Learning and doing geometry **(ME321)** content listing

Unit 1 *Organising and classifying*	The development of geometric thinking. The idea of organising and classifying is introduced and describes how shapes can be classified according to their properties. The way shapes are defined by their properties affects whether they can be classified according to an inclusive classification which recognises some shapes as special cases, or subsets, of other shapes. Another important idea in this unit is perceptual and discursive reasoning which comes into play when learners look at and engage visually with a geometric figure and when they describe it or construct its definition.
Unit 2 *Communicating geometric thinking; conjecturing and convincing*	Introduces the idea of conjecturing and convincing as a precursor to developing the skills of formal proof. You will develop and explore conjectures and use geometric reasoning to develop convincing arguments which identify the conditions under which a conjecture is true. You will also meet the idea of exploring a generality, which has an important part to play in developing and refining a conjecture. You will read about the importance of communicating mathematically; the conventions of geometric vocabulary use, written notations and structure of logical arguments..
Unit 3 *Static and dynamic representations of 2D geometric figures*	The representation of geometric figures particularly static figures (using pencil and paper) and dynamic figures constructed in Dynamic Geometry Software. The drag mode in dynamic geometry is an important tool and allows learners to investigate figures on the screen. You will read about pedagogical approaches to the teaching and learning of geometry and consider how different ways of representing a geometric object allow different actions and types of reasoning.
Unit 4 *Invariance and change*	The concept of invariance and change can support learners and teachers to understand geometric properties and to recognise essential and non-essential features of a general geometric concept. You will read about the linked idea of dimensions of possible variation and use this as a strategy to organise collections of examples and propose similar mathematical tasks. You will learn how invariance and change supports your own problem solving and proving in geometry. You will become aware that a diagram is an example of a general case for which a conjecture must hold, and of the need to draw, construct or visualise other suitable examples.
Unit 5 *Representing abstract concepts in geometry*	An important focus is on the particular figure drawn on paper or on the screen, or the physical model and how these often represent a whole class of abstract geometric objects. You will read how learners may be distracted by the particular example they can see and the way it is presented. This leads on to the pedagogical theories of the *figural concept* and the *concept image*. You will also meet representations of 3D geometric shapes both in 2 dimensions (including on the GeoGebra screen) and in 3 dimensions.
Unit 6 *Transforming shapes in 2- and 3-dimensions*	Transformations and combinations of transformations of geometric figures in 2D and 3D space. You will classify transformations with respect to invariance and change, exploring the effects of transformations on properties of shapes such as length, angle, area and orientation. You will make connections between transformations and congruence, similarity and symmetry. You will explore doing geometry in the classroom; the practicalities and how to support learners to develop their skills of visualising in geometry, and to use doing and undoing as a way of asking non-routine questions.
Unit 7 *Circles and circle theorems*	The kinds of geometric reasoning and proving that are both convincing to a mathematician and accessible to a learner. The mathematical theme of the unit is circles and problem solving and module ideas are used to analyse geometric thinking. You will read how deductive reasoning builds from perceptual and discursive reasoning, use it as part of conjecturing and convincing and discuss the limitations of deductive reasoning for convincing learners.
Unit 8 *Trigonometry*	How trigonometry, ratios and classic geometry are introduced to school learners, and how trigonometry is used to solve problems in geometric and real-life contexts at school level. Trigonometric functions as algebraic entities and co-ordinate geometry using the unit circle. Throughout, you will consider how the ideas of invariance and change, doing and undoing, emphasising and ignoring, among others, are brought out when working on trigonometry problems.
Unit 9 *Geometry and algebra; making the connection*	Areas of the mathematics curriculum where geometry links to and is supported by the topics of number and of algebra. You will read about how the difference in the use of symbol systems in geometry and in algebra often presents learners with difficulties as they move between these systems. You will identify the employability and other life skills which you have developed through the study of learning and doing geometry.