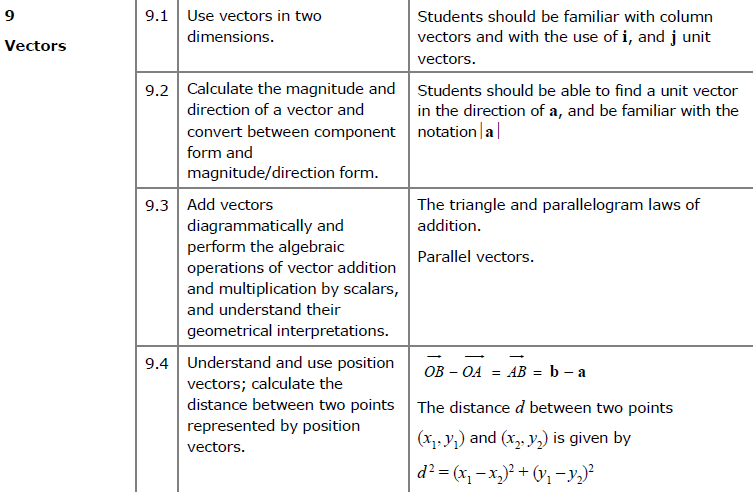
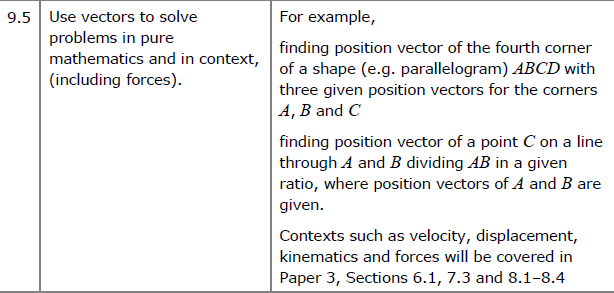
Lower 6 Chapter 11

Vectors

Chapter Overview

1. Add/scale factors and show vectors are parallel.
2. Calculate magnitude and direction of a vector.
3. Understand and use position vectors.
4. Solve geometric problems.
5. Understand speed vs velocity.



Vector basics

Whereas a **coordinate** represents a **position** in space, a **vector** represents a **displacement** in space.

* A vector has 2 properties:
* Direction
* Magnitude (i.e. length)

If and are points then is the vector between them.

* If two vectors and have the same magnitude and direction, **they’re the same vector** and are **parallel**.
* and the two vectors are parallel, equal in magnitude but in **opposite directions**.
* Triangle Law for vector addition:

The vector of multiple vectors is known as the **resultant vector.** (you will encounter this term in Mechanics)

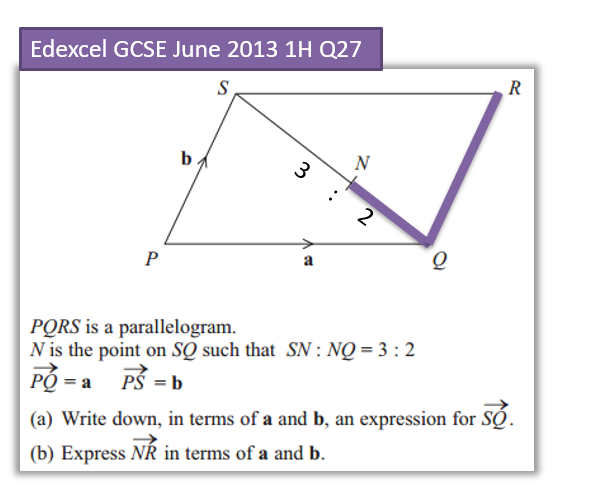
* Vector **subtraction** is defined using vector addition and negation:
* The zero vector (a bold 0), represents no movement.

In 2D**:**

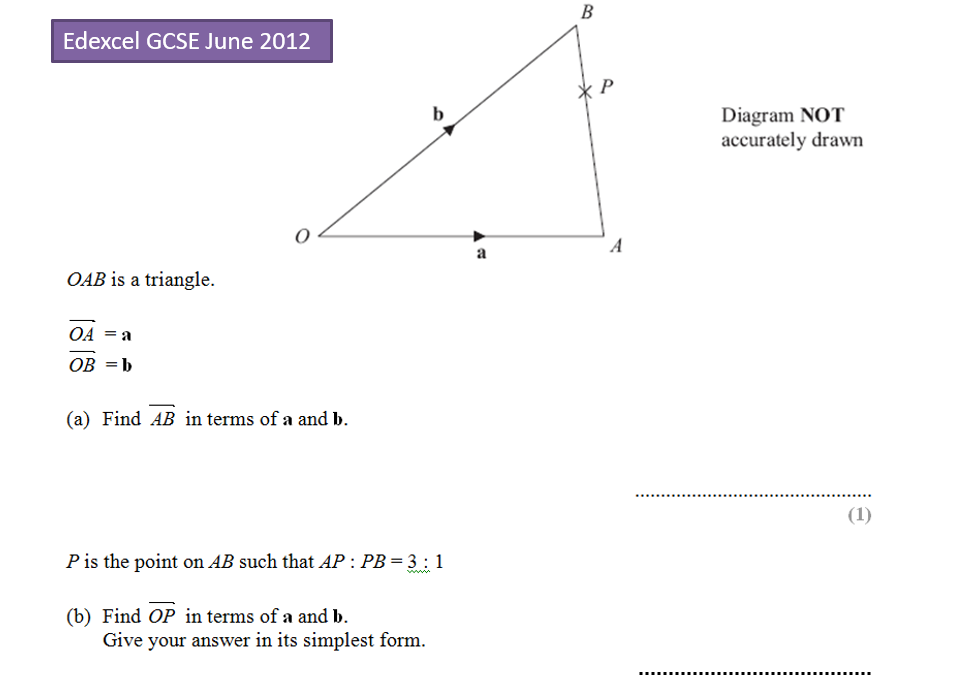
* A **scalar** is a normal number, which can be used to ‘scale’ a vector.
* The **direction** will be the **same**.
* But the **magnitude** will be **different** (unless the scalar is 1).
* Any vector parallel to the vector can be written as , where is a scalar.

The implication is that if we can write one vector **as a multiple of** another, then we can show they are parallel.

Example



Test your understanding



Exercise 11A Pg 234/235

AD Page 11

Representing vectors



A **unit vector** is a vector of magnitude 1.

and are unit vectors in the -axis and -axis respectively. We can write all vectors in terms of and **.**

Example

If then**:**

1. Writein vector form.
2. Find inform.

Exercise 11B Pg 237/238

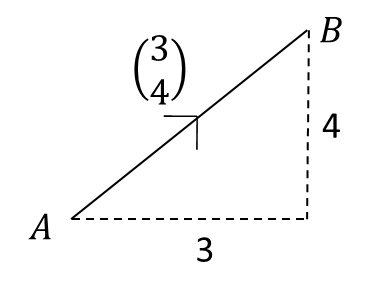
AD Page 11

Magnitude of a vector

The magnitude of a vector is its length.

If

Examples:



Direction of a Vector

The direction of a vector can be found using basic trigonometry.

Examples

1. Find the angle that vector makes with the positive x axis.

2. Find the angle that vector makes with ***j***.

Unit vector

A unit vector is a vector whose magnitude is 1.

If is a vector, then the unit vector in the same direction is

Example:

Find a unit vector in the direction of

**Test Your Understanding:** Convert the following vectors to unit vectors.

Exercise 11C Pg 240/241

AD Page 11

Position vectors

A vector used to represent a position is unsurprisingly known as a **position vector**.

A position can be thought of as a translation from the origin.

The position vector of a point is the vector, where is the origin. is usually written as .

Examples

1. The points and have coordinates and respectively.

Find, in terms of and :

1. The position vector of
2. The position vector of
3. The vector

2. and . Find:

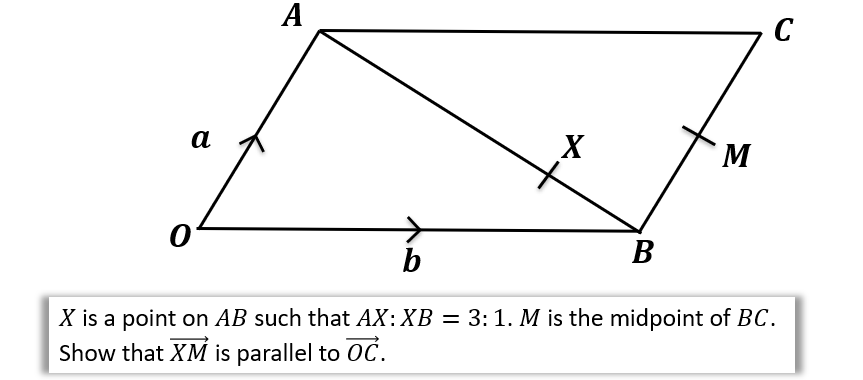
a) The position vector of .

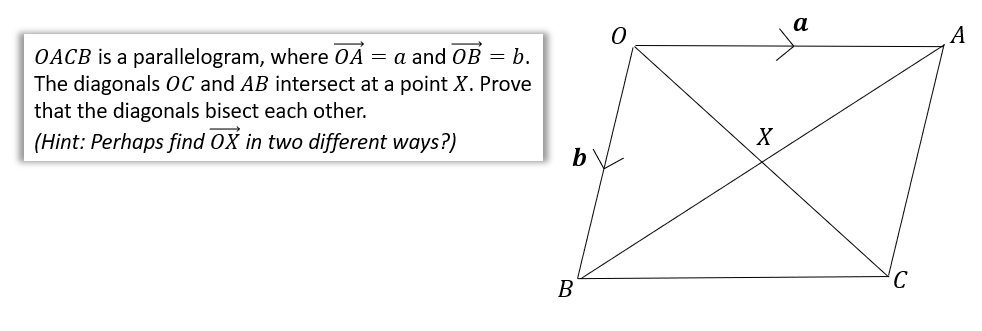
b) The exact value of in simplified surd form.

Exercise 11D Pg 243/244

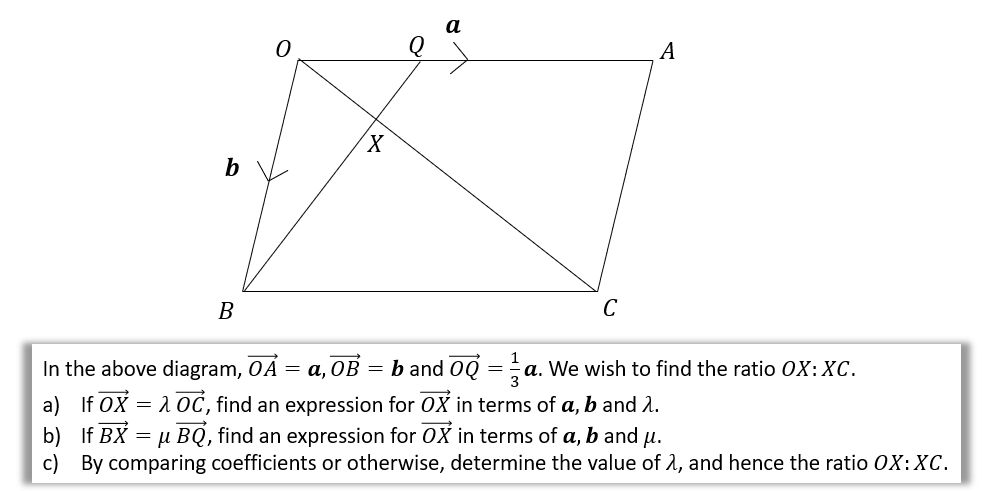
AD Page 11

Solving Geometric Problems





Test your understanding



Area of a triangle example

If and . Determine .

Extension

*[STEP 2010 Q7]*

Relative to a fixed origin , the points and have position vectors and , respectively. (The points and are not collinear.) The point has position vector given by

where and are positive constants with . The lines and meet at the point with position vector and the lines and meet at the point with position vector . Show that

and write down in terms of and .

Show further that the point with position vector given by

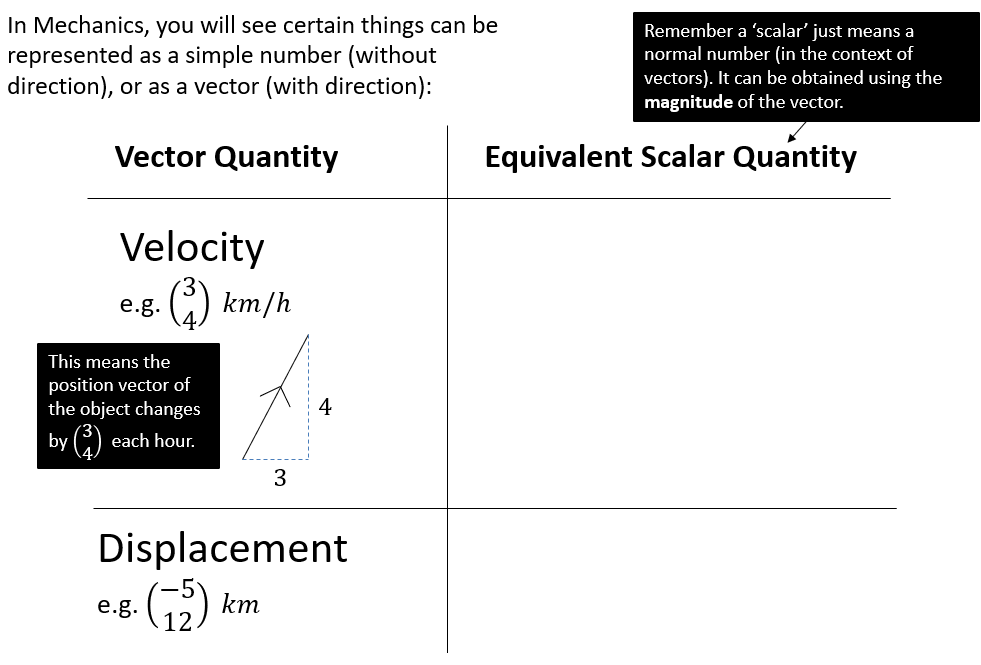
lies on the lines and .

The lines and intersect at the point . Prove that .

Exercise 11E Pg 246/247

AD Page 11

Modelling with vectors



Examples

1. A girl walks 2 km due east from a fixed point to , and then 3 km due south from to . Find
2. the total distance travelled
3. the position vector of relative to
5. The bearing of from .
6. In an orienteering exercise, a cadet leaves the starting point and walks 15 km on a bearing of to reach , the first checkpoint. From he walks 9 km on a bearing of to the second checkpoint, at . From he returns directly to .

Find:

1. the position vector of relative to
3. the bearing of from
4. the position vector of relative .

Exercise 11F Pg 250/251

AD Page 11