

UNIT 18 3-D Geometry

NC: Shape and Space

	St	Ac	Ex	Sp
TOPICS				
18.1 <i>Using Pythagoras' Theorem and Trigonometry in Three Dimensions</i>	×	×	✓	✓
18.2 <i>Angles and Planes</i>	×	×	✓	✓
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Activities				
18.1 <i>Routes on a Cube</i>	×	✓	✓	✓
18.2 <i>Klein Cube</i>	×	✓	✓	✓
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OH Slides				
18.1 <i>Cuboid</i>	×	×	✓	✓
18.2 <i>Square-Based Pyramid</i>	×	×	✓	✓
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Revision Test				
18.1	×	×	✓	✓
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UNIT 18 *3-D Geometry*

Teaching Notes

Background and Preparatory Work

Much of the relevant historical background has been covered in earlier 'geometrical' units; this short unit can be regarded as a natural extension of the geometrical and trigonometrical concepts already introduced.

It should though, perhaps, be noted that some writers have suggested that 3-D geometry is more natural than plane geometry: the experience of most teachers, however, is that pupils find 3-D geometry a great deal more difficult!

Teaching Points

Introduction

In general, pupils find this topic difficult and, at least in the recent past, exam boards have not given it much emphasis. The difficulties pupils experience with 3-D work, compared to those with 2-D, arise, perhaps, because

- pencil and paper provide an excellent way to produce 2-D drawings, but not so naturally 3-D,
- working with 3-D models, which is to be recommended, is both costly and time-consuming,
- the ability to visualise 3-D objects, for example, in identifying angles between lines and planes, is a sophisticated skill,
- 3-D geometry is so much more complicated than 2-D; for example, you have *points*, *lines* and *planes* (rather than points and lines in 2-D), and so you can have angles between

(i) planes

(ii) lines

(iii) lines and planes

instead of just between lines in 2-D.

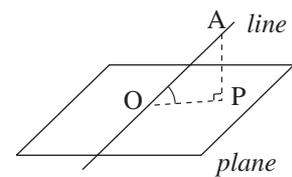
These, and other reasons, led us to relegate this topic – almost to obscurity: in the current GCSE Higher Tier syllabus, there is little now that has to be covered, and this is perhaps unfortunate. Because there is so little 3-D geometry content now, it is tempting for both teachers and examiners to ignore it altogether. Clearly, since we live in 3-D space, 3-D geometry is crucial, and has powerful claims to be a topic of real potential value!

Language / Notation

There is no new language or notation introduced here, but students should be familiar with *vertex*, *face*, *plane*, etc. Hidden lines in diagrams should be indicated with a dotted line.

Key Points

- It is crucial to be able to visualise 3-D objects and understand what is actually needed.
- The angle between a line and a plane is found by dropping a perpendicular from a point on the line to the plane – see diagram.



Misconceptions

- The height of, for example, a pyramid, is the perpendicular from its vertex to the base of the pyramid (*not* the slant line or even the height of one of the side triangles).
- Right angles do not always seem like right angles in 2-D drawings of 3-D objects.

