



An tSraith Shóisearach do Mhúinteoirí

# Junior **CYCLE** for teachers

## GRAPHICS

### Exploring Learning Outcomes

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agus Scileanna  
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Education and Skills



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Graphics  
Specification



# Rationale

Each subject of the technology suite offers the student different experiences which contribute towards their education in technology education. As a result, preparing students for learning in the technology subjects is not just about teaching towards the technology but towards the skills that are fundamental to the technology subjects and are transferable into other areas of their learning. Skills that encourage the student to problem-solve through creation, innovation, communication, collaboration and exploration, all of which are developed in an active learning environment where students can advance their ideas from conception to realisation.

Graphics is recognised as the underpinning language of the technology disciplines and is transferable across a wide range of subjects such as mathematics, science and art. Students will use a variety of media to communicate their ideas and designs through this unique language. Throughout the course, students will explore the geometric world to gain an appreciation of the importance of graphics in the world around them. They will develop cognitive and practical skills such as graphical communication, spatial visualisation, creative problem-solving, design capabilities and modelling, both physically and through the use of computer-aided design.

Students will develop their creativity as they investigate and solve design challenges. During the problem-solving process, they will work with their peers to refine their ideas from an abstract concept to a final, detailed, drafted design. Abstraction, and spatial reasoning are fundamental to this process; graphics provides multiple and varied opportunities for students to develop these high level cognitive and creative skills in engaging contexts.

Accurate technical drawings are essential in the design and manufacture of components and artefacts. The need for precise communication in the preparation of a functional document distinguishes technical drawing from the expressive drawing of the visual arts. Producing accurate drawings requires significant attention to detail and a patient and resilient mind-set. Students will continually review and reflect on their working drawings developing strategies for improvement as they progress.

# Aim

The study of Graphics at junior cycle aims to:

- develop the student's creativity, spatial ability, and capacity to reason and communicate ideas through engagement with abstract and applied geometric problem-solving activities
- encourage the development of the cognitive and practical dexterity skills associated with graphical communication
- instil an appreciation of the role of graphics in the world around them
- equip all students to make judgements on the best mode through which to represent their ideas and solutions
- encourage the production of drawings that promotes the skills of communicating through graphics
- develop students cognitive and practical skills associated with modelling and graphical communication.

*Graphics specification p.5*

# Statements of Learning

## The statement

## Examples of relevant learning

<b>SOL 15</b> Recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning	Students will be able to support their solutions to geometry problems by referencing appropriate geometry concepts and principles.
<b>SOL 19</b> Values the role and contribution of science and technology to society, and their personal, social and global importance	Students will evaluate the impact of technologies on their lives, society and the environment.
<b>SOL 20</b> Uses appropriate technologies in meeting a design challenge	Students will determine the most suitable technologies available to them and apply them to fulfil the criteria of a given design challenge.
<b>SOL 21</b> Applies practical skills as she/he develops models and products using a variety of materials and technologies	Students will develop 3D representations of solutions to problems through modelling using appropriate media.
<b>SOL 23</b> Brings an idea from conception to realisation	Students will individually explore ideas to satisfy a problem and develop their solutions using appropriate modelling skills they have developed.
<b>SOL 24</b> Uses technology and digital media tools to learn, work and think collaboratively and creatively in a responsible and ethical manner	Students will select appropriate digital media tools to research, explore and present design ideas

*Graphics specification p.6*

# Junior Cycle Key Skills and their Elements



# Learning Outcomes

'Learning outcomes are statements that describe the **knowledge, understanding, skills and values** students should be able to **demonstrate** having studied Graphics in junior cycle.'

Learning outcomes are to be experienced over **three years**

The specification stresses that the learning outcomes are for three years and therefore the learning outcomes focused on at a point in time will not have been 'completed' but will continue to support the students' learning of Graphics up to the end of junior cycle.

*Page 13 Graphics specification*

Graphics uses an interdisciplinary approach which encourages the integration of the three strands in the teaching and learning of the subject. It has been designed for a minimum of 200 hours of timetabled student engagement across the three years of junior cycle.

This specification aims to strike a balance between exploring the breadth of possibilities the study of the subject presents and providing opportunities for in-depth experiences of particular areas, as appropriate.

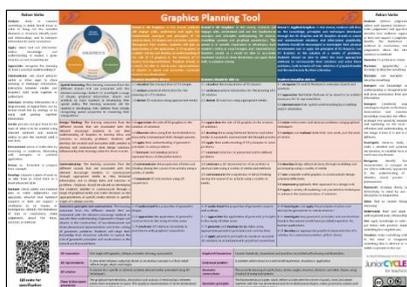
To this end, the specification embodies a certain amount of flexibility and freedom for teachers to facilitate learning in a way that reflects students' own choices, their curiosity and their creativity. The achievement of learning outcomes should be planned in a way that is active and stimulating.

*Page 9 Graphics specification*

## Working with Learning Outcomes

Each learning outcome in the Graphics specification has an action verb or verbs, the action verbs will help to determine the type of student learning experiences and assessment that will enable an active and stimulating engagement with the learning outcomes. Action verbs assist teachers in designing learning experiences which will allow students to demonstrate the knowledge, understanding, skills and values contained in the Graphics learning outcomes.

The definition of each action verb is listed in Appendix B of the Graphics specification and on the Graphics Planning Tool which can be found by clicking [here](#).



The image shows a screenshot of the 'Graphics Planning Tool'. It is a complex table with multiple columns and rows. The columns are color-coded: orange, green, blue, and purple. The table contains various learning outcomes, and several action verbs are highlighted in bold text. An orange arrow points from the text 'Action verb' to the word 'communicate' in the learning outcome '2.9 communicate the progression of ideas/thinking during the course of an activity using a variety of media'.

On the Graphics planning tool the action verbs are shown embolden in each of the learning outcomes as shown by the example below.

**Action verb**

2.9 **communicate** the progression of ideas/thinking during the course of an activity using a variety of media

The active and stimulating learning and assessment activities will be aligned with the action verb, for example, learning outcome 2.9 states that students should be able to communicate. The learning experience should provide students with the opportunity to 'communicate', and in turn the assessment should provide the student/teacher with opportunities to monitor this and provide feedback to progress the learning forward.

Graphics uses an interdisciplinary approach which encourages the integration of the three strands and the four elements in the teaching and learning of the subject. When designing a unit of learning; in order to ensure an integrated learning experience, teachers are encouraged to choose learning outcomes from across the strands and elements, rather than in isolation. Active and stimulating learning activities involving sketching, computer aided graphics and board drawing will aid this integrated approach.

When identifying the key learning in the learning outcomes it is important to reference the Strand and Element within which the learning outcome is contained. The descriptors of the Strands and Elements guide the identification of the key learning in each of the learning outcomes.

The descriptors of each Strand and Element are detailed in the following pages. The descriptors aid the teacher in selecting the knowledge, understanding, skills and values in the learning outcomes. Rather than looking at each learning outcome in isolation it is helpful to look at the learning outcomes with the descriptors of the relevant Strand and Element in mind.

## Strands

### STRAND 1: 2D GRAPHICS

In this strand, students will engage with, understand and apply the fundamental concepts and principles of 2D constructions, 2D shapes and projection systems. Throughout their studies, students will gain an appreciation of the application of 2D graphics to problem solving and develop an understanding of the role of 2D graphics in the creation of 3D objects and representations. Students should, as a result, be able to create clear representations of objects in space and accurately represent these in two-dimensions.

### STRAND 2: 3D GRAPHICS

In this strand, students will engage with, understand and use the fundamental concepts and principles underpinning 3D objects, modelling systems and graphical conventions. This strand is of specific importance in developing each student's ability in visual imagery and representation. Students should as a result be able to accurately represent objects in three dimensions and apply these skills to problem solving.

### STRAND 3: APPLIED GRAPHICS

In this strand, students will draw on the knowledge, principles and techniques developed through the 2D Graphics and 3D Graphics strands to create and communicate solutions and information graphically. Students should be encouraged to investigate their physical environment and to apply the principles of 2D Graphics and 3D Graphics to the solution of a variety of problems. Students should be able to select the most appropriate methods to communicate their solutions and solve these problems, both in terms of their selection of graphical media and the mechanism for their utilisation.

## Elements

### **ELEMENT 1: SPATIAL REASONING**

The learning outcomes from the different strands that are associated with this element encourage students to investigate a range of shapes, graphical information, objects and artefacts to assist students in developing their spatial ability. The learning outcomes aid the student in developing their abilities from initially recognising spatial properties to visualising their manipulation.

### **ELEMENT 2: DESIGN THINKING**

The learning outcomes from the different strands that are associated with this element encourage students to use their understanding of Graphics to develop ideas and solutions to everyday problems. Students develop the creative and innovative skills needed to develop and communicate their design solutions, influenced by their learning under the three strands.

### **ELEMENT 3: COMMUNICATING**

The learning outcomes from the different strands that are associated with this element encourage students to communicate through appropriate media to relay technical information, and to design ideas and solutions to problems. Emphasis should be placed on developing the students' abilities to communicate through a range of graphical media and make decisions on the appropriateness of specific media relative to specific stages of a design process.

### **ELEMENT 4: GEOMETRIC PRINCIPLES AND CONSTRUCTIONS**

The learning outcomes from the different strands that are associated with this element encourage students to execute their understanding of geometric shapes and objects in the construction of two-dimensional and three-dimensional representations and in the solving of geometric problems. Students will adapt their knowledge from classroom activities to explore the role of geometric principles and constructions in the natural world around them.

## Developing Units of Learning

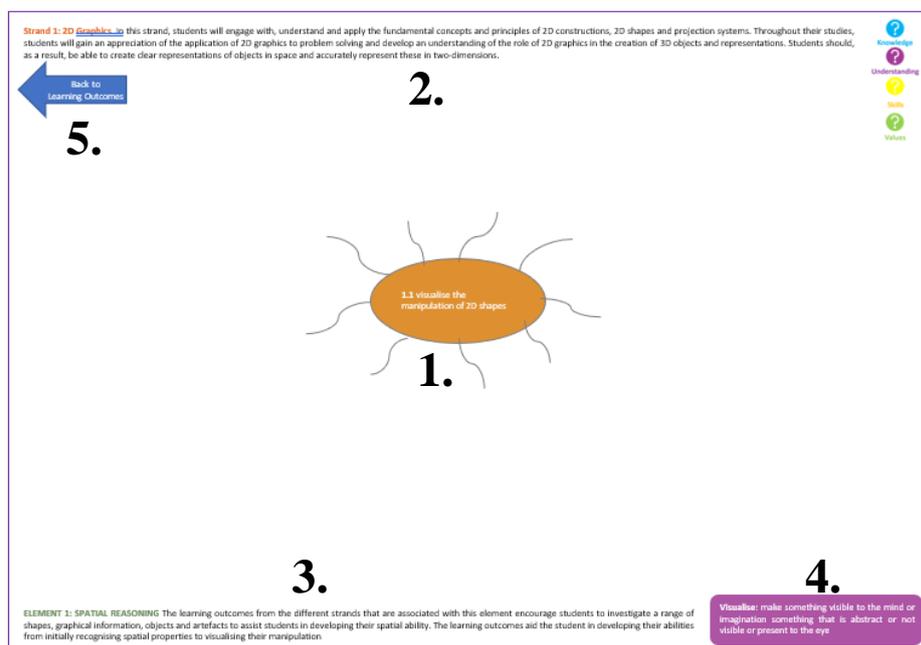
This document aims to support teachers in their exploration of learning outcomes. For suggested supports and resources for developing units of learning, please see the Graphics section of [www.jct.ie](http://www.jct.ie).

Selecting learning outcomes for an integrated unit of learning is best done by identifying connections between the key learning in learning outcomes from different Strands and Elements. Exploring the learning outcomes using mind map sheets will help in identifying the connections between the key learning in the learning outcomes.

## Learning outcomes mind map sheets

On the first A3 sheet select the learning outcome you wish to explore, and you will be taken to a A3 sheet as shown in the diagram below. Each sheet contains the following;

1. The learning outcome selected.
2. A descriptor of the relevant Strand.
3. A descriptor of the relevant Element.
4. A definition of the action verb or verbs.
5. A link back to the learning outcomes.



Click [here](#) to view a video demonstration.

These sheets can be printed out and worked on as shown in this [video](#) or filled in electronically using a pdf editor.

When exploring each of the learning outcomes identify the following;

1. What **knowledge** should the students gain through experiencing the key learning associated with this learning outcome?
2. What **skills** would the students need to develop in order to demonstrate an **understanding** of this **knowledge**
3. What **values** would you hope to foster in the student to contribute to their overall development?

## Useful links

Click [here](#) to explore some classroom strategies on jct.ie

Click [here](#) to visit the Graphics section of jct.ie

Click [here](#) to view the Graphics section of curriculumonline.ie

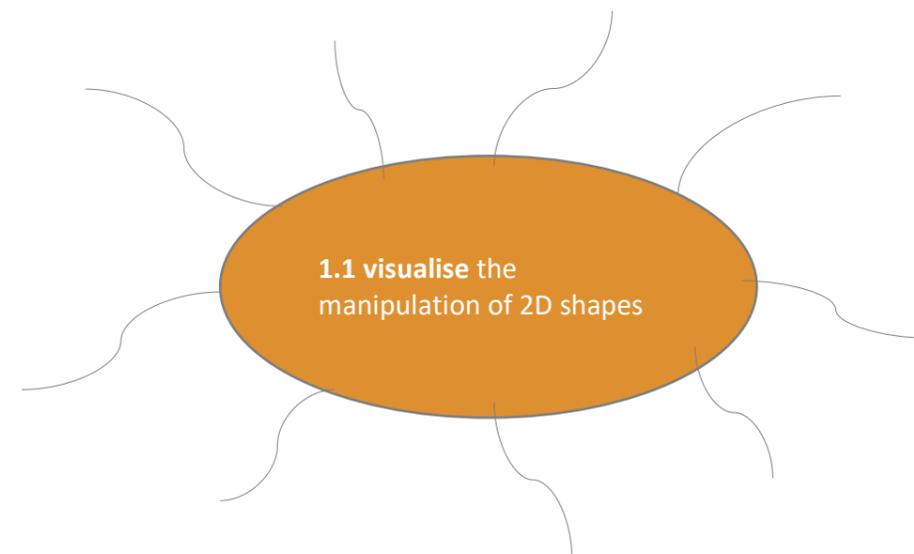
Select the learning outcome you wish to engage with and use the page to explore the learning outcome and identify the key learning.

	STRAND 1: 2D GRAPHICS	STRAND 2: 3D GRAPHICS	STRAND 3: APPLIED GRAPHICS
<b>ELEMENT 1:</b>  SPATIAL REASONING	<p><b>1.1</b> <a href="#">visualise</a> the manipulation of 2D shapes</p> <p><b>1.2</b> <a href="#">analyse</a> graphical information for the planning of a 2D solution</p> <p><b>1.3</b> <a href="#">derive</a> 2D solutions using appropriate media</p>	<p><b>2.1</b> <a href="#">visualise</a> the manipulation of 3D objects</p> <p><b>2.2</b> <a href="#">analyse</a> graphical information for the planning of a 3D solution</p> <p><b>2.3</b> <a href="#">derive</a> 3D solutions using appropriate media</p>	<p><b>3.1</b> <a href="#">recognise</a> 2D and 3D features in everyday objects and artefacts</p> <p><b>3.2</b> <a href="#">appreciate</a> the hidden features of an object or an artefact necessary for its representation</p> <p><b>3.3</b> <a href="#">demonstrate</a> their spatial understanding by modelling and/or simulation</p>
<b>ELEMENT 2:</b>  DESIGN THINKING	<p><b>1.4</b> <a href="#">appreciate</a> the role of 2D graphics in the creation of solutions</p> <p><b>1.5</b> <a href="#">illustrate</a> ideas using free-hand sketches to accurately communicate their thought process</p> <p><b>1.6</b> <a href="#">apply</a> their understanding of geometric principles to solve problems</p> <p><b>1.7</b> <a href="#">interpret</a> and <a href="#">create</a> graphical representations of data/information</p>	<p><b>2.4</b> <a href="#">appreciate</a> the role of 3D graphics in the creation of solutions</p> <p><b>2.5</b> <a href="#">develop</a> ideas using freehand sketches and other media to accurately communicate the thought process</p> <p><b>2.6</b> <a href="#">apply</a> their understanding of 3D principles to solve problems</p> <p><b>2.7</b> <a href="#">construct</a> solutions to presented and/or defined problems</p>	<p><b>3.4</b> <a href="#">solve</a> real-context and abstract problems using graphical techniques</p> <p><b>3.5</b> <a href="#">analyse</a> and <a href="#">evaluate</a> both their own work, and the work of others</p>
<b>ELEMENT 3:</b>  COMMUNICATING	<p><b>1.8</b> <a href="#">communicate</a> the progression of ideas and thinking during the course of an activity using a variety of media</p> <p><b>1.9</b> <a href="#">represent</a> 3D information using 2D conventions</p>	<p><b>2.8</b> <a href="#">construct</a> a 3D representation of an artefact or abstract idea using a variety of media and methods</p> <p><b>2.9</b> <a href="#">communicate</a> the progression of ideas/thinking during the course of an activity using a variety of media</p>	<p><b>3.6</b> <a href="#">develop</a> design ideas/solutions through modelling and prototyping using a variety of media</p> <p><b>3.7</b> <a href="#">use</a> computer-aided graphics to communicate design solutions effectively</p> <p><b>3.8</b> <a href="#">represent</a> graphically their approach to a design task</p> <p><b>3.9</b> <a href="#">apply</a> a variety of rendering and presentation techniques to enhance the communication of solutions</p>
<b>ELEMENT 4:</b>  GEOMETRIC PRINCIPLES AND CONSTRUCTIONS	<p><b>1.10</b> <a href="#">understand</a> the properties of geometric shapes</p> <p><b>1.11</b> <a href="#">appreciate</a> the application of geometric constructions in the study of other areas</p> <p><b>1.12</b> <a href="#">construct</a> 2D solutions accurately in accordance with graphical conventions</p>	<p><b>2.10</b> <a href="#">understand</a> the properties of geometric objects and surfaces</p> <p><b>2.11</b> <a href="#">appreciate</a> the application of geometric principles in the study of other areas</p> <p><b>2.12</b> <a href="#">generate</a> and <a href="#">develop</a> design ideas using appropriate geometric principles and constructions</p> <p><b>2.13</b> <a href="#">apply</a> geometric principles to construct accurate 3D solutions in accordance with graphical conventions</p>	<p><b>3.10</b> <a href="#">investigate</a> and <a href="#">apply</a> the principles of plane and descriptive geometries to create solutions</p> <p><b>3.11</b> <a href="#">investigate</a> how geometric principles and constructions found in the natural world have provided inspiration for human applications</p> <p><b>3.12</b> <a href="#">develop</a> an appropriate graphical representation of a solution to a contextual problem of their choice</p>

**Strand 1: 2D Graphics** In this strand, students will engage with, understand and apply the fundamental concepts and principles of 2D constructions, 2D shapes and projection systems. Throughout their studies, students will gain an appreciation of the application of 2D graphics to problem solving and develop an understanding of the role of 2D graphics in the creation of 3D objects and representations. Students should, as a result, be able to create clear representations of objects in space and accurately represent these in two-dimensions.



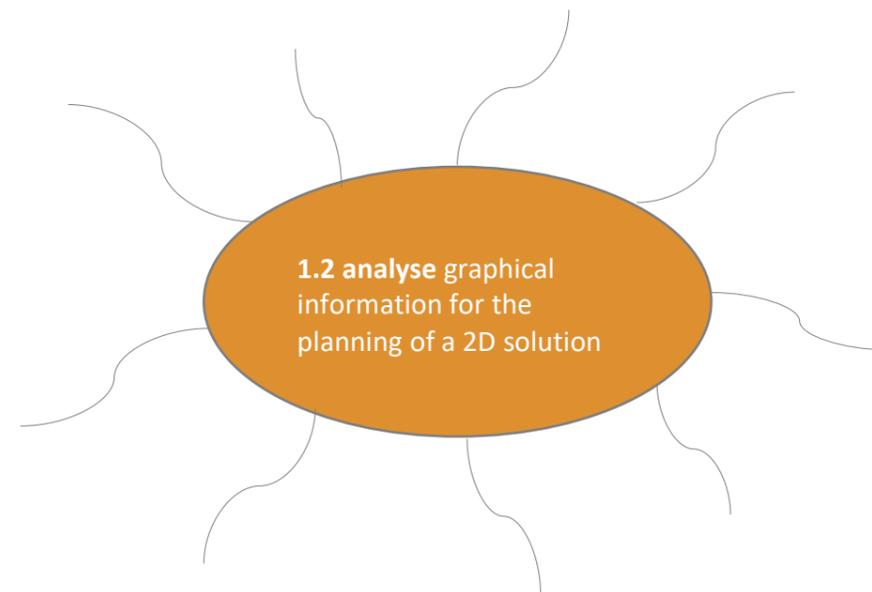
-   
Knowledge
-   
Understanding
-   
Skills
-   
Values



**ELEMENT 1: SPATIAL REASONING** The learning outcomes from the different strands that are associated with this element encourage students to investigate a range of shapes, graphical information, objects and artefacts to assist students in developing their spatial ability. The learning outcomes aid the student in developing their abilities from initially recognising spatial properties to visualising their manipulation

**Visualise:** make something visible to the mind or imagination something that is abstract or not visible or present to the eye

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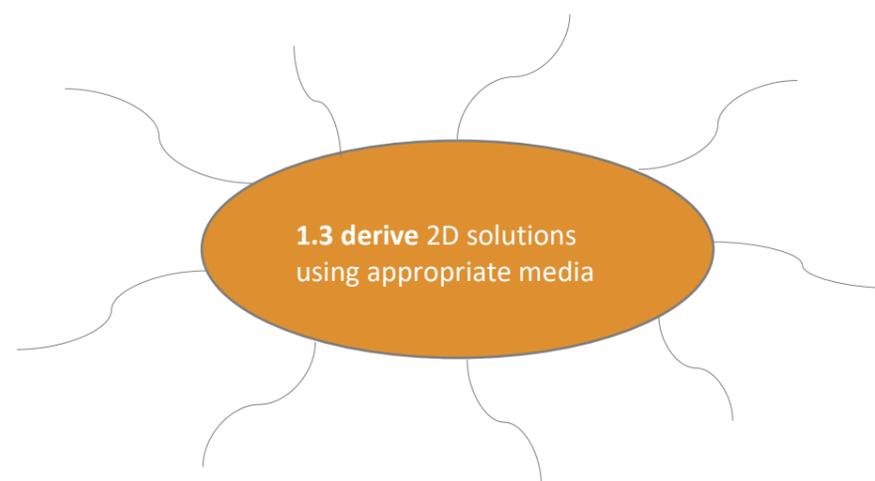
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**Analyse:** study or examine something in detail, break down in order to bring out the essential elements or structure; identify parts and relationships, and to interpret information to reach conclusions

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**Derive:** to formulate or prepare from concepts

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Knowledge



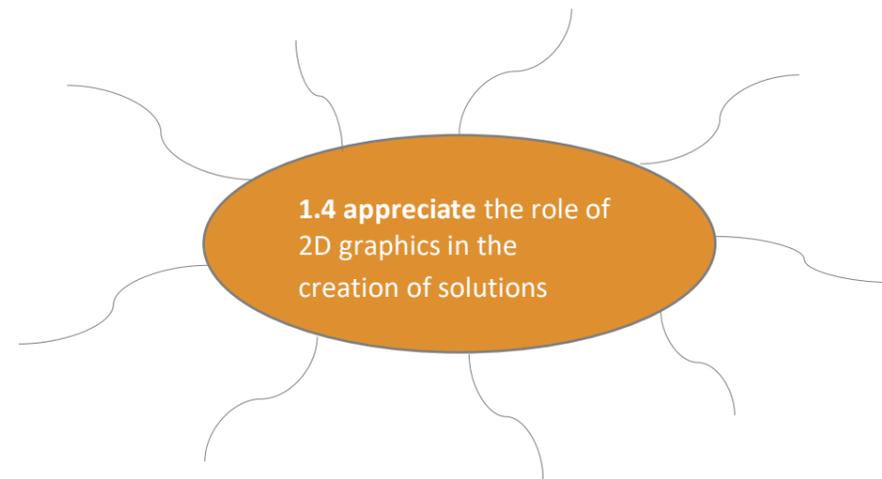
Understanding



Skills



Values



**ELEMENT 2: DESIGN THINKING** The learning outcomes from the different strands that are associated with this element encourage students to use their understanding of Graphics to develop ideas and solutions to everyday problems. Students develop the creative and innovative skills needed to develop and communicate their design solutions, influenced by their learning under the three strands.

**Appreciate:** recognise the meaning of, have a practical understanding of

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**Illustrate:** use examples to describe something

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Knowledge



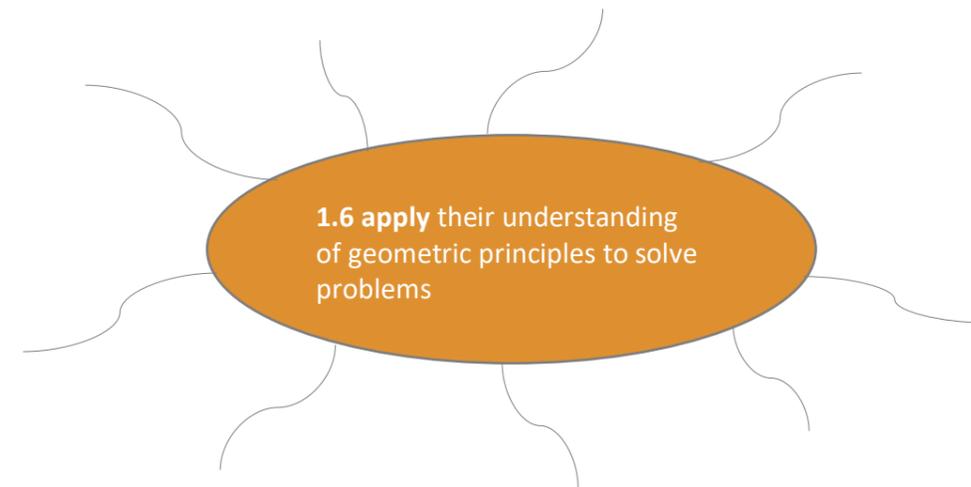
Understanding



Skills



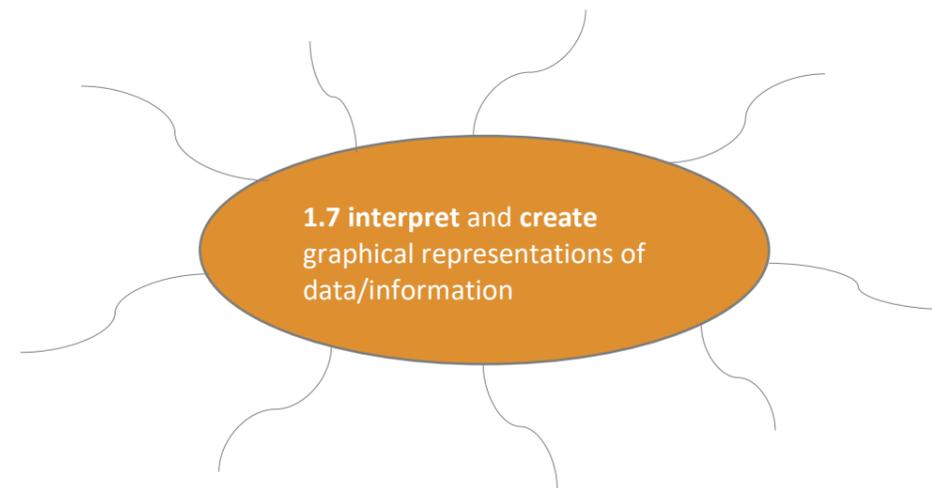
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**Apply:** select and use information and/or knowledge and understanding to explain a given situation or real circumstances

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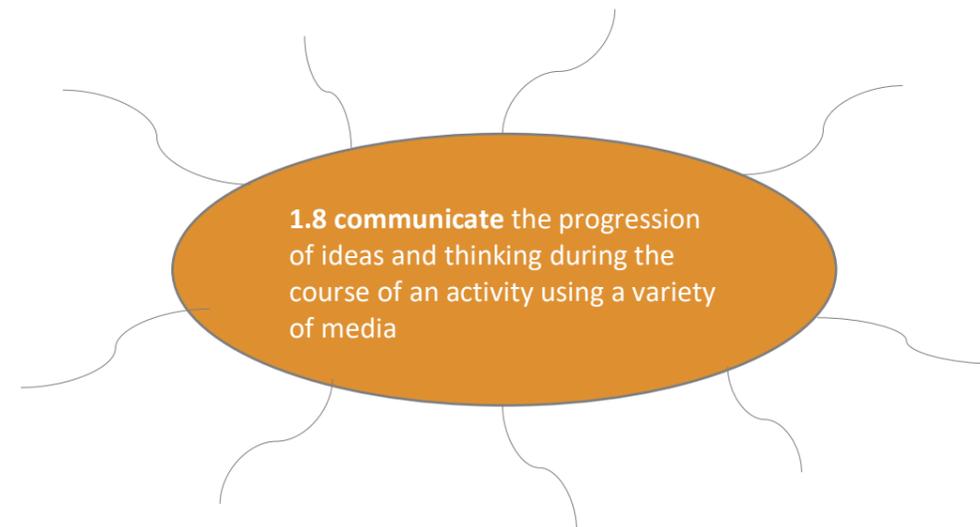
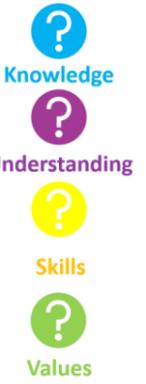


**Create:** process and give form to the topic of what is to be created using selected methods and material and/or to give the material used a new form

**Interpret:** use knowledge and understanding to recognise trends and draw conclusions from given information  
**Interpret:** (aesthetic) assign meaning to objects on the basis of observations and contextual knowledge; translate the effect of an image into words by reasoning and explaining on the basis of reflection and understanding why the image is how it is and is not different.

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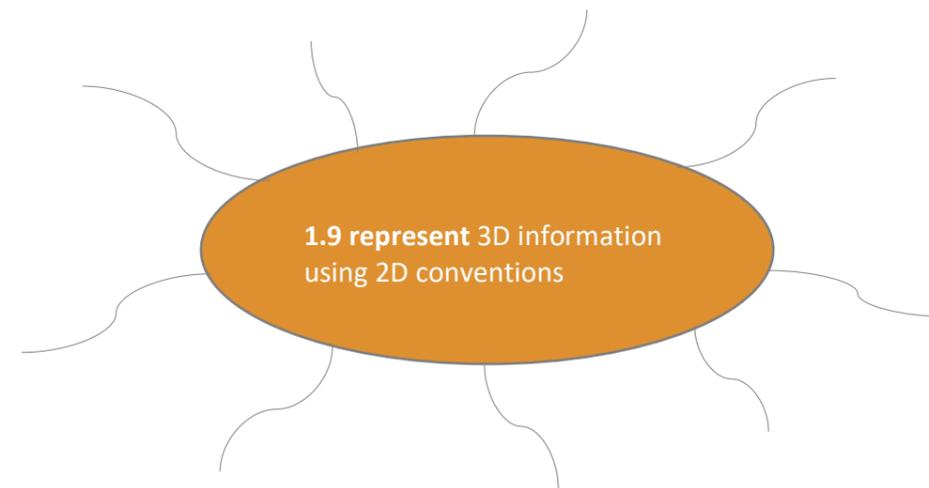
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**Communicate:** use visual gestural, verbal or other signs to share meaning or exchange information; interaction between sender and recipient; both work together to understand

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**Represent:** bringing clearly and distinctively to mind by use of description or imagination

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Knowledge



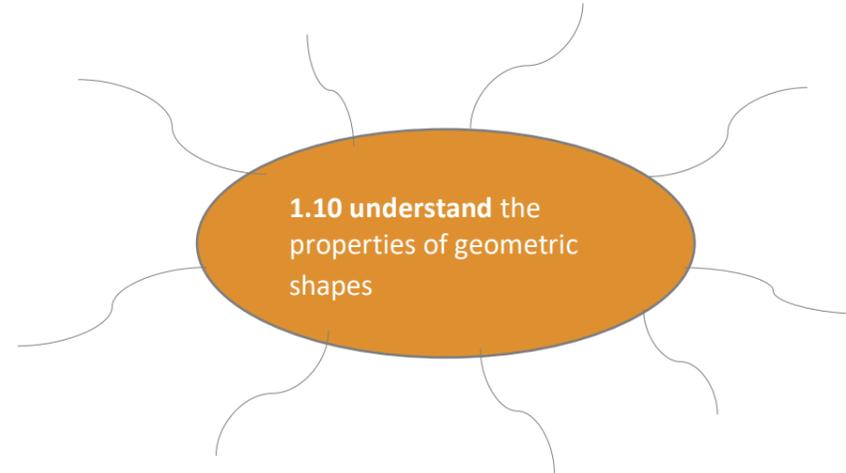
Understanding



Skills



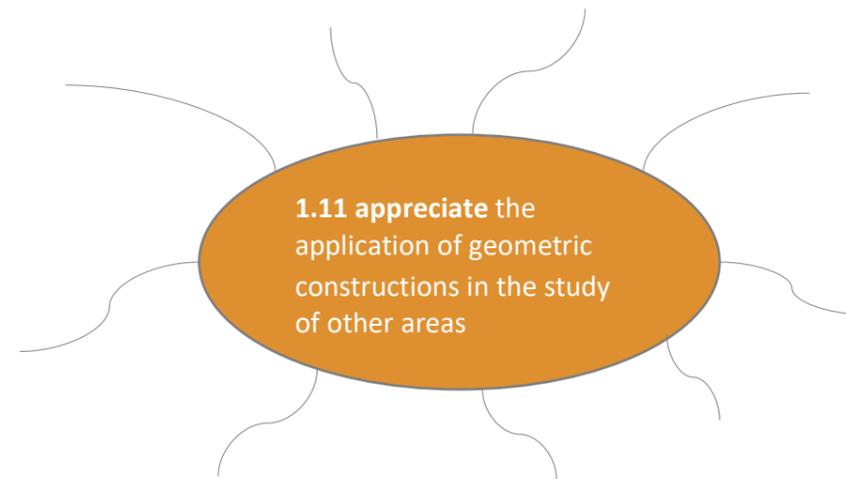
Values



**ELEMENT 4: GEOMETRIC PRINCIPLES AND CONSTRUCTIONS** - The learning outcomes from the different strands that are associated with this element encourage students to execute their understanding of geometric shapes and objects in the construction of two-dimensional and three-dimensional representations and in the solving of geometric problems. Students will adapt their knowledge from classroom activities to explore the role of geometric principles and constructions in the natural world around them.

**Understand:** have and apply a well-organised body of knowledge

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**Appreciate:** recognise the meaning of, have a practical understanding of

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Knowledge



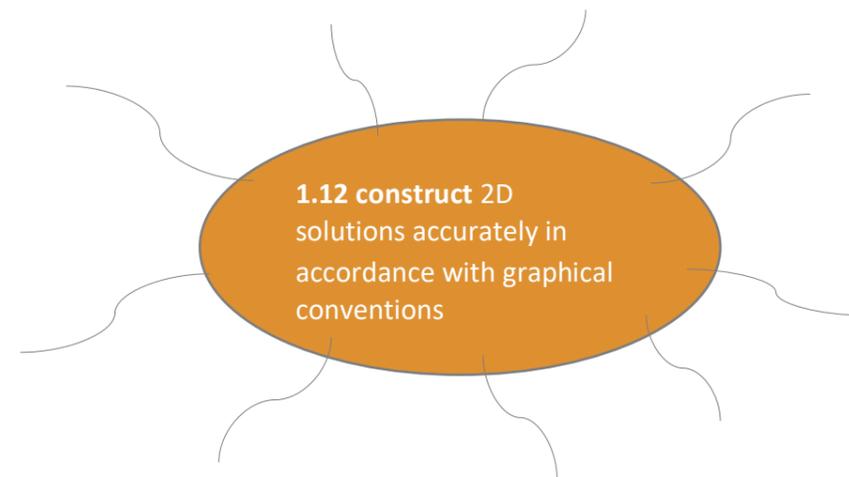
Understanding



Skills



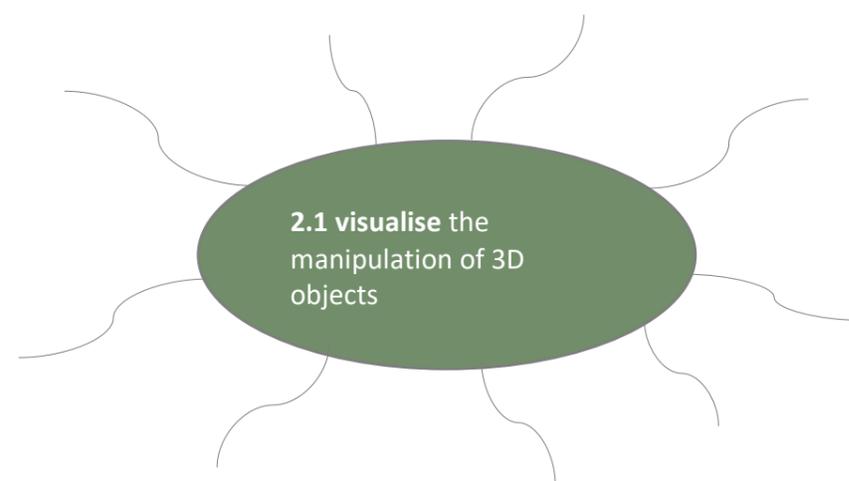
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**Construct:** develop information in a diagrammatic or logical form; not by factual recall but by analogy or by using and putting together information

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**Visualise:** make something visible to the mind or imagination something that is abstract or not visible or present to the eye

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Knowledge



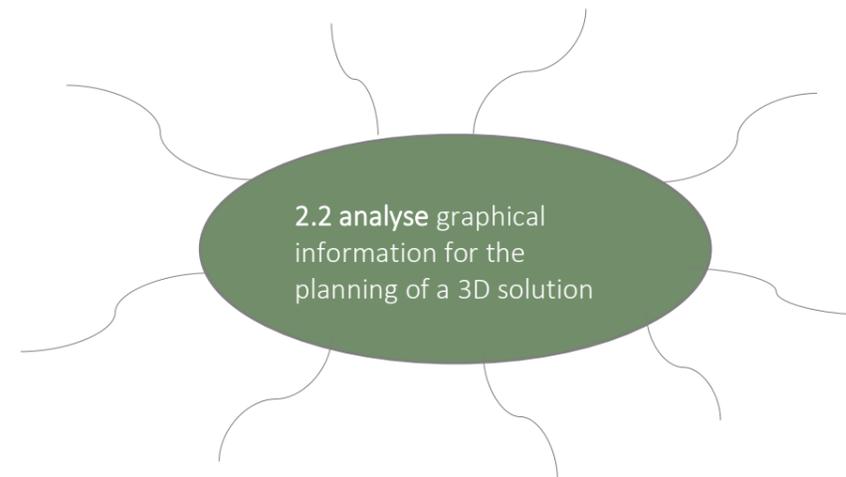
Understanding



Skills



Values



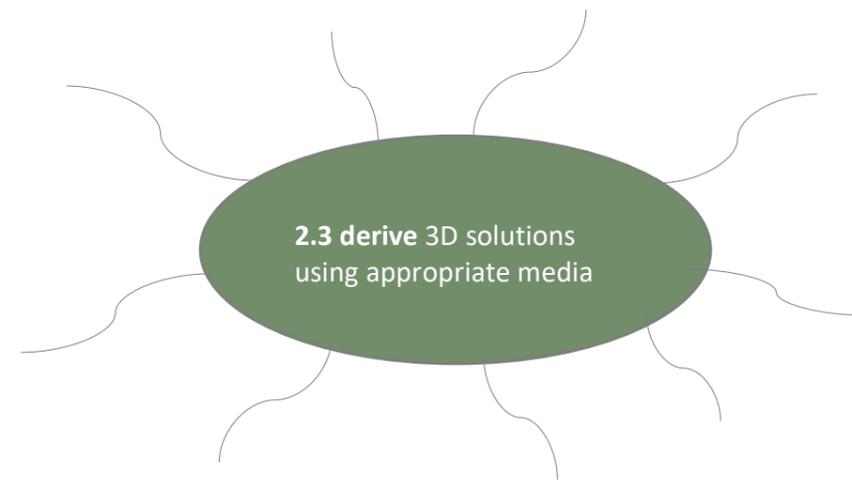
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- Understanding
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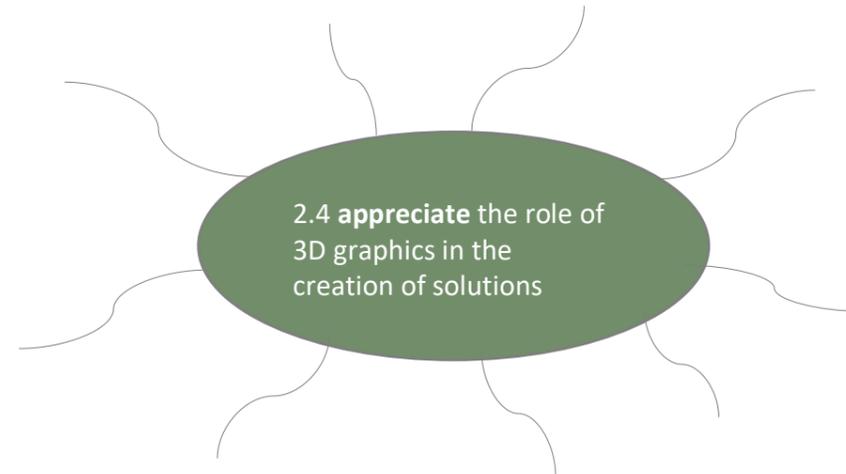
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**Derive:** to formulate or prepare from concepts

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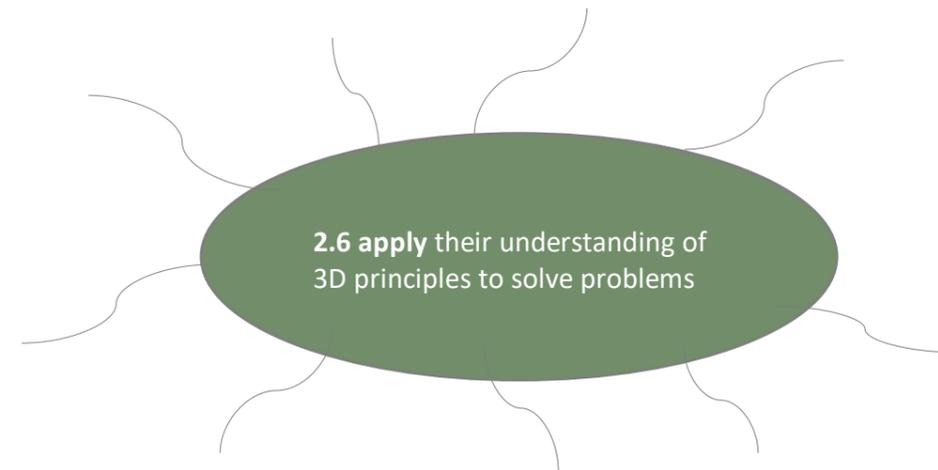
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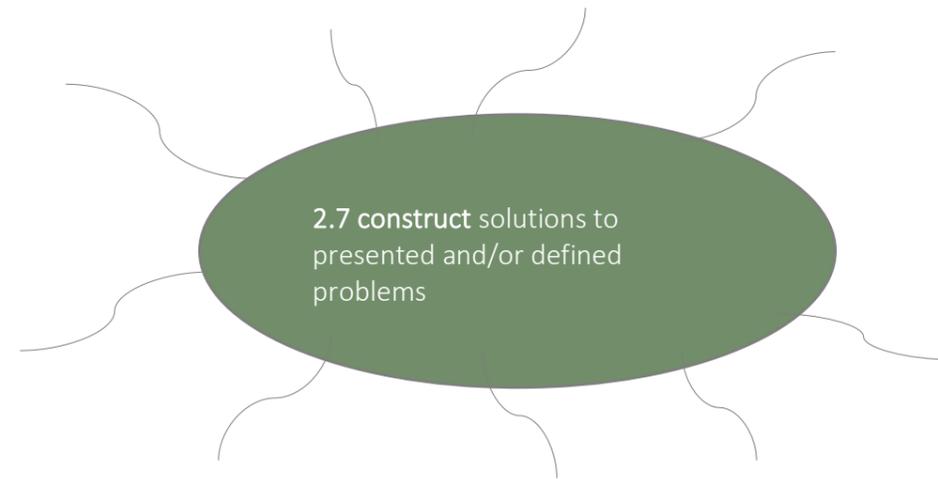
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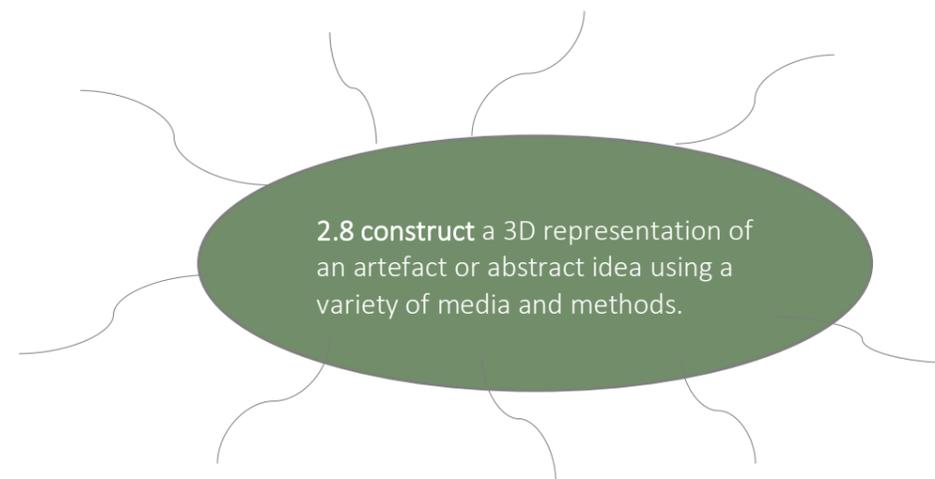
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Skills



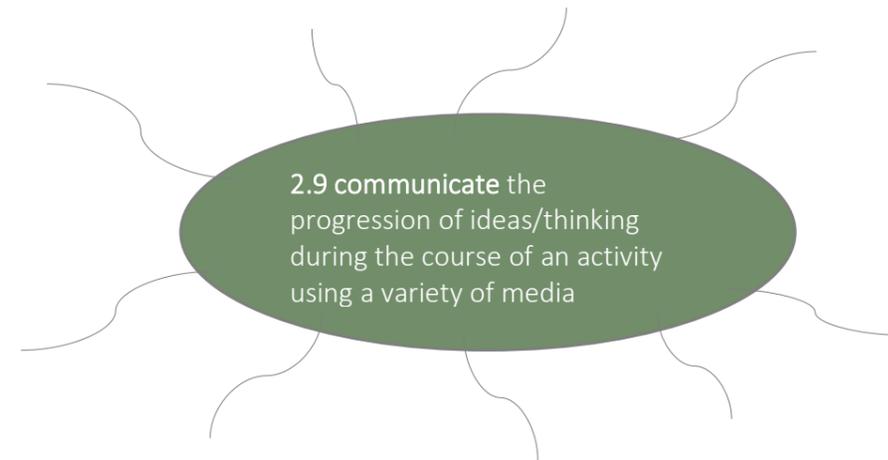
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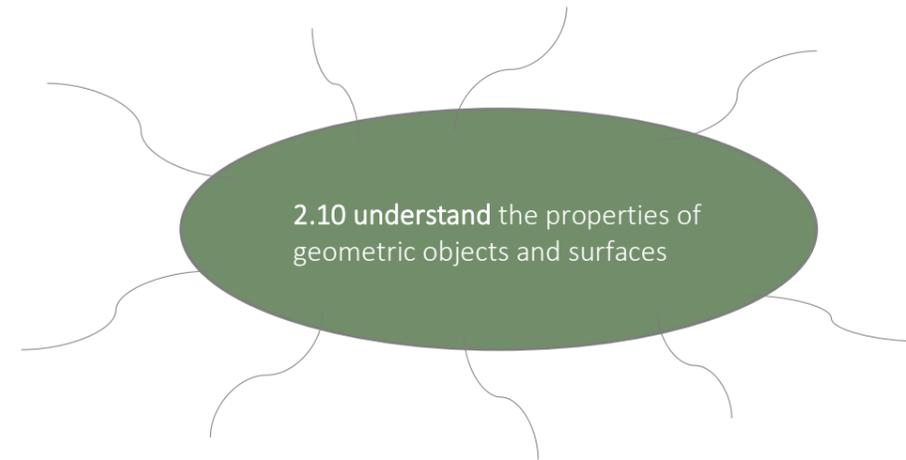
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**Communicate:** use visual gestural, verbal or other signs to share meaning or exchange information; interaction between sender and recipient; both work together to understand

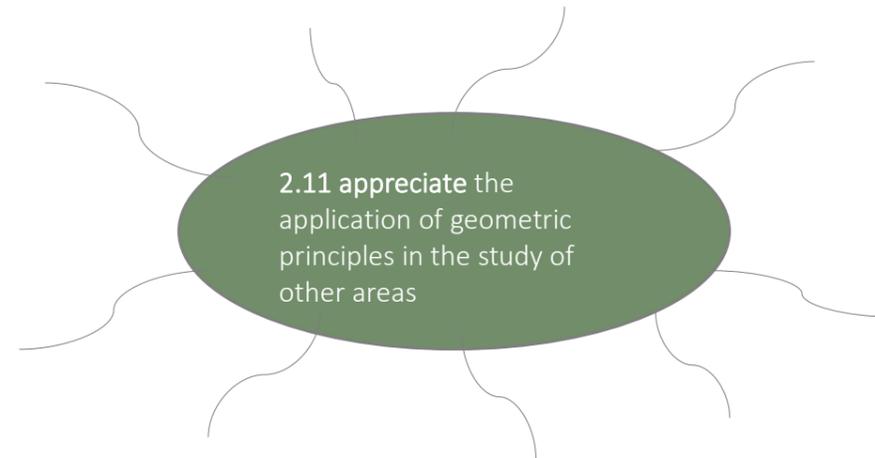
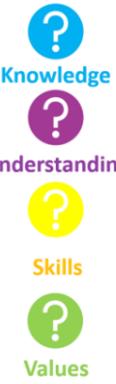
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**Understand:** have and apply a well-organised body of knowledge

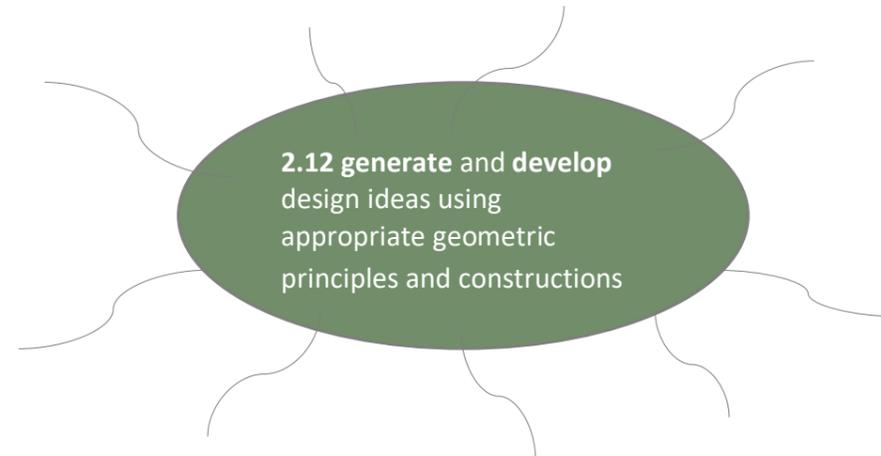
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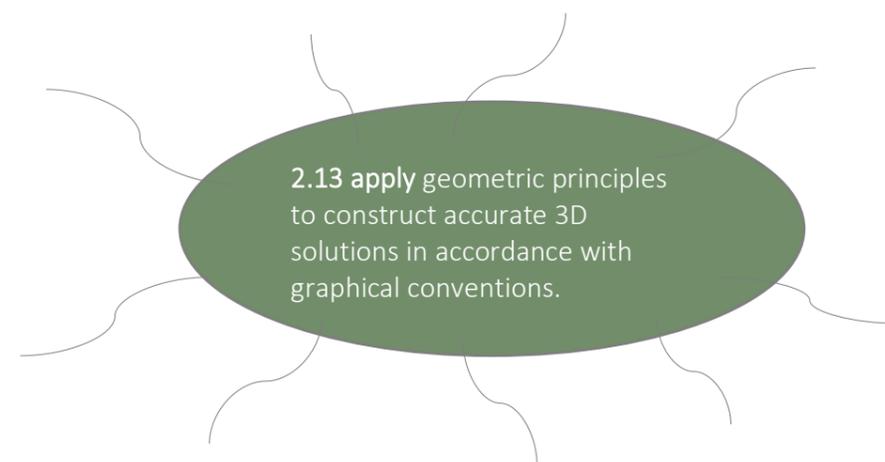


**Generate:** to produce or create

**Develop:** advance a piece of work or an idea from an initial state to a more advanced state

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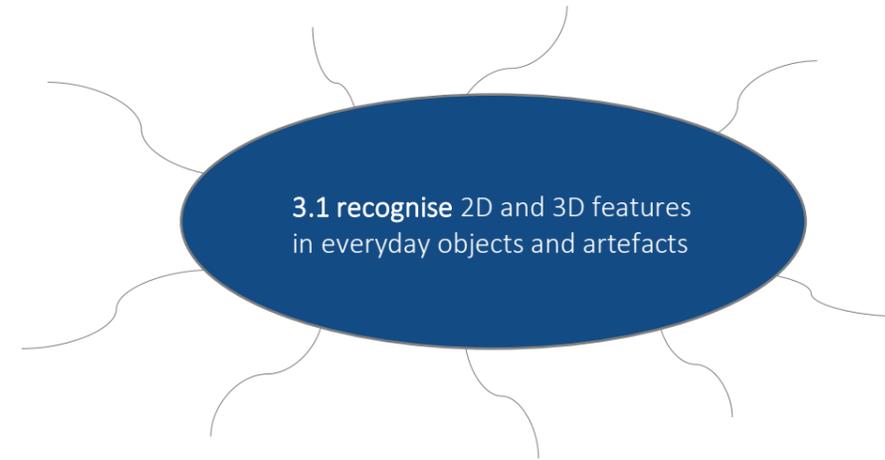
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-  Knowledge
-  Understanding
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-  Values



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**Recognise:** identify facts, characteristics or concepts that are critical (relevant/appropriate) to the understanding of a situation, event, process or phenomenon

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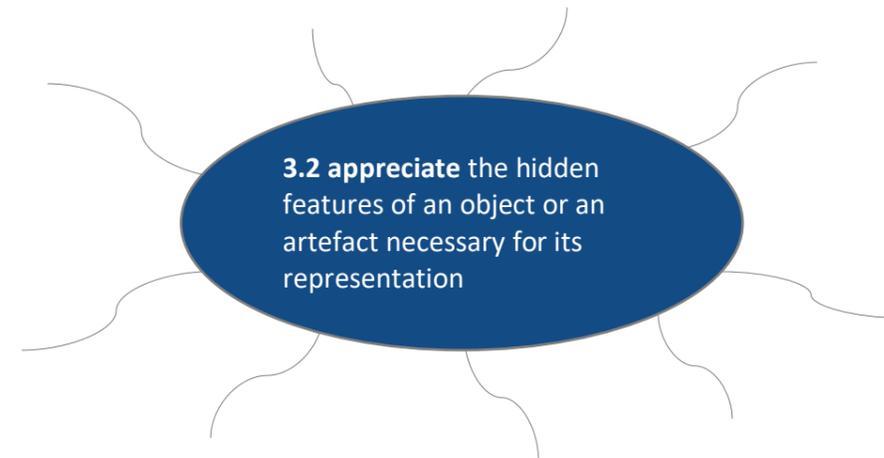
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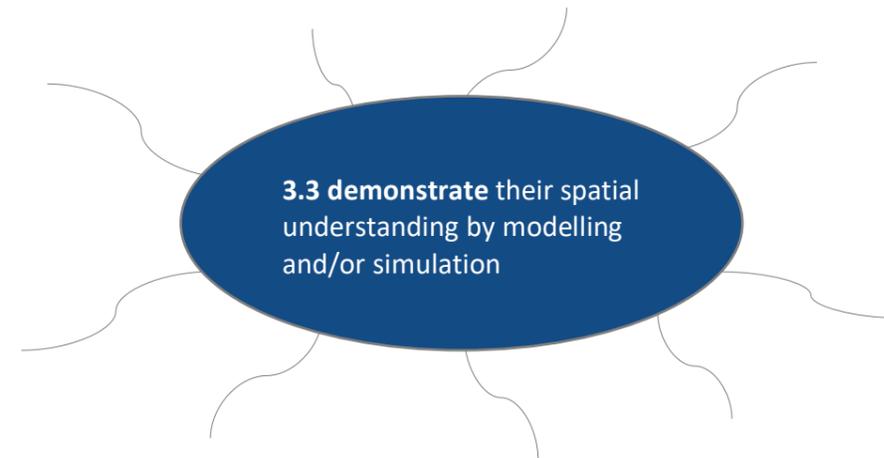
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**Demonstrate:** prove or make clear by reasoning or evidence, illustrating with examples or practical application

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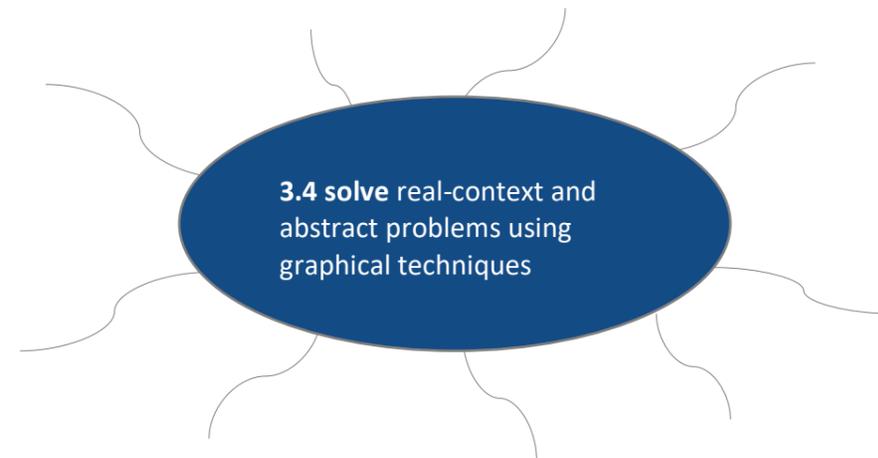
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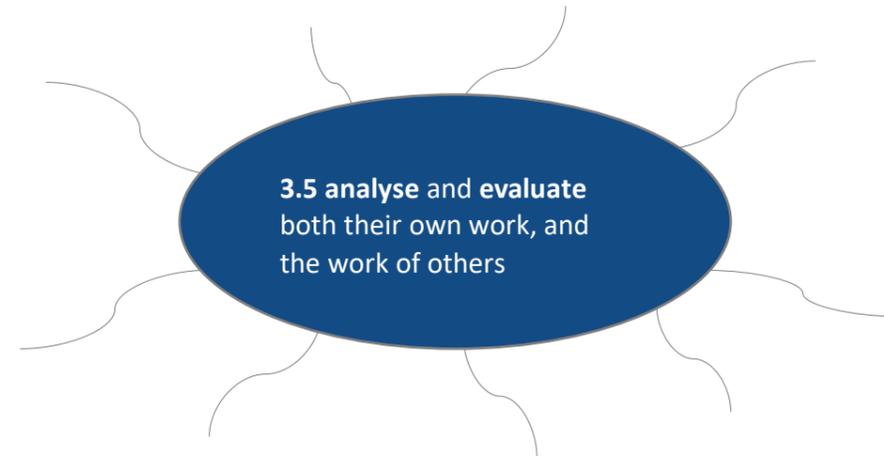
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**Solve:** find an answer through reasoning

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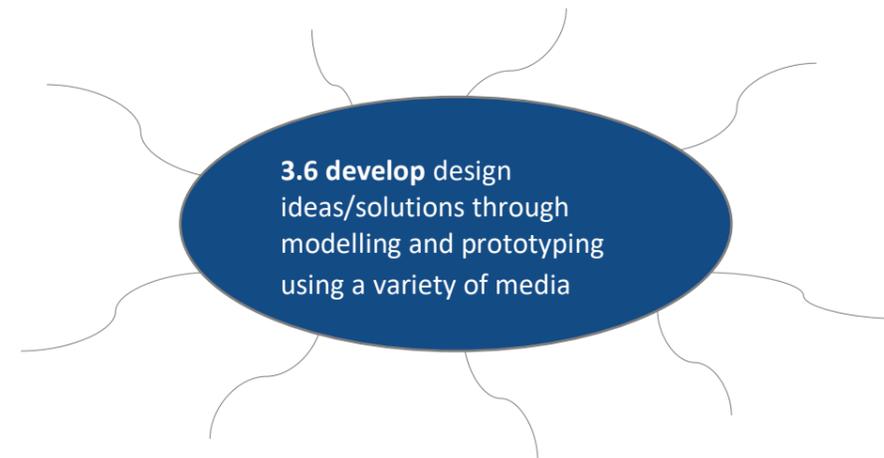
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**Evaluate:** (data) collect and examine data to make judgements and appraisals; describe how evidence supports or does not support a conclusion in an inquiry or investigation; identify the limitations of data in conclusions; make judgements about the ideas, solutions or methods

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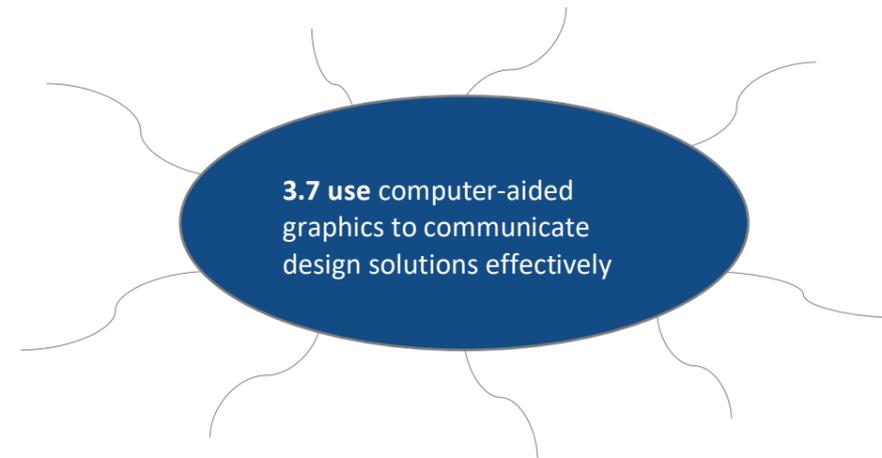
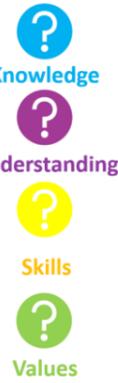
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**Use:** apply knowledge or rules to put theory into practice; employ something in a targeted way

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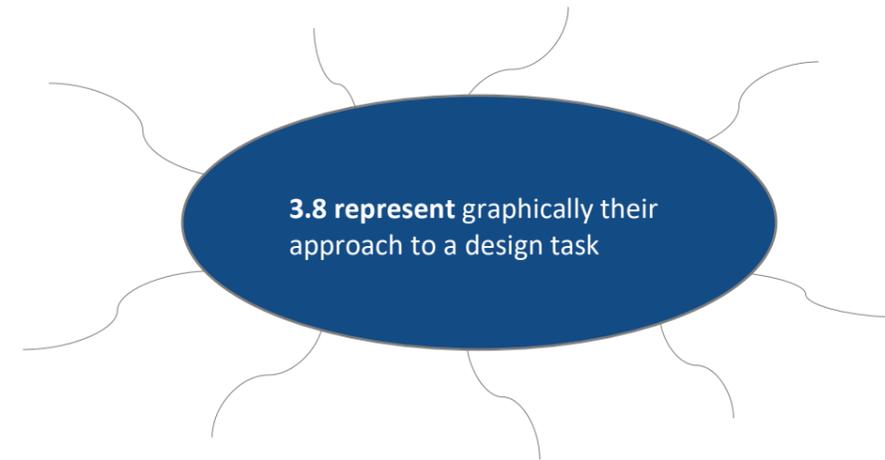
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**Represent:** bringing clearly and distinctively to mind by use of description or imagination

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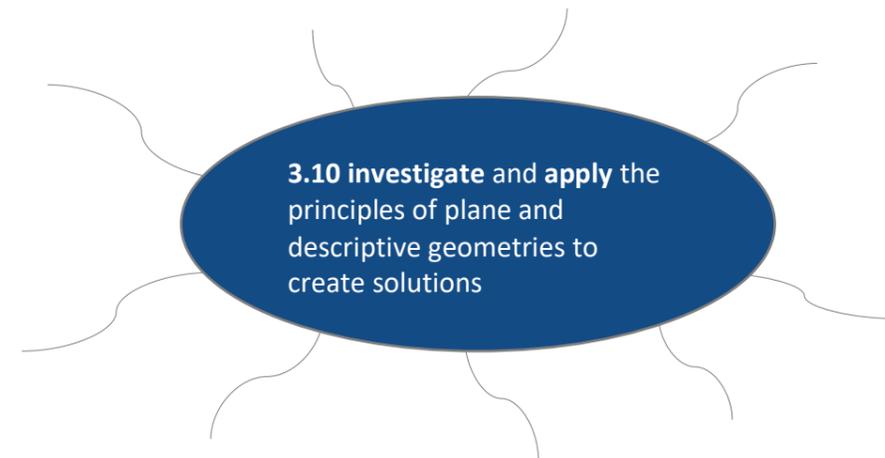
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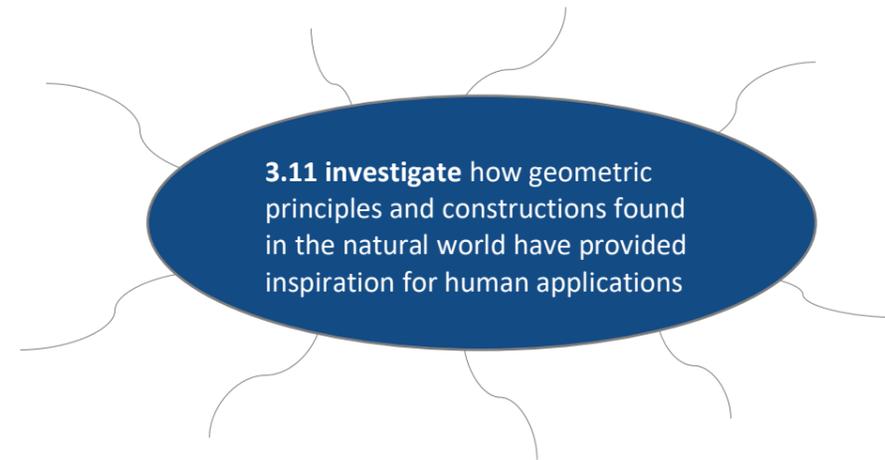


**Investigate:** observe, study, or make a detailed and systematic examination, to establish facts and reach new conclusions

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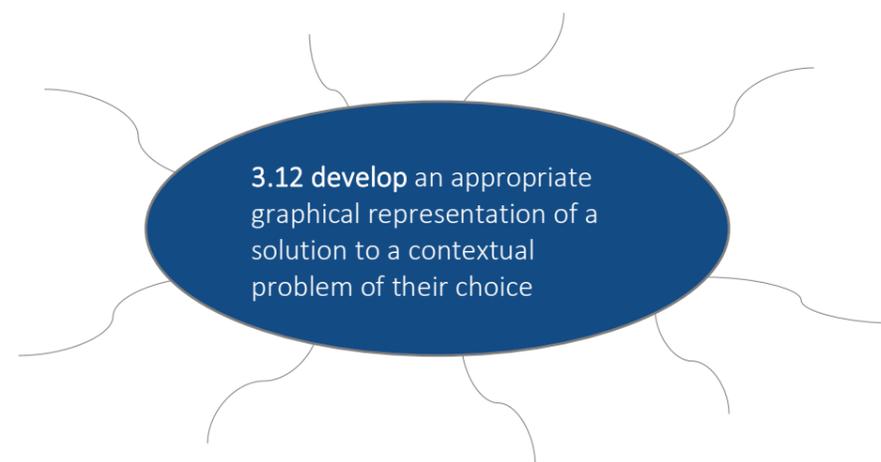
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