**Pure 2**

**Vectors**

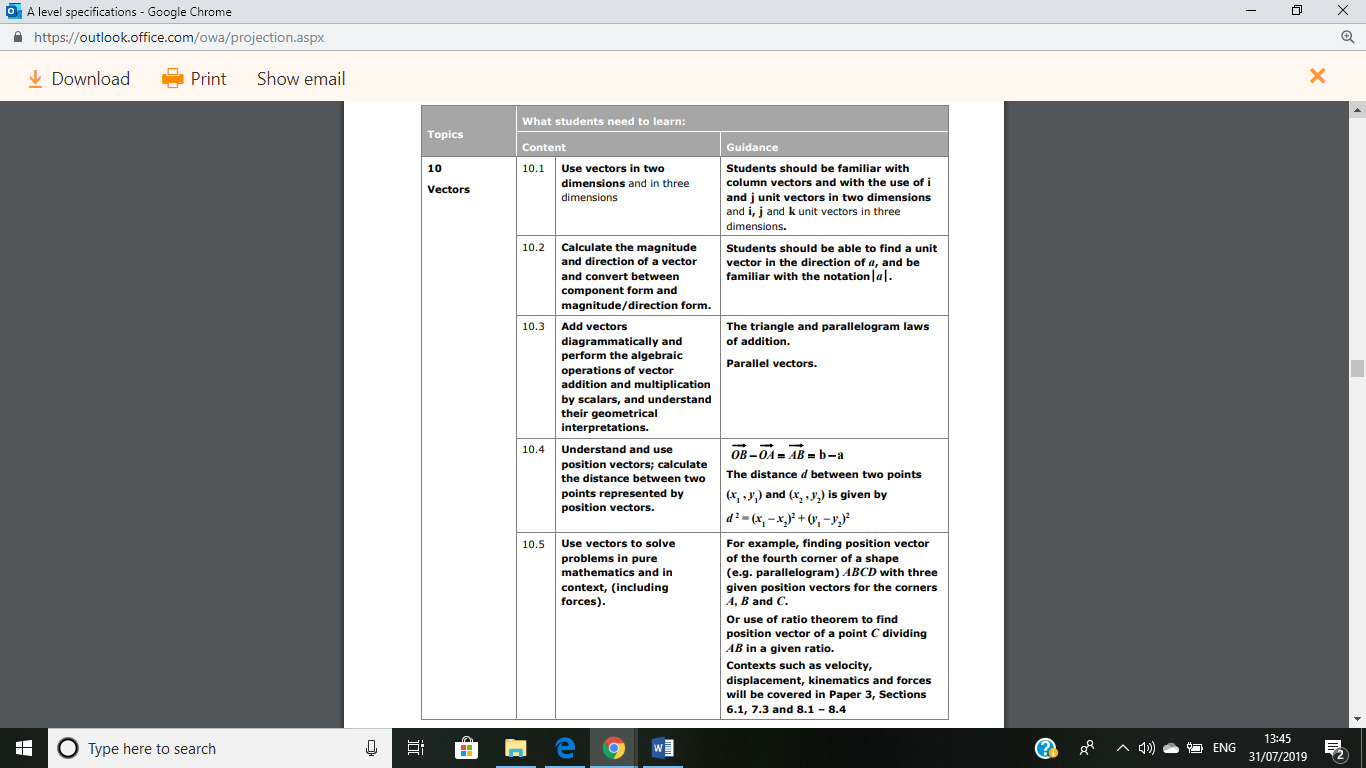
Chapter Overview

1:: Distance between two points.

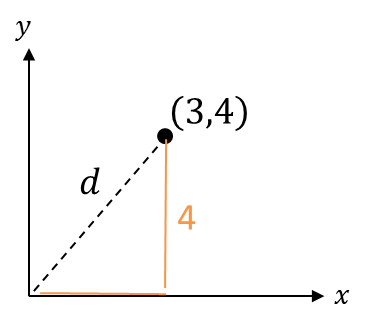
2:: notation for vectors

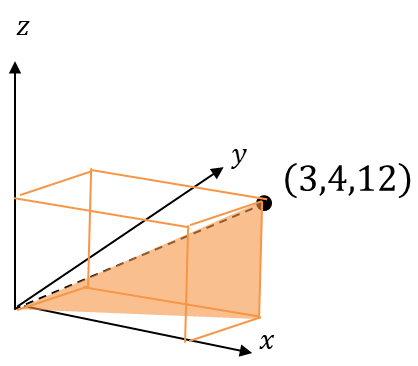
3:: Magnitude of a 3D vector and using it to find angle between vector and a coordinate axis.

4:: Solving Geometric Problems

5:: Application to Mechanics

**Distance from the origin and magnitude of a vector**

 In 2D, how did we find the distance from a point to the origin?

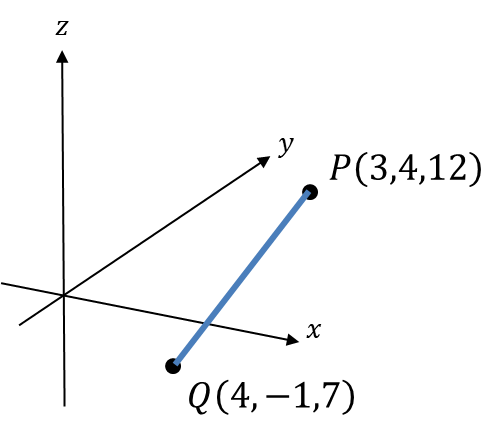




**The magnitude of a vector :**

**And the distance of from the origin is**

**Distance between two 3D points**



How do we find the distance between and ?

**The distance between two points is:**

**means “change in ”**

**Quickfire Questions:**

Distance of from the origin:

Distance between and

Distance between and

Distance between and

**Tip**: Because we’re squaring, it doesn’t matter whether the change is negative or positive.

***Test Your Understanding So Far…***

[Textbook] **Find the distance from the origin to the point .**

[Textbook] **The coordinates of and are and respectively. Given that the distance from to is units, find the possible values of .**

Ex 12A p.338

**, and notation**

In 2D you were previously introduced to and as unit vectors in each of the and directions.

It meant for example that could be written as since

Unsurprisingly, **in 3D:**

**Quickfire Questions**

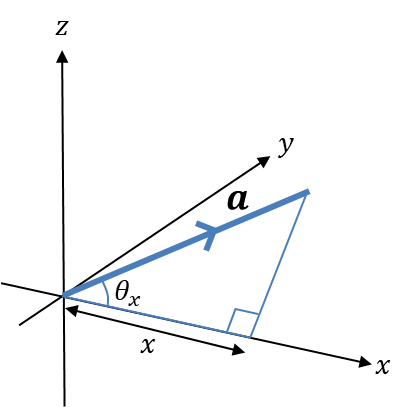
1. Put in notation:
2. Write as a column vector:
3. If then
4. If and then

**Examples**

1. Find the magnitude of and hence find , the unit vector in the direction of .
2. If and is parallel to ?

**Angles between vectors and an axis**

How could you work out the angle between a vector and the -axis?



* **The angle between and the -axis is:**

**and similarly for the and axes.**

[Textbook] **Find the angles that the vector makes with each of the positive coordinate axis.**

***Test Your Understanding***

[Textbook] **The points and have position vectors and**

**relative to a fixed origin, . Find and show that is isosceles.**

**(a) Find the angle that the vector makes with the -axis.**

**(b) By similarly considering the angle that makes with the -axis, determine the area of where and . (Hint: draw a diagram)**

Ex 12B p.341-343

**Solving geometric problems**

For more general problems involving vectors, often **drawing a diagram** helps!

[Textbook]  **and are the points , and respectively.**

1. **Find and , giving your answers in the form   
   .**
2. **Show that the lines and are parallel and that .**
3. **Hence describe the quadrilateral .**

[Textbook]  **and are the points and respectively. Find the coordinates of the point so that forms a parallelogram.**

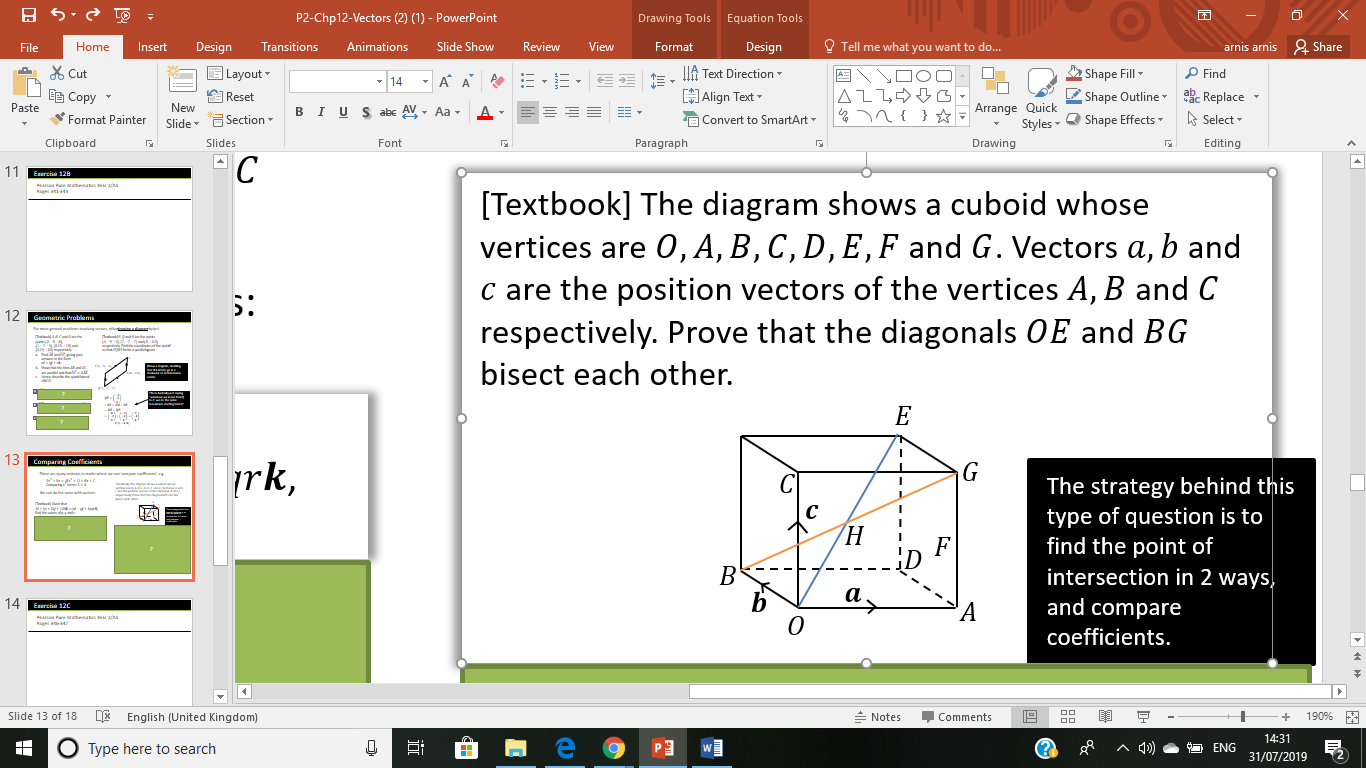
There are many contexts in maths where we can ‘compare coefficients’, e.g.

Comparing terms:

We can do the same with vectors:

[Textbook] **Given that   
, find the values of and .**

[Textbook] **The diagram shows a cuboid whose vertices are and . Vectors and are the position vectors of the vertices and respectively. Prove that the diagonals and bisect each other.**



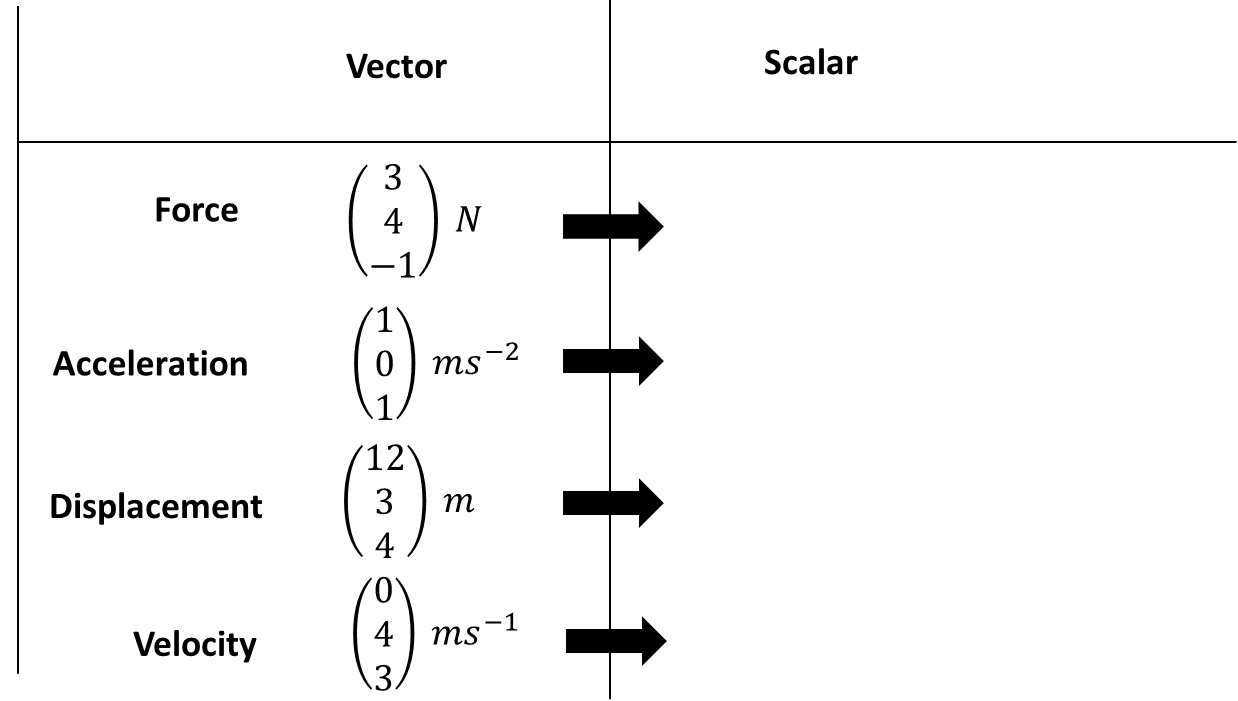
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The strategy behind this type of question is to find the point of intersection in 2 ways, and compare coefficients.

Ex 12C p.346-347

**Application to Mechanics**

Out of displacement, speed, acceleration, force, mass and time, all but mass and time are vectors. Clearly these can act in 3D space.



**Example**

[Textbook] **A particle of mass 0.5 kg is acted on by three forces.**

1. **Find the resultant force acting on the particle.**
2. **Find the acceleration of the particle, giving your answer in the form ms-2.**
3. **Find the magnitude of the acceleration.**

**Given that the particle starts at rest,**

**d. Find the distance travelled by the particle in the first 6 seconds of its motion.**

Ex 12D p.348-349