, verbs and nouns to explode- how do these words suggest what the character or setting is like?
Consider the language a character uses in his or her speech. Is it timid? Authoritative? Apologetic? Something else? What might this reveal about their character?	Which words help you identify the tone or mood of the character? How do the words imply his or her feelings or attitude? What are the reasons why?	RHETORIC EMOTIVE LANGUAGE MODAL VERBS DIRECT ADDRESS PREPOSITIONS IMPERATIVE VERBS HYPERBOLE

TOP TIPS!

Narrative viewpoint Repeated symbols Sentence structure and punctuation Opening and Closing Semantic field Rhythm Timeframe	How the sentence structures or specific punctuation reflect feelings or emotions within the text. How does it change or develop?	Are there groups of words that belong to a particular semantic field? What difference does this make to the atmosphere of the text?
Considering how the narrative choice enhances the meaning of the text overall. WHY do we hear the 'story' from that perspective?	**Analysing STRUCTURE could be...**	Can you identify a rhythm to the text? Is it written in a particular style or form?
Analysing how a repeated symbol (motif), idea of theme runs through a whole text.	Looking at the opening and closing lines to see how they are connected. What impact do they have on the reader?	Is the timeline straightforward, or is there a flash back or flash forward? Does the event occur in the distant past, recent past or does it describe an ongoing event? Why would this matter?

Names
By Wendy Cope

She was Eliza for a few weeks
when she was a baby –
Eliza Lily. Soon it changed to Lil.

Later she was Miss Steward in the baker's shop
And then 'my love', 'my darling', Mother.

Widowed at thirty, she went back to work
As Mrs Hand. Her daughter grew up,
Married and gave birth.

Now she was Nanna. 'Everybody
Calls me Nanna,' she would say to visitors.
And so they did – friends, tradesmen, the doctor.

In the geriatric ward
They used the patients' Christian names.
'Lil,' we said, 'or Nanna,'
But it wasn't in her file
And for those last bewildered weeks
She was Eliza once again.

What I Regret
By Nina Cassian

. . . never having heard the voice of the Dodo bird . . .
. . . never having smelled the Japanese cherry trees . . .
. . . never having punished the lovers and friends that deserted me . . .
. . . never having asked for honours that I deserved . . .
. . . never having composed a Mozart sonata . . .
. . . never having realised that I'd live long enough to regret all the above . . .
. . . and much, much more . . .

1. In 'Names' how does the poet present the speakers feelings towards Eliza?

24 marks

2. In both 'Names' and 'What I Regret' the speakers describe feelings about growing old. What are the similarities and/or differences between the ways the poets present those feelings?

8 marks

The Explosion By Philip Larkin

On the day of the explosion
Shadows pointed towards the pithead:
In thesun the slagheap slept.

Down the lane came men in pitboots
Coughing oath-edged talk and pipe-smoke
Shouldering off the freshened silence.

One chased after rabbits; lost them;
Came back with a nest of lark's eggs;
Showed them; lodged them in the grasses.

So they passed in beards and moleskins
Fathers brothers nicknames laughter
Through the tall gates standing open.

At noon there came a tremor; cows
Stopped chewing for a second; sun
Scarfed as in a heat-haze dimmed.

The dead go on before us they
Are sitting in God's house in comfort
We shall see them face to face—

plain as lettering in the chapels
It was said and for a second
Wives saw men of the explosion

Larger than in life they managed—
Gold as on a coin or walking
Somehow from the sun towards them

One showing the eggs unbroken.

Belfast Confetti by Ciaran Carson

Suddenly as the riot squad moved in, it was raining exclamation marks,
Nuts, bolts, nails, car keys. A fount of broken type.
And the explosion
Itself – an asterisk on the map. This hyphenated line, a burst of rapid fire …
I was trying to complete a sentence in my head, but it kept stuttering,
All the alleyways and side-streets blocked with stops and colons.

I know this labyrinth so well – Balaclava, Raglan, Inkerman, Odessa Street –
Why can't I escape? Every move is punctuated.
Crimea Street. Dead end again.
A Saracen, Kremlin-2 mesh. Makrolon face-shields.
Walkie-talkies. What is
My name? Where am I coming from? Where am I
going? A fusillade of question-marks.

Makrolon = toughened plastic
Fusillade = a series of shots fired rapidly one after another

1. In 'Belfast Confetti' how does the poet present the speakers feelings towards the explosion?

24 marks

2. In both 'Belfast Confetti' and 'The Explosion' the speakers describe the impact an explosion has upon the community it happens to. What are the similarities and/or differences between the ways the poets present those feelings about their impact?

8 marks

Love is a Losing Game by A Winehouse

For you I was the flame
Love is a losing game
Five story fire as you came
Love is losing game

One I wished, I never played
Oh, what a mess we made
And now the final frame
Love is a losing game

Played out by the band
Love is a losing hand
More than I could stand
Love is a losing hand

Self-professed profound
Till the chips were down
Know you're a gambling man
Love is a losing hand

Though I battled blind
Love is a fate resigned
Memories mar my mind
Love is a fate resigned

Over futile odds
And laughed at by the gods
And now the final frame
Love is a losing game

A Vow by Wendy Cope.

I cannot promise never to be angry;
I cannot promise always to be kind.
You know what you are taking on, my darling –
It's only at the start that love is blind.
And yet I'm still the one you want to be with
And you're the one for me – of that I'm sure.
You are my closest friend, my favorite person,
The lover and the home I've waited for.
I cannot promise that I will deserve you
From this day on. I hope to pass that test.
I love you and I want to make you happy.
I promise I will do my very best.

1. In 'Love is a Losing Game' how does the poet present the speakers feelings towards love?

24 marks

2. In both 'Love is a Losing Game' and 'A Vow' the speakers describe the conflicted feelings that come with love. What are the similarities and/or differences between the ways the poets present those feelings about their impact?

8 marks

First Frost by Andrei Vosnesensky

A girl is freezing in a telephone booth,
huddled in her flimsy coat,
her face stained by tears
and smeared with lipstick.

She breathes on her thin little fingers.
Fingers like ice. Glass beads in her ears.

She has to beat her way back alone
down the icy street.

First frost. A beginning of losses.
The first frost of telephone phrases.

It is the start of winter glittering on her cheek,
the first frost of having been hurt.

Hard Frost by Andrew J Young

Frost called to the water Halt
And crusted the moist snow with sparkling salt;
Brooks, their one bridges, stop,
And icicles in long stalactites drop.
And tench in water-holes
Lurk under gluey glass like fish in bowls.

In the hard-rutted lane
At every footstep breaks a brittle pane,
And tinkling trees ice-bound,
Changed into weeping willows, sweep the ground;
Dead boughs take root in ponds
And ferns on windows shoot their ghostly fronds.

But vainly the fierce frost
Interns poor fish, ranks trees in an armed host,
Hangs daggers from house-eaves
And on the windows ferny ambush weaves;
In the long war grown warmer
The sun will strike him dead and strip his armour.

1. In 'First Frost' how does the poet present the speakers feelings towards love?

24 marks

2. In both ‘First Frost’ and ‘Hard Frost’ the speakers describe the weather. What are the similarities and/or differences between the ways the poets present those feelings?

8 marks

Last Lesson of the Afternoon by D H Lawrence

When will the bell ring, and end this weariness?
How long have they tugged the leash, and strained apart,
My pack of unruly hounds! I cannot start
Them again on a quarry of knowledge they hate to hunt,
I can haul them and urge them no more.

No longer now can I endure the brunt
Of the books that lie out on the desks; a full threescore
Of several insults of blotted pages, and scrawl
Of slovenly work that they have offered me.
I am sick, and what on earth is the good of it all?
What good to them or me, I cannot see!

So, shall I take
My last dear fuel of life to heap on my soul
And kindle my will to a flame that shall consume
Their dross of indifference; and take the toll
Of their insults in punishment? — I will not! -

I will not waste my soul and my strength for this.
What do I care for all that they do amiss!
What is the point of this teaching of mine, and of this
Learning of theirs? It all goes down the same abyss.

What does it matter to me, if they can write
A description of a dog, or if they can't?
What is the point? To us both, it is all my aunt!
And yet I'm supposed to care, with all my might.

I do not, and will not; they won't and they don't; and that's all!
I shall keep my strength for myself; they can keep theirs as well.
Why should we beat our heads against the wall
Of each other? I shall sit and wait for the bell.

Mrs Tilscher's Class by Carol Ann Duffy

In Mrs Tilscher's class
You could travel up the Blue Nile
with your finger, tracing the route
while Mrs Tilscher chanted the scenery.
"Tana. Ethiopia. Khartoum. Aswan."
That for an hour,
then a skittle of milk
and the chalky Pyramids rubbed into dust.
A window opened with a long pole.
The laugh of a bell swung by a running child.

This was better than home. Enthralling books.
The classroom glowed like a sweetshop.
Sugar paper. Coloured shapes. Brady and Hindley
faded, like the faint, uneasy smudge of a mistake.
Mrs Tilscher loved you. Some mornings, you found
she'd left a gold star by your name.
The scent of a pencil slowly, carefully, shaved.
A xylophone's nonsense heard from another form.

Over the Easter term the inky tadpoles changed
from commas into exclamation marks. Three frogs
hopped in the playground, freed by a dunce
followed by a line of kids, jumping and croaking
away from the lunch queue. A rough boy
told you how you were born. You kicked him, but stared
at your parents, appalled, when you got back
home

That feverish July, the air tasted of electricity.
A tangible alarm made you always untidy, hot,
fractious under the heavy, sexy sky. You asked her
how you were born and Mrs Tilscher smiled
then turned away. Reports were handed out.
You ran through the gates, impatient to be grown
the sky split open into a thunderstorm.

1. In 'Mrs Tilcher's Class' how does the poet present the speakers feelings towards school?

24 marks

2. In both ‘Last Lesson’ and ‘Mrs Tilcher's Class’ the speakers describe their time at school. What are the similarities and/or differences between the ways the poets present those feelings?

8 marks

Ex-miner by Adrian Burke

The man next door to me was a miner
Until the dust filled his lungs like coal-sacks;
Now he's good for nothing so he says.

Now he walks in slippers and leans on walls,
And eats the clean air while his eyes fix on
Reaching the bottom of his garden.

His wife hides the Woodbines* 'for his own good',
The pub's half-a-day's walk away for him
And it's cruel crawling to the privy**.

So few pleasures remain to him
That he takes a grim-sour joy in rudeness
To neighbours: he savours the honorary title

Of old misery-guts like a vintage wine.
His other treat's to stand upright each day
And not to bang his head against the sky.

*Woodbines = brand of cigarettes
**privy = outside toilet

Abandoned Farmhouse By Ted Kooser

He was a big man, says the size of his shoes
on a pile of broken dishes by the house;
a tall man too, says the length of the bed
in an upstairs room; and a good, God-fearing man,
says the Bible with a broken back
on the floor below the window, dusty with sun;
but not a man for farming, say the fields
cluttered with boulders and the leaky barn.

A woman lived with him, says the bedroom wall
papered with lilacs and the kitchen shelves
covered with oilcloth, and they had a child,
says the sandbox made from a tractor tire.
Money was scarce, say the jars of plum preserves
and canned tomatoes sealed in the cellar hole.
And the winters cold, say the rags in the window frames.
It was lonely here, says the narrow country road.

Something went wrong, says the empty house
in the weed-choked yard. Stones in the fields
say he was not a farmer; the still-sealed jars
in the cellar say she left in a nervous haste.
And the child? Its toys are strewn in the yard
like branches after a storm—a rubber cow,
a rusty tractor with a broken plow,
a doll in overalls. Something went wrong, they say.

1. In 'Ex-miner' how does the poet present the speakers feelings towards identity?
24 marks
2. In both 'Ex-miner' and 'Abandoned Farmhouse' the speakers describe people who are not well known to them. What are the similarities and/or differences between the ways the poets present those feelings about the people they describe?
8 marks

MATHS

These tasks should take you: 8 hours

Higher: Read through the examples making notes in your book. Then answer the questions in your book.

25.1 Properties of vectors

This section will show you how to:

- add and subtract vectors.

Key terms	
direction	magnitude
position vector	resultant vector
scalar	vector

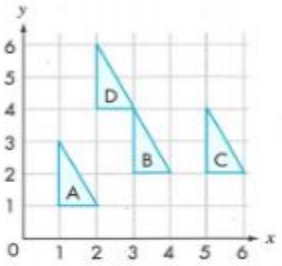
A quantity that is completely described by its **magnitude**, and has no **direction** associated with it, is a **scalar**. The mass of a bus (10 tonnes) and the length of a line (25.4 mm) are scalars.

A **vector** is a quantity that has both magnitude and direction. It may be represented by a straight line, with an arrow to show its direction. The length of the line represents the magnitude of the vector.

This vector **a** represents the translation or movement from A to B.

You used vectors in transformation geometry, where you described a translation in terms of horizontal and vertical shifts.

A translation was described as $\begin{pmatrix} x \\ y \end{pmatrix}$, where x is a movement parallel to the x-axis and y is a movement parallel to the y-axis. This means that $\begin{pmatrix} x \\ y \end{pmatrix}$ is a vector, since it has magnitude and direction.



The vector describing the translation from A to B is $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$.

The vector describing the translation from B to C is $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$.

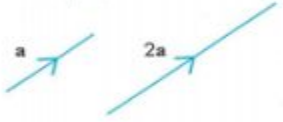
The vector describing the translation from C to D is $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$.

The vector describing the translation from D to A is $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$.

You can express vectors in other ways.

- In textbooks, a vector may be shown as a small letter, such as **a**, printed in bold type. When you write the vector down, you underline it, like this: $\underline{a}$.
- You may also write the vector **a** as $\overrightarrow{AB}$. The arrow above the letters shows the direction: here it is from A to B. The vector from B to A has the same magnitude but acts in the opposite direction, so you write it as $\overrightarrow{BA}$. The first letter is always the starting point and the second letter is the finishing point.

Multiplying a vector by a number (scalar) alters its magnitude (length) but not its direction. For example, the vector 2**a** is twice as long as the vector **a**, but acts in the same direction.



A negative vector, for example **–b**, has the same magnitude as the vector **b**, but acts in the opposite direction.

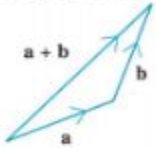
Addition and subtraction of vectors

Think about two non-parallel vectors, **a** and **b**.

Then **a** + **b** is the translation of **a** followed by the translation of **b**.

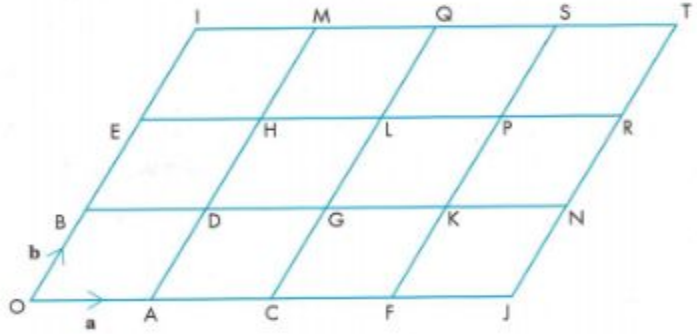
The vector **a** + **b** is the **resultant vector** as it is the result of adding them.

You can see this on a vector diagram.



Similarly, **a** – **b** is defined as the translation of **a** followed by the translation of –**b**.

This grid is made from congruent parallelograms.



Each small parallelogram represents two independent vectors, **a** and **b**.

You can define the position of any point on this grid, with reference to O, as a vector expressed in terms of **a** and **b**. This is the **position vector** of the point, with respect to O.

- The position vector of K is $\overrightarrow{OK}$ or $\mathbf{k} = 3\mathbf{a} + \mathbf{b}$.
- The position vector of E is $\overrightarrow{OE}$ or $\mathbf{e} = 2\mathbf{b}$.

You can also define the vector linking any two points, in terms of **a** and **b**.

$\overrightarrow{HT} = 3\mathbf{a} + \mathbf{b}$ $\quad \overrightarrow{PN} = \mathbf{a} - \mathbf{b}$ $\quad \overrightarrow{MK} = 2\mathbf{a} - 2\mathbf{b}$ $\quad \overrightarrow{TP} = -\mathbf{a} - \mathbf{b}$

Note:

- $\overrightarrow{OK}$ and $\overrightarrow{HT}$ are equal vectors because they have exactly the same length and act in the same direction
- $\overrightarrow{MK}$ and $\overrightarrow{PN}$ are parallel vectors but $\overrightarrow{MK}$ has twice the magnitude of $\overrightarrow{PN}$.

Example 1

a Refer to the grid on the previous page. Write down each of these vector in terms of **a** and **b**.

i $\overrightarrow{BH}$ ii $\overrightarrow{HP}$ iii $\overrightarrow{GT}$

iv $\overrightarrow{TI}$ v $\overrightarrow{FH}$ vi $\overrightarrow{BQ}$

b What is the relationship between the vectors in each pair?

i $\overrightarrow{BH}$ and $\overrightarrow{GT}$ ii $\overrightarrow{BQ}$ and $\overrightarrow{GT}$ iii $\overrightarrow{HP}$ and $\overrightarrow{TI}$

c Show that B, H and Q lie on the same straight line.

a i $\mathbf{a}+\mathbf{b}$ ii $2\mathbf{a}$ iii $2\mathbf{a}+2\mathbf{b}$

iv $-4\mathbf{a}$ v $-2\mathbf{a}+2\mathbf{b}$ vi $2\mathbf{a}+2\mathbf{b}$

b i $\overrightarrow{BH}$ and $\overrightarrow{GT}$ are parallel and $\overrightarrow{GT}$ has twice the magnitude of $\overrightarrow{BH}$ because it is twice its length.

ii $\overrightarrow{BQ}$ and $\overrightarrow{GT}$ are equal.

iii $\overrightarrow{HP}$ and $\overrightarrow{TI}$ act in opposite directions and $\overrightarrow{TI}$ has twice the magnitude of $\overrightarrow{HP}$ because it is twice its length.

c $\overrightarrow{BH}$ and $\overrightarrow{BQ}$ are parallel and start at the same point B. Therefore, B, H and Q must lie on the same straight line.

Example 2

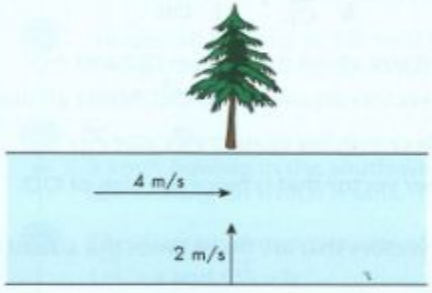
Tebor sees a pine tree, directly opposite him, across a river. He decides to swim across to pick up some cones. He swims with a velocity of 2 m/s, at right angles to the bank. The current of the river has a velocity of 4 m/s. The river is 40 metres wide.

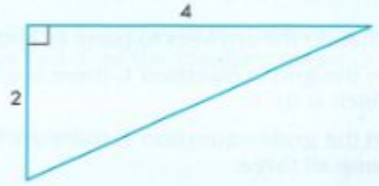
a At what velocity will Tebor actually be travelling?

b How far along the bank from the tree will Tebor be when he reaches the other side?

As Tebor swims 2 m across the river, he is moved 4 m down the river by the current.

You can use a vector diagram to represent the velocity of Tebor swimming and the velocity of the current.





You can then add the two vectors to give the resultant velocity.

This force is represented by the hypotenuse in the right-angled triangle.

a Use Pythagoras' theorem to find the resultant.

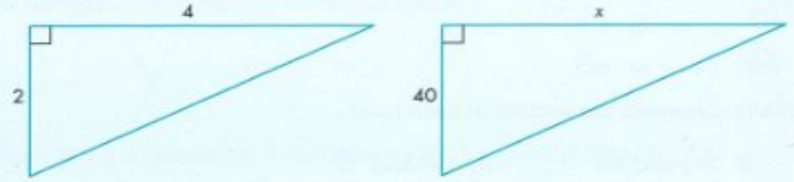
(Length of the hypotenuse)$^2 = 2^2 + 4^2$

$= 20$

Length of the hypotenuse $= \sqrt{20}$

So Tebor's resultant velocity is 4.47 m/s.

b Use similar triangles to find x, the distance travelled downstream.



$\frac{x}{4} = \frac{40}{2}$

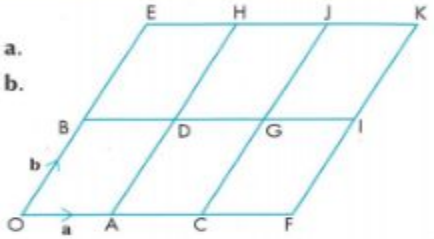
$x = \frac{40 \times 4}{2}$

$= 80$ m

Tebor reaches the bank 80 m downstream from the tree.

Exercise 25A

1 On this grid, $\vec{OA}$ is **a** and $\vec{OB}$ is **b**.



a Name three other vectors that are equivalent to **a**.

b Name three other vectors that are equivalent to **b**.

c Name three vectors that are equivalent to **–a**.

d Name three vectors that are equivalent to **–b**.

2 Look again at the grid in question **1**. Write each of these vectors in terms of **a** and **b**.

a $\vec{OC}$ **b** $\vec{OE}$ **c** $\vec{OD}$ **d** $\vec{OG}$ **e** $\vec{OJ}$ **f** $\vec{OH}$

g $\vec{AG}$ **h** $\vec{AK}$ **i** $\vec{BK}$ **j** $\vec{DI}$ **k** $\vec{GJ}$ **l** $\vec{DK}$

MR **3** **a** What do the answers to parts **2c** and **2g** tell you about the vectors $\vec{OD}$ and $\vec{AG}$?

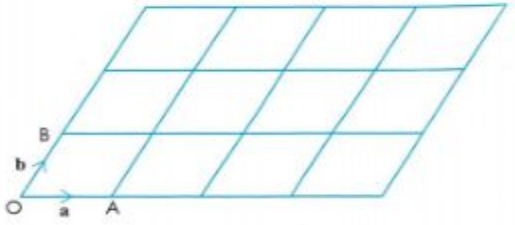
b On the grid in question **1**, there are three vectors equivalent to $\vec{OG}$. Name all three.

MR **4** **a** What do the answers to parts **2c** and **2e** tell you about vectors $\vec{OD}$ and $\vec{OJ}$?

b On the grid in question **1**, there is one other vector that is twice the size of $\vec{OD}$. Which is it?

c On the grid in question **1**, there are three vectors that are three times the size of $\vec{OA}$. Name all three.

5 Copy this grid. Use the information below to mark the points C to P on your grid.



a $\vec{OC} = 2\mathbf{a} + 3\mathbf{b}$ **b** $\vec{OD} = 2\mathbf{a} + \mathbf{b}$

c $\vec{OE} = \mathbf{a} + 2\mathbf{b}$ **d** $\vec{OF} = 3\mathbf{b}$

e $\vec{OG} = 4\mathbf{a}$ **f** $\vec{OH} = 4\mathbf{a} + 2\mathbf{b}$

g $\vec{OI} = 3\mathbf{a} + 3\mathbf{b}$ **h** $\vec{OJ} = \mathbf{a} + \mathbf{b}$

i $\vec{OK} = 2\mathbf{a} + 2\mathbf{b}$ **j** $\vec{OM} = 2\mathbf{a} + \frac{3}{2}\mathbf{b}$

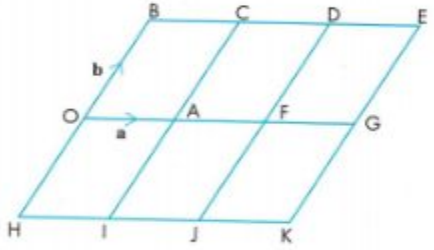
k $\vec{ON} = \frac{1}{2}\mathbf{a} + 2\mathbf{b}$ **l** $\vec{OP} = \frac{5}{2}\mathbf{a} + \frac{3}{2}\mathbf{b}$

CM **6** **a** Look at the grid you completed in question **5**. What can you say about the points O, J, K and I?

b How could you tell this by looking at the vectors for parts **5g**, **5h** and **5i**?

c There is another point on the same straight line as O and D. Which is it?

7 On this grid, $\overrightarrow{OA}$ is **a** and $\overrightarrow{OB}$ is **b**.



Write each of these vectors in terms of **a** and **b**.

a $\overrightarrow{OH}$	**b** $\overrightarrow{OK}$	**c** $\overrightarrow{OJ}$	**d** $\overrightarrow{OI}$
e $\overrightarrow{OC}$	**f** $\overrightarrow{CO}$	**g** $\overrightarrow{AK}$	**h** $\overrightarrow{DI}$
i $\overrightarrow{JE}$	**j** $\overrightarrow{AB}$	**k** $\overrightarrow{CK}$	**l** $\overrightarrow{DK}$

CM **8** **a** What do your answers to parts **7e** and **7f** tell you about the vectors $\overrightarrow{OC}$ and $\overrightarrow{CO}$?

b On the grid in question **7**, there are five other vectors that are opposite to $\overrightarrow{OC}$. Name at least three.

CM **9** **a** What do your answers to parts **7j** and **7k** tell you about vectors $\overrightarrow{AB}$ and $\overrightarrow{CK}$?

b On the grid in question **7**, there are two vectors that are twice the size of $\overrightarrow{AB}$ and act in the opposite direction. Name both of them.

c On the grid in question **7**, there are three vectors that are three times the size of $\overrightarrow{OA}$ and act in the opposite direction. Name all three.

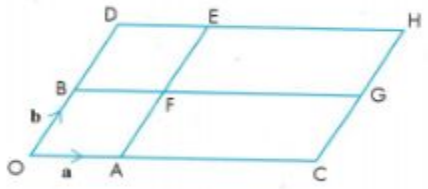
PS **10** An aircraft is flying at 500 mph through a wind of 80 mph blowing from the west. It is being steered due north. What is the actual bearing and speed of travel of the aircraft?

PS **11** A boat attempts to sail due east at 15 km/h, but is taken off course by a current of 5 km/h flowing in the south-west direction. Find the resultant speed of the boat and the bearing on which it sails.

PS **12** The diagram shows two sets of parallel lines.

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

$\overrightarrow{OC} = 3\overrightarrow{OA}$ and $\overrightarrow{OD} = 2\overrightarrow{OB}$



a Write each of these vectors in terms of **a** and **b**.

i $\overrightarrow{OF}$ **ii** $\overrightarrow{OG}$

iii $\overrightarrow{EG}$ **iv** $\overrightarrow{CE}$

b Write down two vectors that can be written as $3\mathbf{a} - \mathbf{b}$.

EV **13** The points P, Q and R lie on a straight line. The vector $\overrightarrow{PQ}$ is $2\mathbf{a} + \mathbf{b}$, where **a** and **b** are vectors.

Work out which of these vectors could be the vector $\overrightarrow{PR}$ and which could not be the vector $\overrightarrow{PR}$. There are two of each.

a $2\mathbf{a} + 2\mathbf{b}$ **b** $4\mathbf{a} + 2\mathbf{b}$ **c** $2\mathbf{a} - \mathbf{b}$ **d** $-6\mathbf{a} - 3\mathbf{b}$

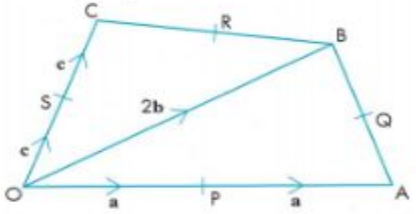
EV **14** The points P, Q and R lie on a straight line. The vector $\overrightarrow{PQ}$ is $3\mathbf{a} - \mathbf{b}$, where **a** and **b** are vectors.

a Write down any other vector that could represent $\overrightarrow{PR}$.

b How can you tell from another vector $\overrightarrow{PS}$ that S lies on the same straight line as P, Q and R?

CM **15** Use a vector diagram to prove that $\mathbf{a} + (\mathbf{b} + \mathbf{c}) = (\mathbf{a} + \mathbf{b}) + \mathbf{c}$.

CM **16** OABC is a quadrilateral.



P, Q, R and S are the midpoints of OA, AB, BC and OC respectively.

$\overrightarrow{OA} = 2\mathbf{a}$, $\overrightarrow{OB} = 2\mathbf{b}$ and $\overrightarrow{OC} = 2\mathbf{c}$

a Work out these vectors in terms of **a**, **b** and **c**.

Give your answers in their simplest form.

i $\overrightarrow{AB}$ **ii** $\overrightarrow{SP}$ **iii** $\overrightarrow{BC}$ **iv** $\overrightarrow{PR}$

b Use vectors to prove that PQRS is a parallelogram.

25.2 Vectors in geometry

This section will show you how to:

- use vectors to solve geometrical problems.

Key term

collinear

You can use vectors to prove many results in geometry. The next two examples will show you how.

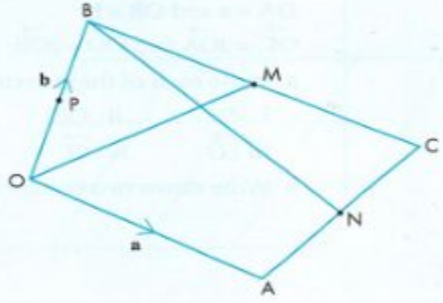
Example 3

In the diagram, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$, and $\overrightarrow{BC} = \frac{3}{2}\mathbf{a}$.

M is the midpoint of BC, N is the midpoint of AC and P is the midpoint of OB.

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

b Prove that PN is parallel to OA.



a $\overrightarrow{BN} = \overrightarrow{BC} + \overrightarrow{CN}$

$= \overrightarrow{BC} - \frac{1}{2}\overrightarrow{AC}$

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

$= \frac{3}{2}\mathbf{a} - \frac{1}{4}\mathbf{a} - \frac{1}{2}\mathbf{b}$

$= \frac{5}{4}\mathbf{a} - \frac{1}{2}\mathbf{b}$

Check that if you started with $\overrightarrow{BN} = \overrightarrow{BO} + \overrightarrow{OA} + \overrightarrow{AN}$, you would get the same result.

b $\overrightarrow{AN} = \frac{1}{2}\overrightarrow{AC} = \frac{1}{2}(-\mathbf{a} + \mathbf{b} + \frac{3}{2}\mathbf{a}) = \frac{1}{2}(\frac{1}{2}\mathbf{a} + \mathbf{b})$

$\overrightarrow{PN} = \overrightarrow{PO} + \overrightarrow{OA} + \overrightarrow{AN}$

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

$= -\frac{1}{2}\mathbf{b} + \mathbf{a} + \frac{1}{4}\mathbf{a} + \frac{1}{2}\mathbf{b}$

$= \frac{5}{4}\mathbf{a}$

$\overrightarrow{PN}$ is a multiple of **a** only, so must be parallel to $\overrightarrow{OA}$.

Note: If three or more points lie on the same line, they are said to be **collinear**.

Example 4

OACB is a parallelogram.

$\overrightarrow{OA}$ is represented by the vector **a**.

$\overrightarrow{OB}$ is represented by the vector **b**.

P is the point that divides OC in the ratio 2 : 1.

M is the midpoint of AC.

Show that B, P and M are collinear.

$\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$

$= \mathbf{a} + \mathbf{b}$

Since P divides OC in the ratio 2:1, then $\overrightarrow{OP} = \frac{2}{3}\overrightarrow{OC}$

$= \frac{2}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$

$\overrightarrow{OM} = \overrightarrow{OA} + \overrightarrow{AM}$

$= \overrightarrow{OA} + \frac{1}{2}\overrightarrow{AC}$

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

$\overrightarrow{BP} = \overrightarrow{BO} + \overrightarrow{OP}$

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

$= \frac{2}{3}\mathbf{a} - \frac{1}{3}\mathbf{b}$

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

$\overrightarrow{BM} = \overrightarrow{BO} + \overrightarrow{OM}$

$= -\mathbf{b} + \mathbf{a} + \frac{1}{2}\mathbf{b}$

$= \mathbf{a} - \frac{1}{2}\mathbf{b}$

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

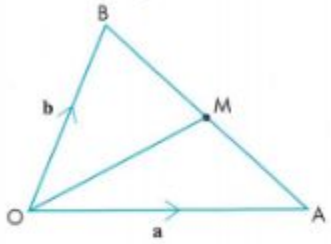
Therefore, $\overrightarrow{BM}$ is a multiple of $\overrightarrow{BP}$ ($\overrightarrow{BM} = \frac{3}{2}\overrightarrow{BP}$).

Therefore, $\overrightarrow{BP}$ and $\overrightarrow{BM}$ are parallel and, as they have a common point, B, they must lie on the same straight line.

Exercise 25B

CM **1** In the diagram, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

M is the midpoint of AB.



a i Work out the vector $\overrightarrow{AB}$.

ii Work out the vector $\overrightarrow{AM}$.

iii Explain why $\overrightarrow{OM} = \overrightarrow{OA} + \overrightarrow{AM}$.

iv Use your answers to parts **ii** and **iii** to work out $\overrightarrow{OM}$ in terms of **a** and **b**.

b i Work out the vector $\overrightarrow{BA}$.

ii Work out the vector $\overrightarrow{BM}$.

iii Explain why $\overrightarrow{OM} = \overrightarrow{OB} + \overrightarrow{BM}$.

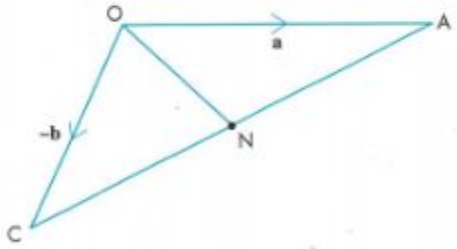
iv Use your answers to parts **ii** and **iii** to work out $\overrightarrow{OM}$ in terms of **a** and **b**.

c Copy the diagram. Show the vector $\overrightarrow{OC}$ which is equal to **a** + **b**.

d Describe in geometrical terms the position of M in relation to O, A, B and C.

MR **2** In the diagram, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = -\mathbf{b}$.

N is the midpoint of AC.



a i Work out the vector $\overrightarrow{AC}$.

ii Work out the vector $\overrightarrow{AN}$.

iii Explain why $\overrightarrow{ON} = \overrightarrow{OA} + \overrightarrow{AN}$.

iv Using your answers to parts **ii** and **iii**, work out $\overrightarrow{ON}$ in terms of **a** and **b**.

b i Work out the vector $\overrightarrow{CA}$.

ii Work out the vector $\overrightarrow{CN}$.

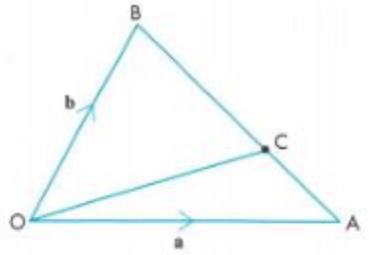
iii Explain why $\overrightarrow{ON} = \overrightarrow{OC} + \overrightarrow{CN}$.

iv Using your answers to parts **ii** and **iii**, work out $\overrightarrow{ON}$ in terms of **a** and **b**.

c Copy the diagram above and show on it the vector $\overrightarrow{OD}$ which is equal to **a** – **b**.

d Describe in geometrical terms the position of N in relation to O, A, C and D.

PS **3** In the diagram, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. The point C divides the line AB in the ratio 1 : 2.



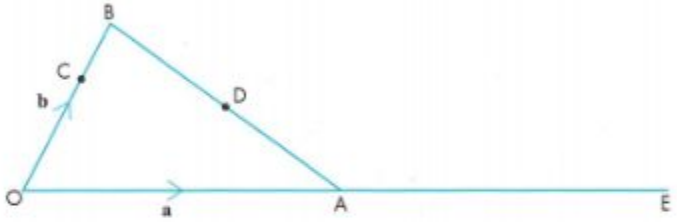
a **i** Work out the vector $\overrightarrow{AB}$.

ii Work out the vector $\overrightarrow{AC}$.

iii Work out the vector $\overrightarrow{OC}$ in terms of **a** and **b**.

b If point D now divides the line AB in the ratio 1 : 3, write down the vector that represents $\overrightarrow{OD}$.

EV **4** The diagram shows the vectors $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.



The point C divides OB in the ratio 2 : 1. The point E is such that $\overrightarrow{OE} = 2\overrightarrow{OA}$. D is the midpoint of AB.

a Write down (or work out) these vectors in terms of **a** and **b**.

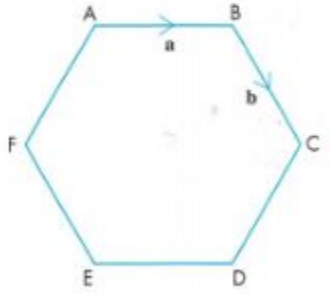
i $\overrightarrow{OC}$ **ii** $\overrightarrow{OD}$ **iii** $\overrightarrow{CO}$

b You can write vector $\overrightarrow{CD}$ as $\overrightarrow{CD} = \overrightarrow{CO} + \overrightarrow{OD}$. Use this fact to work out $\overrightarrow{CD}$ in terms of **a** and **b**.

c Write down a similar rule to that in part **b** for the vector $\overrightarrow{DE}$. Use this rule to work out $\overrightarrow{DE}$ in terms of **a** and **b**.

d Show how you know that C, D and E lie on the same straight line.

MR **5** ABCDEF is a regular hexagon. $\overrightarrow{AB}$ is represented by the vector **a** and $\overrightarrow{BC}$ by the vector **b**.



a By means of a diagram, or otherwise, show that $\overrightarrow{CD} = \mathbf{b} - \mathbf{a}$.

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

i $\overrightarrow{DE}$ **ii** $\overrightarrow{EF}$ **iii** $\overrightarrow{FA}$

c Work out the resultant vector of adding:

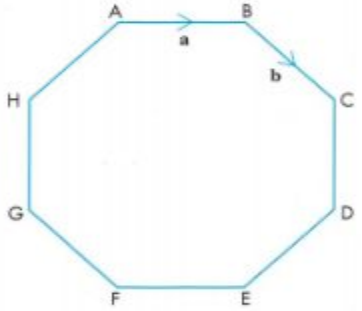
$\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CD} + \overrightarrow{DE} + \overrightarrow{EF} + \overrightarrow{FA}$

Explain your answer.

d Express these vectors in terms of **a** and **b**.

i $\overrightarrow{AD}$ **ii** $\overrightarrow{BE}$ **iii** $\overrightarrow{CF}$ **iv** $\overrightarrow{AE}$ **v** $\overrightarrow{DF}$

PS **6** ABCDEFGH is a regular octagon. $\overrightarrow{AB}$ is represented by the vector **a** and $\overrightarrow{BC}$ by the vector **b**.



a By means of a diagram, or otherwise, show that $\overrightarrow{CD} = \sqrt{2}\,\mathbf{b} - \mathbf{a}$.

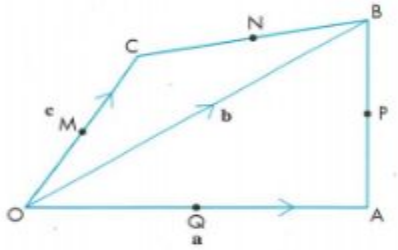
b By means of a diagram, or otherwise, explain why $\overrightarrow{DE} = \mathbf{b} - \sqrt{2}\,\mathbf{a}$.

c Express these vectors in terms of **a** and **b**.

i $\overrightarrow{EF}$ **ii** $\overrightarrow{FG}$ **iii** $\overrightarrow{GH}$ **iv** $\overrightarrow{HA}$

v $\overrightarrow{HC}$ **vi** $\overrightarrow{AD}$ **vii** $\overrightarrow{BE}$ **viii** $\overrightarrow{BF}$

MR **7** In the quadrilateral OABC, M, N, P and Q are the midpoints of the sides as shown. $\overrightarrow{OA}$ is represented by the vector **a** and $\overrightarrow{OC}$ by the vector **c**. The diagonal $\overrightarrow{OB}$ is represented by the vector **b**.



a Express these vectors in terms of **a**, **b** and **c**.

i $\overrightarrow{AB}$ **ii** $\overrightarrow{AP}$ **iii** $\overrightarrow{OP}$

Give your answers as simply as possible.

b i Express the vector $\overrightarrow{ON}$ in terms of **b** and **c**.

ii Hence express the vector $\overrightarrow{PN}$ in terms of **a** and **c**.

c i Express the vector $\overrightarrow{QM}$ in terms of **a** and **c**.

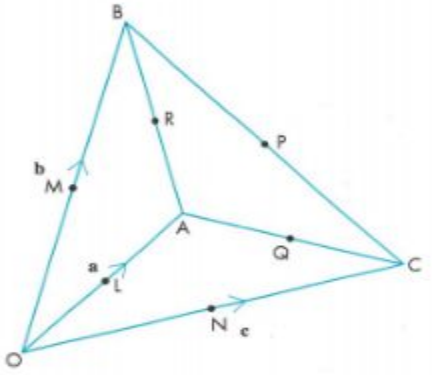
ii What relationship is there between $\overrightarrow{PN}$ and $\overrightarrow{QM}$?

iii What sort of quadrilateral is PNMQ?

d Prove that $\overrightarrow{AC} = 2\overrightarrow{QM}$.

MR **8** In the diagram, L, M, N, P, Q, R are the midpoints of the line segments OA, OB, OC, BC, AC and AB, as shown.

$\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$



a Express these vectors in terms of **a** and **c**.

i $\overrightarrow{OL}$ **ii** $\overrightarrow{AC}$ **iii** $\overrightarrow{OQ}$ **iv** $\overrightarrow{LQ}$

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

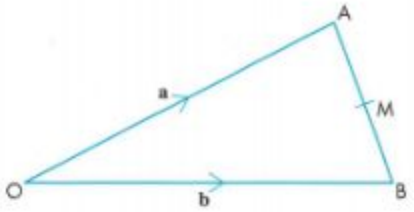
i $\overrightarrow{LM}$ **ii** $\overrightarrow{QP}$

c Prove that the quadrilateral LMPQ is a parallelogram.

d Find two other sets of four points that form parallelograms.

EV **9** In the triangle OAB, M is the midpoint of AB.

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



a Write $\overrightarrow{AM}$ in terms of **a** and **b**.

Give your answer in its simplest form.

b $\overrightarrow{OC} = \mathbf{a} + \mathbf{b}$

The length of OA is equal to the length of OB.

i Write down the name of the shape OACB.

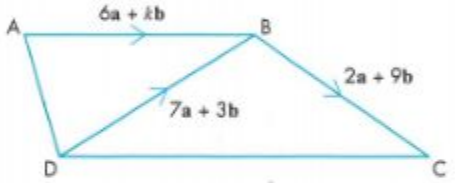
ii Write down one fact about the points O, M and C.

Give a reason for your answer.

PS **10** ABCD is a trapezium with AB parallel to DC.

$\overrightarrow{AB} = 6\mathbf{a} + k\mathbf{b}$, $\overrightarrow{BC} = 2\mathbf{a} + 9\mathbf{b}$ and $\overrightarrow{DB} = 7\mathbf{a} + 3\mathbf{b}$, where k is a number.

Work out the value of k.



CM **11** **a** and **b** are vectors.

$\overrightarrow{XY} = \mathbf{a} + \mathbf{b}$ $\overrightarrow{YZ} = 2\mathbf{a} + \mathbf{b}$ $\overrightarrow{ZW} = \mathbf{a} + 2\mathbf{b}$

a Show that $\overrightarrow{YW}$ is parallel to $\overrightarrow{XY}$.

b Write down the ratio YW : XY.

c What do your answers to **a** and **b** tell you about the points X, Y and W?

d O is the origin.

A, B and C are three points such that:

$$\overrightarrow{OA} = \begin{pmatrix} 6 \\ 2 \end{pmatrix} \quad \overrightarrow{OB} = \begin{pmatrix} 1 \\ 1 \end{pmatrix} \quad \overrightarrow{OC} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$$

Prove that angle ABC is a right angle.

CM **12** Show, by using vectors that the diagonals of a parallelogram bisect each other.

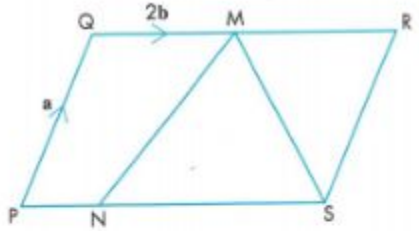
Review questions

1 PQRS is a parallelogram.

M is the midpoint of QR.

N is a point on PS such that NS = 3PN

$\overrightarrow{PQ} = \mathbf{a}$ $\overrightarrow{QM} = 2\mathbf{b}$



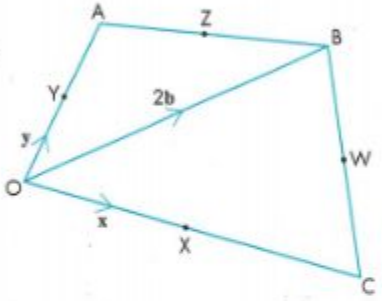
Express these vectors as simply as possible, in terms of **a** and **b**.

a $\overrightarrow{MS}$ **b** $\overrightarrow{SN}$ **c** $\overrightarrow{NM}$

EV **2** OABC is a quadrilateral.

W, X, Y and Z are the midpoints of BC, OC, OA and AB.

$\overrightarrow{OX} = \mathbf{x}$, $\overrightarrow{OY} = \mathbf{y}$ and $\overrightarrow{OB} = 2\mathbf{b}$.



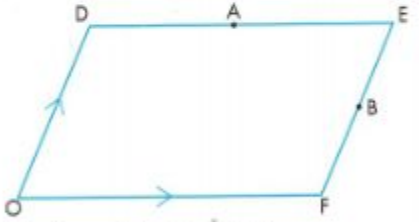
a Write these vectors in terms of **b**, **x** and **y**.

i $\overrightarrow{BA}$ **ii** $\overrightarrow{CB}$

b Show that $\overrightarrow{WZ} = \mathbf{y} - \mathbf{x}$

c Tim said: 'WXYZ is a parallelogram.' Evaluate Tim's statement.

CM **3** ODEF is a parallelogram.



A is the midpoint of DE.

B is the midpoint of EF.

Show that AB is parallel to DF.

CM **4** OPQR is a parallelogram. Let $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OR} = \mathbf{r}$.

a Express these vectors in terms of **p** and **r**.

i $\overrightarrow{OQ}$ **ii** $\overrightarrow{PR}$

The point X is the midpoint of PR.

b Express $\overrightarrow{PX}$ in terms of **p** and **r**.

c Show that X is the midpoint of OQ.

Foundation: Read through the examples making notes in your book. Then answer the questions in your book.

12.7 Vectors

This section will show you how to:

- represent vectors
- add and subtract vectors.

Key terms

- direction
- magnitude
- resultant vector
- scalar

A **scalar** is a quantity that has a **magnitude** (length) but no **direction**. The mass of a bus (10 tonnes) and the length of a line (25.4 mm) are scalars.

A vector is a quantity that has both magnitude and direction. It may be represented by a straight line, with an arrow to show its direction. The length of the line represents the magnitude of the vector.

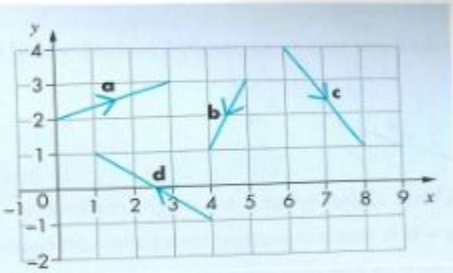
In the same way that you used vectors to describe a translation in terms of horizontal and vertical shifts, this vector **a** represents the translation or movement from A to B.

You can write vectors in other ways.

- In textbooks, a vector may be shown as a small letter, such as **a**, printed in bold type. When you write the vector down, you underline it, like this: $\underline{a}$.
- You may also write the vector **a** as $\overrightarrow{AB}$. The arrow above the letters shows the direction: here it is from A to B.

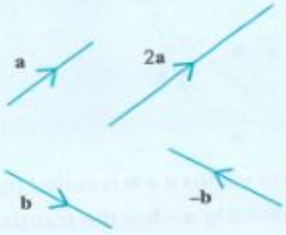
Example 5

Write each vector as a column vector.



$\mathbf{a} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -1 \\ -2 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ $\mathbf{d} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$

Multiplying a vector by a number (scalar) alters its magnitude (length) but not its direction. For example, the vector $2\mathbf{a}$ is twice as long as the vector $\mathbf{a}$, but acts in the same direction.



A negative vector, for example $-\mathbf{b}$, has the same magnitude as the vector $\mathbf{b}$, but acts in the opposite direction.

Exercise 12G

1 Draw lines to represent these vectors. (Remember to include the arrow.)

$\mathbf{a} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} -3 \\ -5 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ $\mathbf{d} = \begin{pmatrix} 1 \\ -4 \end{pmatrix}$ $\mathbf{e} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$

2 **a** Draw the points A(3, 2), B(6, 8) and C(4, –1) on a coordinate grid.

b Write these as column vectors.

i $\overrightarrow{AB}$ **ii** $\overrightarrow{BC}$ **iii** $\overrightarrow{AC}$

3 A is the point (–3, 2). $\overrightarrow{AB} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$ and $\overrightarrow{AC} = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$.

a Write down the coordinates of B and C. **b** What is the column vector for $\overrightarrow{BC}$?

4 A triangle has vertices at A(–3, 1), B(1, 0) and C(1, 3).

Give the coordinates of triangle ABC after:

a a translation of $\begin{pmatrix} 5 \\ 1 \end{pmatrix}$ **b** a translation of $\begin{pmatrix} -3 \\ -2 \end{pmatrix}$.

5 B is the point (4, 2). $\overrightarrow{AB} = \begin{pmatrix} 3 \\ -3 \end{pmatrix}$

Give the coordinates of point A.

6 A translation, T, transforms the point A(3, –2) to A′(5, 3).

a What will be the coordinates of point B(1, 3) after the same translation?

b C′(8, –1) has been transformed by T. What were the original coordinates of point C?

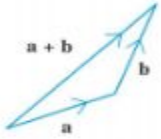
Adding and subtracting of vectors

Here are two non-parallel vectors, **a** and **b**.

Think about what **a** + **b** might represent.

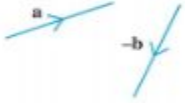
a + **b** is the translation by **a** followed by the translation by **b**.

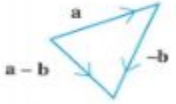
You can see this on a vector diagram.



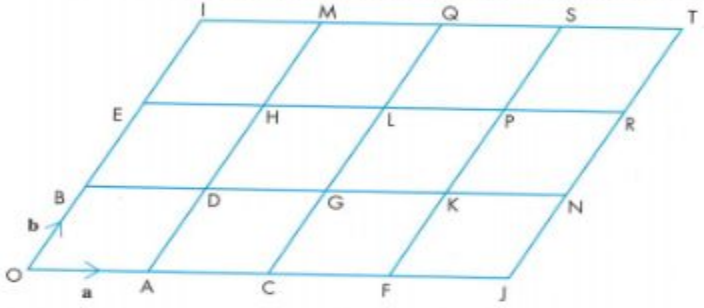
The vector **a** + **b** is called the **resultant vector**.

Similarly, **a** – **b** is the translation by **a** followed by the translation by –**b** as shown below.





This grid is made from parallelograms that are all the same size.



Each small parallelogram represents two independent vectors, **a** and **b**.

You can define the position of any point on this grid, with reference to O, as a vector written in terms of **a** and **b**.

For example:

$\overrightarrow{OK} = 3\mathbf{a} + \mathbf{b}$

$\overrightarrow{OE} = 2\mathbf{b}$.

You can also define the vector linking any two points in terms of **a** and **b**.

$\overrightarrow{HT} = 3\mathbf{a} + \mathbf{b}$ $\quad \overrightarrow{PN} = \mathbf{a} - \mathbf{b}$ $\quad \overrightarrow{MK} = 2\mathbf{a} - 2\mathbf{b}$ $\quad \overrightarrow{TP} = -\mathbf{a} - \mathbf{b}$

Note:

- $\overrightarrow{OK}$ and $\overrightarrow{HT}$ are equal vectors because they have exactly the same length and the same direction
- $\overrightarrow{MK}$ and $\overrightarrow{PN}$ are parallel vectors but $\overrightarrow{MK}$ has twice the magnitude of $\overrightarrow{PN}$.

Example 6

a Refer to the grid above. Write down each vector in terms of **a** and **b**.

i $\overrightarrow{BH}$ ii $\overrightarrow{HP}$ iii $\overrightarrow{GT}$

iv $\overrightarrow{TI}$ v $\overrightarrow{FH}$ vi $\overrightarrow{BQ}$

b What is the relationship between the vectors in each pair?

i $\overrightarrow{BH}$ and $\overrightarrow{GT}$ ii $\overrightarrow{BQ}$ and $\overrightarrow{GT}$ iii $\overrightarrow{HP}$ and $\overrightarrow{TI}$

a i $\mathbf{a} + \mathbf{b}$ ii $2\mathbf{a}$ iii $2\mathbf{a} + 2\mathbf{b}$

iv $-4\mathbf{a}$ v $-2\mathbf{a} + 2\mathbf{b}$ vi $2\mathbf{a} + 2\mathbf{b}$

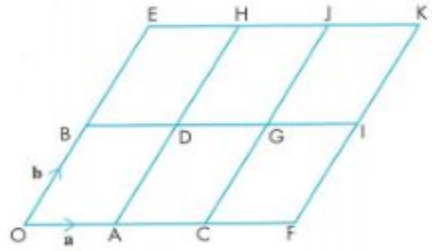
b i $\overrightarrow{BH}$ and $\overrightarrow{GT}$ are parallel and $\overrightarrow{GT}$ has twice the magnitude of $\overrightarrow{BH}$ because it is twice its length.

ii $\overrightarrow{BQ}$ and $\overrightarrow{GT}$ are equal.

iii $\overrightarrow{HP}$ and $\overrightarrow{TI}$ are opposite directions and $\overrightarrow{TI}$ has twice the magnitude of $\overrightarrow{HP}$ because it is twice its length.

Exercise 12H

1 On this grid, $\overrightarrow{OA}$ is **a** and $\overrightarrow{OB}$ is **b**.



a Name three other vectors that are equivalent to **a**.

b Name three other vectors that are equivalent to **b**.

c Name three vectors that are equivalent to $-\mathbf{a}$.

d Name three vectors that are equivalent to $-\mathbf{b}$.

2 Look again at the grid in question **1**. Write each of these vectors in terms of **a** and **b**.

a $\overrightarrow{OC}$ **b** $\overrightarrow{OE}$ **c** $\overrightarrow{OD}$ **d** $\overrightarrow{OG}$ **e** $\overrightarrow{OJ}$ **f** $\overrightarrow{OH}$

g $\overrightarrow{AG}$ **h** $\overrightarrow{AK}$ **i** $\overrightarrow{BK}$ **j** $\overrightarrow{DI}$ **k** $\overrightarrow{GJ}$ **l** $\overrightarrow{DK}$

MR **3** **a** What do the answers to parts **2c** and **2g** tell you about the vectors $\overrightarrow{OD}$ and $\overrightarrow{AG}$?

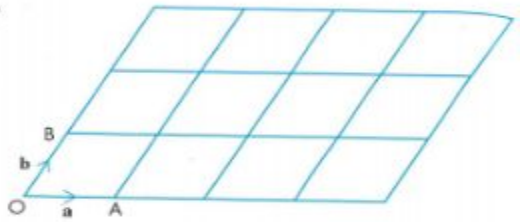
b On the grid in question **1**, there are three vectors equivalent to $\overrightarrow{OG}$. Name all three.

MR **4** **a** What do the answers to parts **2c** and **2e** tell you about vectors $\overrightarrow{OD}$ and $\overrightarrow{OJ}$?

b On the grid in question **1**, there is one other vector that is twice the size of $\overrightarrow{OD}$. Which is it?

c On the grid in question **1**, there are three vectors that are three times the size of $\overrightarrow{OA}$. Name all three.

5 Copy this grid. Use the information below to mark the points C to K on your grid.



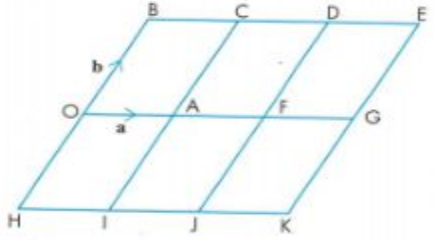
a $\overrightarrow{OC} = 2\mathbf{a} + 3\mathbf{b}$
b $\overrightarrow{OD} = 2\mathbf{a} + \mathbf{b}$
c $\overrightarrow{OE} = \mathbf{a} + 2\mathbf{b}$
d $\overrightarrow{OF} = 3\mathbf{a} + 3\mathbf{b}$
e $\overrightarrow{OG} = \mathbf{a} + \mathbf{b}$
f $\overrightarrow{OH} = 2\mathbf{a} + 2\mathbf{b}$
g $\overrightarrow{OI} = 3\mathbf{a} + 2\mathbf{b}$
h $\overrightarrow{OJ} = 3\mathbf{b}$
i $\overrightarrow{OK} = 4\mathbf{a} + \mathbf{b}$

CM **6** a Look at your grid from question **5**. What can you say about the points O, F, G and H?

b How could you tell this by looking at the vectors in question **5** parts **d**, **e** and **f**?

c L is a point on the edge of the grid, on the extended line OD. Write the vector $\overrightarrow{OL}$ in terms of **a** and **b**.

7 On this grid, $\overrightarrow{OA}$ is **a** and $\overrightarrow{OB}$ is **b**.
Write these vectors in terms of **a** and **b**.



a $\overrightarrow{OH}$
b $\overrightarrow{OK}$
c $\overrightarrow{OJ}$
d $\overrightarrow{OI}$
e $\overrightarrow{OC}$
f $\overrightarrow{CO}$
g $\overrightarrow{AK}$
h $\overrightarrow{DI}$
i $\overrightarrow{JE}$
j $\overrightarrow{AB}$
k $\overrightarrow{CK}$
l $\overrightarrow{DK}$

CM **8** a What do your answers to parts **7e** and **7f** tell you about the vectors $\overrightarrow{OC}$ and $\overrightarrow{CO}$?

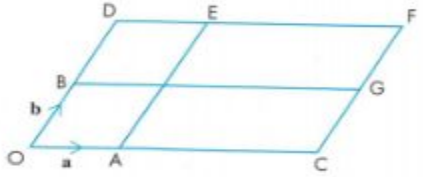
b On the grid in question **7**, there are five other vectors in the opposite direction to $\overrightarrow{OC}$. Name at least three.

CM **9** a What do your answers to parts **7j** and **7k** tell you about vectors $\overrightarrow{AB}$ and $\overrightarrow{CK}$?

b On the grid in question **7**, there are two vectors that are twice the size of $\overrightarrow{AB}$ and are in the opposite direction. Name both of them.

c On the grid in question **7**, there are three vectors that are three times the size of $\overrightarrow{OA}$ and in the opposite direction. Name all three.

PS **10** The diagram shows two sets of parallel lines.



$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$
$\overrightarrow{OC} = 3\overrightarrow{OA}$ and $\overrightarrow{OD} = 2\overrightarrow{OB}$

a Write these vectors in terms of **a** and **b**.
i $\overrightarrow{OF}$ ii $\overrightarrow{OC}$ iii $\overrightarrow{EG}$ iv $\overrightarrow{CE}$

b Write down two vectors that can be written as $3\mathbf{a} - \mathbf{b}$.

To find the resultant by adding vectors

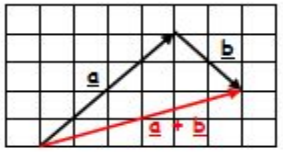
- **The resultant** is the vector that 'results' from adding two or more vectors together e.g. $\underline{a} + \underline{b}$

e.g. if $\underline{a} = \begin{pmatrix} 4 \\ 4 \end{pmatrix}$ and $\underline{b} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$

then $\underline{a} + \underline{b} = \begin{pmatrix} 4 \\ 4 \end{pmatrix} + \begin{pmatrix} 2 \\ -2 \end{pmatrix} = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$

- **The resultant** can also be shown by lining up the head of the one vector with the tail of the other.

e.g. $\underline{a} + \underline{b}$



Triangle law - the directional arrows are really important

Show $\underline{a} + \underline{b}$ (i) as an addition of column vectors
(ii) using the triangle law of vector addition

1. If $\underline{a} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$ and $\underline{b} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$

1. $\begin{pmatrix} 4 \\ 2 \end{pmatrix} + \begin{pmatrix} 1 \\ 3 \end{pmatrix} =$ ☐

2. If $\underline{a} = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$ and $\underline{b} = \begin{pmatrix} -2 \\ 2 \end{pmatrix}$

2. $\begin{pmatrix} 6 \\ 3 \end{pmatrix} + \begin{pmatrix} -2 \\ 2 \end{pmatrix} =$ ☐

3. If $\underline{a} = \begin{pmatrix} 3 \\ -5 \end{pmatrix}$ and $\underline{b} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$

3. $\begin{pmatrix} 3 \\ -5 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \end{pmatrix} =$ ☐

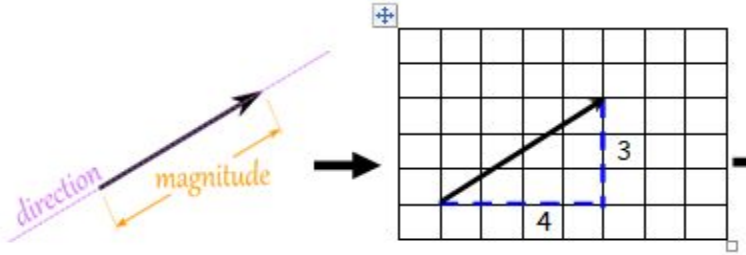
4. If $\underline{a} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$ and $\underline{b} = \begin{pmatrix} 4 \\ -2 \end{pmatrix}$

4. $\begin{pmatrix} 2 \\ 5 \end{pmatrix} + \begin{pmatrix} 4 \\ -2 \end{pmatrix} =$ ☐

5. If $\underline{a} = \begin{pmatrix} 1 \\ -4 \end{pmatrix}$ and $\underline{b} = \begin{pmatrix} 3 \\ 0 \end{pmatrix}$

5. $\begin{pmatrix} 1 \\ -4 \end{pmatrix} + \begin{pmatrix} 3 \\ 0 \end{pmatrix} =$ ☐

Magnitude is defined as the length of a vector



Magnitude (length) can be calculated using Pythagoras Theorem:
$3^2 + 4^2 = 25$
$\sqrt{25} = 5$

For each of the following column vectors:

(i) Find its magnitude (correct to 2dp if applicable)

(ii) Draw a diagram to show its direction

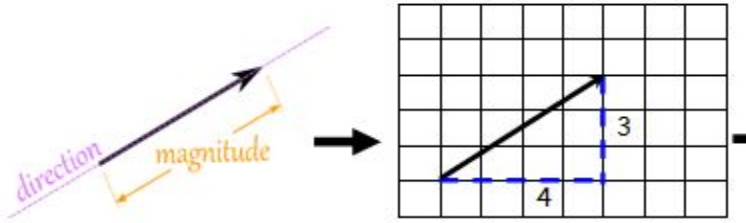
(a) $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ (c) $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ (e) $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$

(b) $\begin{pmatrix} -4 \\ 1 \end{pmatrix}$ (d) $\begin{pmatrix} -6 \\ -6 \end{pmatrix}$ (f) $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$

Name .....

To calculate the magnitude of a vector

Magnitude is defined as the length of a vector



Magnitude (length) can be calculated using Pythagoras Theorem:
$3^2 + 4^2 = 25$
$\sqrt{25} = 5$

For each of the following column vectors:

(i) Find its magnitude (correct to 2dp if applicable)

(ii) Draw a diagram to show its direction

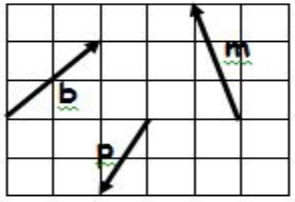
(a) $\begin{pmatrix} 3 \\ 2 \end{pmatrix}$ (b) $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ (c) $\begin{pmatrix} 5 \\ -2 \end{pmatrix}$

(d) $\begin{pmatrix} -4 \\ 1 \end{pmatrix}$ (e) $\begin{pmatrix} -6 \\ -6 \end{pmatrix}$ (f) $\begin{pmatrix} -4 \\ 3 \end{pmatrix}$

When we multiply a vector by a scalar it is called "scaling" a vector, because we change how big or small the vector is.

The scalar scales the vector up or down

Here the vector 3**a**
3 is the scalar
It is scaled up by 3 times the magnitude(length) of **a**
It still points in the same direction, but is 3 times longer



TASK A - Using the vectors **b**, **p** and **m** from the grid above, draw the following vectors on the grid below

- Put on the arrow to show direction
- Label to show what it is

1. $2\underline{b}$	2. $-\underline{m}$	3. $4\underline{p}$	4. $\frac{1}{2}\underline{b}$	5. $-2\underline{p}$
6. $-\underline{b}$	7. $2\underline{m}$	8. $2\underline{p}$	9. $3\underline{m}$	10. $2\underline{m} + \underline{p}$

SCIENCE **These tasks should take you:** **Each task should take approximately 1 hour**	J-band ONLY Task 1 Revision ï CB1 Key Concepts in Biology This unit contains the following topics: - Microscopes - Cells - Enzymes - Diffusion, osmosis and active transport Your task is to produce revision material on this topic that you can use next year in Year 11. Your revision material could be any of the following; mind maps, revision/flash cards, past paper questions, writing your own practice questions and answers, revision sheets or any others that you can think of. Your revision should be active and not simply copying information from one source to another. Task 2 Revision ï CB2 *Cells and Control* This unit contains the following topics: - Mitosis - Growth in animals and plants - Stem cells - The nervous system - The reflex arc Your task is to produce revision material on this topic that you can use next year in Year 11. Your revision material could be any of the following; mind maps, revision/flash cards, past paper questions, writing your own practice

questions and answers, revision sheets or any others that you can think of. Your revision should be active and not simply copying information from one source to another.

J and K-band

Task 1

Revision ï CC1 and CC2 Methods of purifying and separating substances.

Answer each of the following questions:

1) What are the differences between a *mixture* and a *pure* substance?

2) Describe how a mixture of sand and water can be separated; include a diagram of the equipment that you would use.

3) Explain how distillation can separate pure water from a mixture of ink and water

4) Explain why fractional distillation is used to separate substances with similar boiling points

5) Describe how water can be made potable (safe to drink)

Task 2

Revision ï CC3 and CC4 *Atomic Structure and the Periodic Table*

This unit contains the following topics:

- Structure of the atom
- Properties of subatomic particles
- Isotopes
- Mendeleev and the development of the periodic tables
- Electron configurations

Your task is to produce revision material on this topic that you can use next year in Year 11. Your revision material could be any of the following; mind maps, revision/flash cards, past paper questions, writing your own practice

	questions and answers, revision sheets or any others that you can think of. Your revision should be active and not simply copying information from one source to another. K-band ONLY Revision ï CP1 and CP2 Forces and Motion This unit contains the following topics: ر Vectors and scalars ر Distance/time and velocity/time graphs ر Acceleration ر Newtonîs 3 laws of motion ر Momentum ر Thinking, braking and stopping distances Your task is to produce revision material on this topic that you can use next year in Year 11. Your revision material could be any of the following; mind maps, revision/flash cards, past paper questions, writing your own practice questions and answers, revision sheets or any others that you can think of. Your revision should be active and not simply copying information from one source to another. Task 2 Revision ï CP3 and CP4 *Energy and Waves* This unit contains the following topics: ر Energy stores and transfers ر Thermal conductivity and insulators ر Renewable and non-renewable energy resources ر Properties of waves

	↳ Calculating wave speed ↳ Refraction Your task is to produce revision material on this topic that you can use next year in Year 11. Your revision material could be any of the following; mind maps, revision/flash cards, past paper questions, writing your own practice questions and answers, revision sheets or any others that you can think of. Your revision should be active and not simply copying information from one source to another.
BIOLOGY **These tasks should take you:** **Each task should take approximately 1 hour**	Task 1 Our immune systems help to protect us from infectious diseases. Explain how the immune system responds to an infection and how it helps to prevent future infection from a pathogen Task 2 To develop new drugs and vaccines several different tests need to be carried out: ● Computer modelling ● Testing on cells and tissues ● Testing on animals like fruit flies and mice ● Testing on healthy human volunteers ● Testing on patients For each step, explain why it is taken and the importance of all five steps for producing drugs and vaccines which are safe for human use Task 3 Viruses like COVID-19 are not classified as living organisms Explain why viruses are not living organisms, but other pathogens like bacteria, fungi and protists are. Task 4

	Scientists are racing to develop a vaccine for the coronavirus. Explain how a vaccine would help to prevent infection by coronavirus
CHEMISTRY **These tasks should take you:** **Each task should take approximately 1 hour**	Task 1 Produce a sheet which could be given to next year's separate science students about electron configuration. You should include how to work out the electron configuration of an element and how this relates to the position of an element in the periodic table Task 2 Revision ï SC1 and 2 *Methods of separating and purifying substances* This unit contains the following topics: ï States of matter ï Pure and impure substances ï Separating techniques ï *including distillation, filtration, crystallisation, paper chromatography and fractional distillation* ï Preparing water to make it safe for drinking Your task is to produce revision material on this topic that you can use next year in Year 11. Your revision material could be any of the following; mind maps, revision/flash cards, past paper questions, writing your own practice questions and answers, revision sheets or any others that you can think of. Your revision should be active and not simply copying information from one source to another. Task 3 Revision ï SC3 and 4 *Atomic structure and the periodic table* This unit contains the following topics: ï Structure of the atom

	↳ Properties of subatomic particles ↳ Isotopes ↳ Mendeleev and the development of the periodic table ↳ Electron configurations Your task is to produce revision material on this topic that you can use next year in Year 11. Your revision material could be any of the following; mind maps, revision/flash cards, past paper questions, writing your own practice questions and answers, revision sheets or any others that you can think of. Your revision should be active and not simply copying information from one source to another. Task 4 A student had a mixture of water, ink, salt and sand. Design an experiment that the student could carry out to produce pure samples of water, ink, salt and sand from the mixture. You must include a list of the equipment that the student would need to use. You may also use diagrams to show the setup of the equipment that you have chosen. For each separating technique used, provide a brief explanation of how it works.
PHYSICS **These tasks should take you:** **Each task should take approximately 1 hour**	Task 1 Revision ï SP1 and 2 *Forces and Motion* This unit contains the following topics: ↳ Vectors and scalars ↳ Distance/time and velocity/time graphs ↳ Acceleration ↳ Resultant forces ↳ Newtonîs three laws of motion ↳ Mass and weight

	٠ Momentum ٠ Stopping distances and braking hazards Your task is to produce revision material on this topic that you can use next year in Year 11. Your revision material could be any of the following; mind maps, revision/flash cards, past paper questions, writing your own practice questions and answers, revision sheets or any others that you can think of. Your revision should be active and not simply copying information from one source to another. Task 2 Revision ï SP3 *Energy* This unit contains the following topics: ٠ Energy stores and transfers ٠ Thermal conductivity and insulators ٠ Renewable and non-renewable energy resources Your task is to produce revision material on this topic that you can use next year in Year 11. Your revision material could be any of the following; mind maps, revision/flash cards, past paper questions, writing your own practice questions and answers, revision sheets or any others that you can think of. Your revision should be active and not simply copying information from one source to another. Task 3 A student wanted to investigate the thermal conductivity of 5 different materials and find which material could be used as an insulator. Design an experiment to investigate the thermal properties of 5 materials of your choice. You must include a list of the equipment that the student would need to use, identify the dependent, independent and control variables for each experiment and suggest what results you would expect from this experiment.

Citizenship

These tasks should take you:

KQ: What happens when people don't obey international laws?

DO NOW:

Recap quiz

1) What is the role of International law?
2) Name two examples of international laws
3) Why might people critique these international laws

What happens if countries do not obey international laws?

What is the role of International laws such as th Geneva Convention?

Task

Watching the video https://www.youtube.com/watch?v=NWB6lUE0hJU

1. What are the strengths and weaknesses of the ICC?

Why the USA dislikes the ICC

The ICC is currently participating in a global fight to end impunity. Furthermore, through the International Court of Justice (ICJ), the ICC aims to hold those responsible, accountable for their crimes to help prevent these crimes from happening again in the future.

The ICC cannot achieve these goals alone. This court is viewed as a last resort, assisting but not replacing the ICJ. Governed by an international treaty called the Rome Statute, the ICC is the world's first permanent international criminal court.

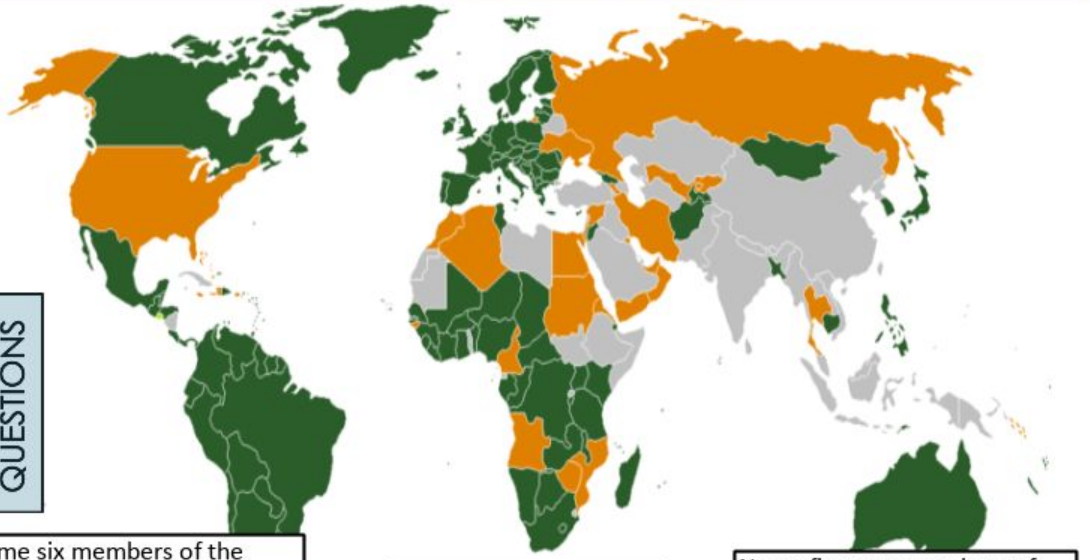
- The ICC does not have retrospective jurisdiction. It can only deal with crimes committed after the 1st July, 2002, when the Rome Statute of the ICC came into force.

- It is a court of last resort, intervening only when national authorities cannot or will not prosecute.

Did you know?

Cases are referred to the court by national governments or the United Nations Security Council.
The 18 judges serve nine-year terms

DIAGRAM OF THE ICC AND ITS INSTITUTIONS



QUESTIONS

Name six members of the International Criminal Court

1.
2.
3.
4.
5.
6

Name five non-members of the ICC

1.
2.
3.
4.
5.

KQ: What is the role of international law in conflict situations?

Introduction

Read the information sheet and answer the following questions

1. How was the International Criminal Court set up?
2. What issues does it deal with?
3. What countries have refused to join?
4. What is the aim of the International Criminal Court?

Development

Using your own knowledge of current wars occuring and the information sheet create a list of strengths and weaknesses of The International court

Strengths of International court	Weaknesses of international court
It stands for equality of all before the law	Difficult to prosecute criminals

Depth

Overall- how effective is the International criminal court in reducing war crimes?

Information sheet

International **Humanitarian Law is a set of rules** that aims to protect people's rights in times of war.

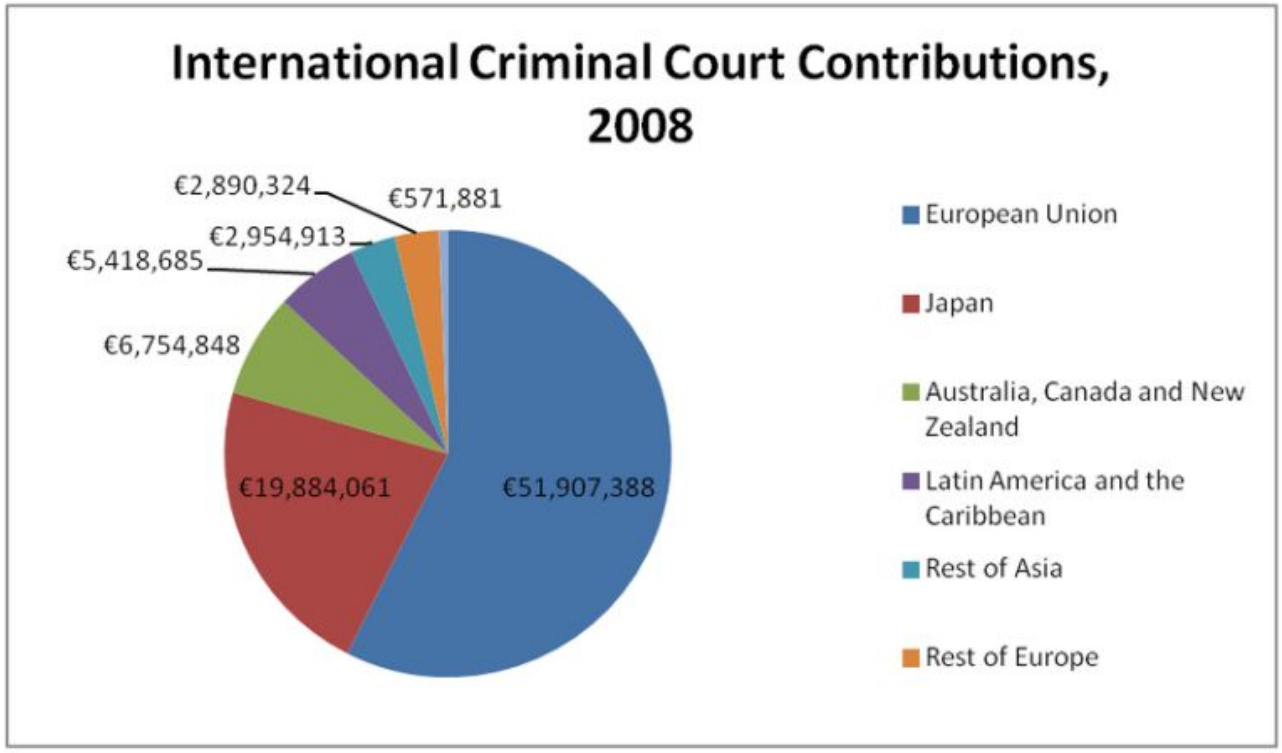
The **International Criminal Court** was set up in 2002, born out of the UN *(but, independent of the UN).* It is an independent organisation based in the Hague in the Netherlands.

Over **100 countries** have signed up however, some countries including **USA, China, Russia and India have** not agreed to work with the ICC**.**

This court is a **'last resort'** and will only deal with cases that are not being dealt with the countries judicial system. They only deal with serious crimes including; genocide, crimes against humanity and war crimes.

However, Sudanese President **Omar al-Bashir** remains the only sitting head of state wanted for genocide, war crimes, and crimes against humanity for his crimes in Darfur.

In 2009 & 2010 the ICC issued him with an arrest warrant, but he has denounced any calls for him to be prosecuted.



Task

What do you notice about the funding of the ICC? How might this impact upon the work it does?

Extension

Why do you think countries like Russia and the USA don't want to be members of the ICC?

ÝHvYx kz¥ Yxd YlYnx¦¨ Y¥l©wfx¨ kz¥ Ï6x¨f¥xY¨nzxYv vY¯¦ Y¥f fkkfb¨n®f nx¥fd©bnxl ¯Y¥ b¥nwf¦ Yxd ¨mf ¨¥Ylfdnf¦ zk ¯Y¥Î .®Yv©Y¨f ¨mn¦ ¦¨Y¨fwfx¨ Ïã ć wY¥u¦ä

Ý*¥fY¨f Y 3Yb¨ knvf Yaz©¨ ¨mf ¯z¥u zk ¨mf 6x¨f¥xY¨nzxYv *¥nwnxYv *z©¥¨Î
M¥± ¨z knxd z©¨ Yaz©¨ Ă dnkkf¥fx¨ bY¦f¦ n¨ mY¦ affx nx®zv®fd nx

ÝKf¦fY¥bm kz©¥ dnkkf¥fx¨ bz©x¨¥nf¦ ¯mz mY®f xz¨ afbzwf wfwaf¥¦ zk
¨mf 6** Yxd knxd z©¨ ¯m±Î *¥fY¨f Yx !ă dn¦¢vY± ¢z¦¨f¥ z¥ vfYkvf¨
mnlmvnlm¨nxl ¯mY¨ ±z© mY®f kz©xd z©¨

=f¦¦zx ã

Case study: Rwandaê
Task 1: Answer the questions: using slide 10-15êê
1. Using an example, define the word genocideê
2. Explain 2 reasons might the Rwandan people feel let down by the UNê
3. Identify how many people were killed and howê
4. Explain the role of the UNSC in this case studyê
5. Use this case study to argue for or against the existence of the UNSCê
ê

There are two main ethnic groups in Rwanda, in central Africa, the Hutus and the Tutsis. There had been decades of tensions between Hutus and Tutsis, and a history of persecution and discrimination against Tutsis.

This led to the start of the 100 day genocide. Despite about 1 million Tutsis being killed, this Genocide was carried out almost entirely by hand, usually using machetes and clubs. The state provided support and organisation – politicians, officials, intellectuals and professional soldiers incited the killers to do their work. Local officials assisted in rounding up victims and making suitable places available for slaughter.

After rampaging killers in Rwanda killed 10 Belgian peacekeepers at the beginning of the genocide, there was little will to keep the peacekeepers in place. The departure of peacekeepers from a school where thousands of civilians had gathered hoping for protection was cited by the report as one of the main reasons for the enduring bitterness Rwandans feel toward the United Nations. The manner in which the troops left, including attempts to pretend to the refugees that they were not in fact leaving, was considered disgraceful in later reports.

November 8, 1994

- The United Nations Establishes the ICTR
- In the aftermath of the Genocide and considering reports on *"violations of international humanitarian law in Rwanda"*, the Security Council affirms its determination *"to put an end to such crimes and to take effective measures to bring to justice the persons (...) responsible for them"*.
- The International Criminal Tribunal for Rwanda is therefore established

On 6 April 1994 the plane carrying Rwanda's President was shot down. Extremist Hutu leaders accused Tutsis of killing the President, and Hutu civilians were told by radio and word of mouth that it was their duty to wipe out and kill all the Tutsis.