An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

Cluster Delivery 2018/19

Graphics

Scan for the Graphics specification

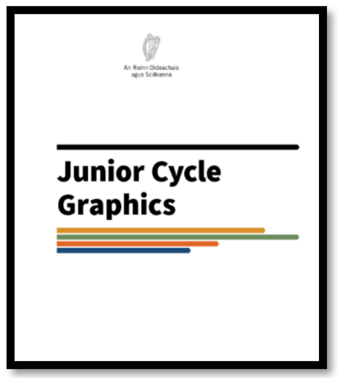
Rationale

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 solve problems 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.


Junior Cycle
Graphics

Assessment in Junior Cycle Graphics

Classroom-Based Assessment 1: Communicating through sketching

This Classroom-Based Assessment will provide students with the opportunity to develop their skills to become competent in communicating through sketching. Students will be asked to graphically communicate their ideas using two-dimensional and three-dimensional sketching techniques in response to a chosen stimulus theme.

Through this Classroom-Based Assessment, students will develop their skills in using effective sketching methods and media to accurately communicate their vision, design and solution. This Classroom-Based Assessment is an opportunity to instil in students a curious disposition where they are free to experiment, allowed to take risks, encouraged to explore new and challenging opportunities and to reflect on the process.

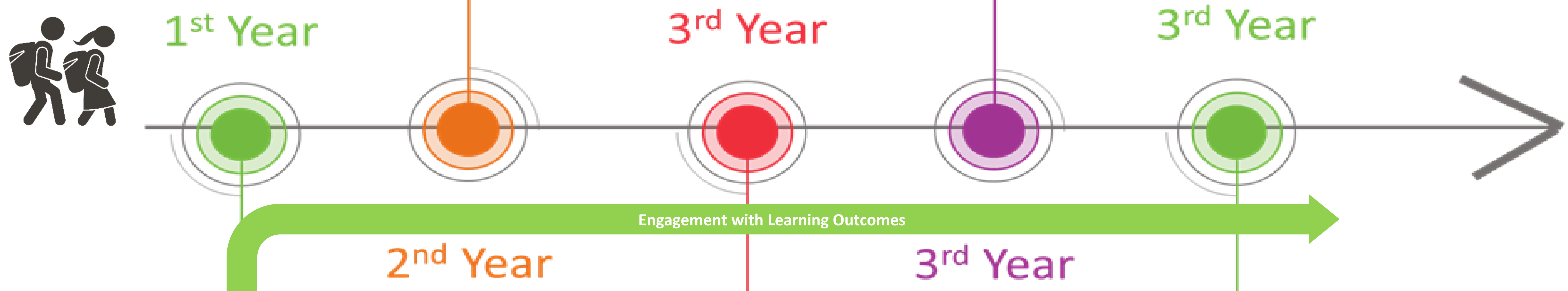
Students can communicate their work through any appropriate media.

Project

On completion of the Classroom-Based Assessments, students undertake a project as part of their final assessment. The project is completed after the second Classroom-Based Assessment in third year. The brief for the project is set and marked by the State Examinations Commission.

Students will be required to complete three outputs:

- Output 1: Responding to a theme informed by the work of Classroom-Based Assessment 2
- Output 2: Dimensioned drawings
- Output 3: Three-dimensional computer-aided design modelling



Engagement with Learning Outcomes

Learning through engagement with 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 to be experienced over three years

Classroom-Based Assessment 2: Graphical presentation skills

This Classroom-Based Assessment will focus on how effectively students present their research graphically. It will inform the project assessment element (see below). Through this CBA, students research and investigate the domain in which the project is situated and present their findings graphically through any appropriate graphical media. This enables them to develop the concepts for their final project in a real-life context prior to starting their work on the project.
This Classroom-Based Assessment is an opportunity to instil in students a curious disposition, where they are free to experiment, encouraged to explore new and challenging opportunities and to reflect on the process.

Students can communicate their work through any appropriate media.

Final examination

Students will sit a two-hour examination at the end of third year and this will be offered at a common level.

The examination will be prepared and marked by the State Examinations Commission.

Strand 1: 2D Graphics

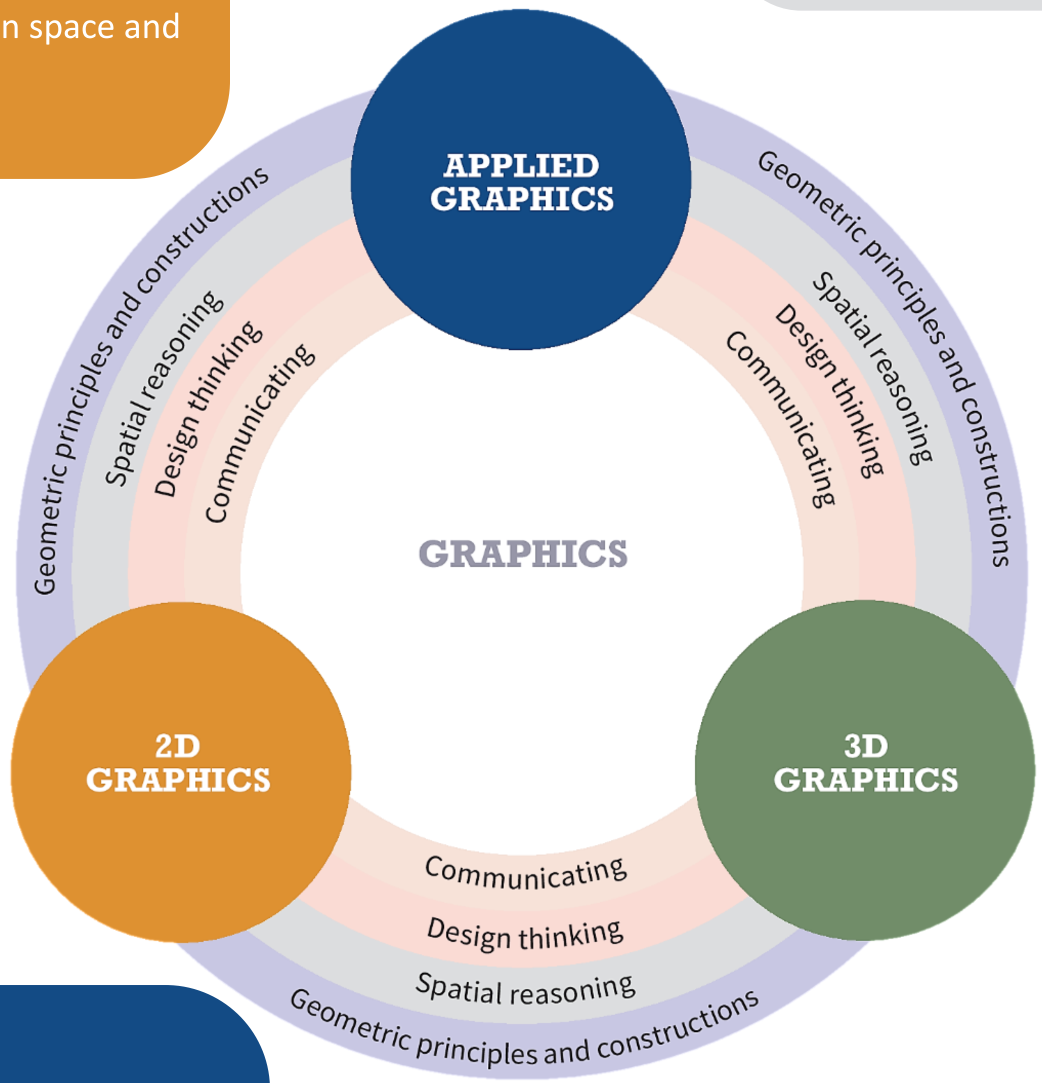
In this strand, students will engage with, understand and apply the fundamental concepts and principles of 2D constructions, 2D shapes and projection systems. Throughout their studies, students will gain an appreciation of the application of 2D graphics to problem solving and develop an understanding 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 to solve these problems, both in terms of their selection of graphical media and the mechanism for their utilisation.



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

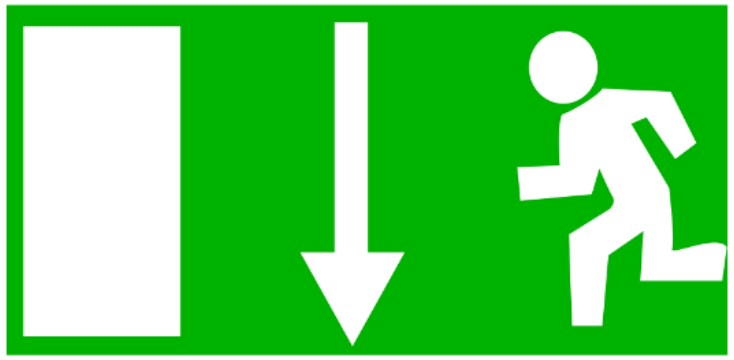
The learning outcomes from the different strands that are associated with this element encourage students to communicate through appropriate media to relay technical information, and to design ideas and solutions to problems. Emphasis should be placed on developing the students' abilities to communicate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

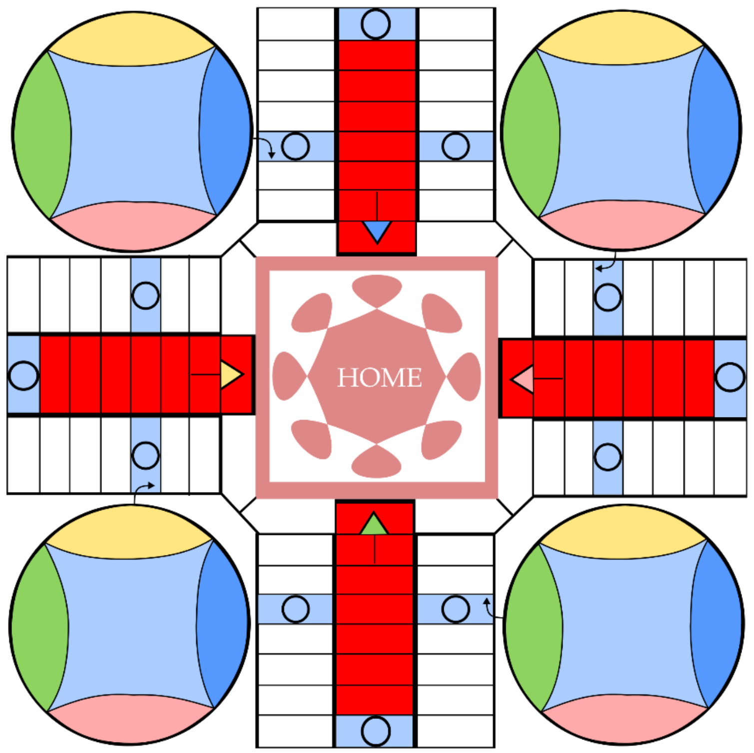
Element 4: Geometric principles and constructions

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.

Plane figures in the world around us:

Plane figures are **flat 2-dimensional** shapes which can be made up of straight lines, curves and a combination of both. When we look at everyday objects, we recognise plane figures such as circles, triangles and squares depending on the number of sides the shape has.
Complete the activities shown on the right.

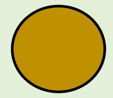


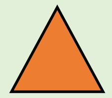


Identification of shapes

Identify how many images contain the following shapes within them.

List the **geometric properties** of that shape.

Circle: ____

Properties:
____
____

Triangle: ____

Properties:
____
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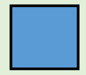
Square: ____

Properties:
____
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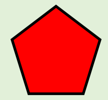
Rectangle: ____

Properties:
____
____

Pentagon: ____

Properties:
____
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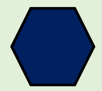
Hexagon: ____

Properties:
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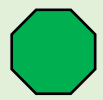
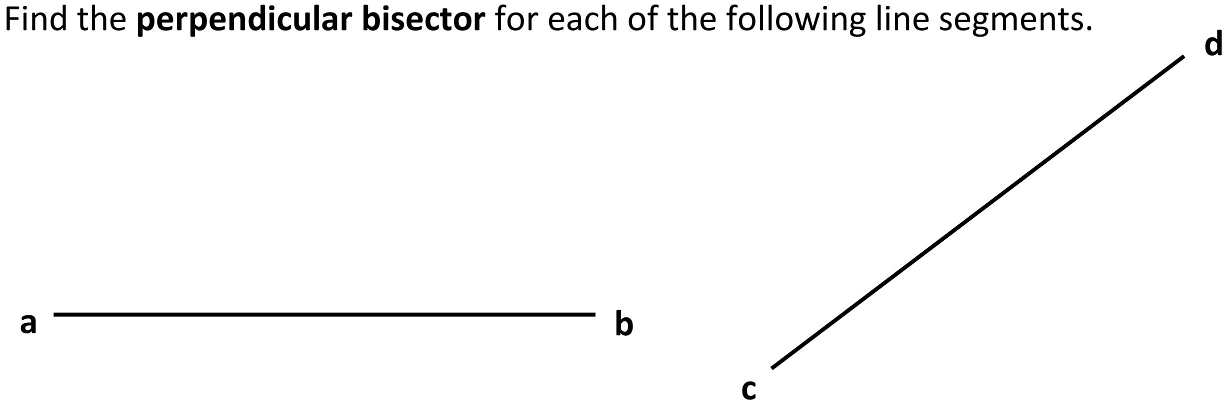
Octagon: ____

Properties:
____
____

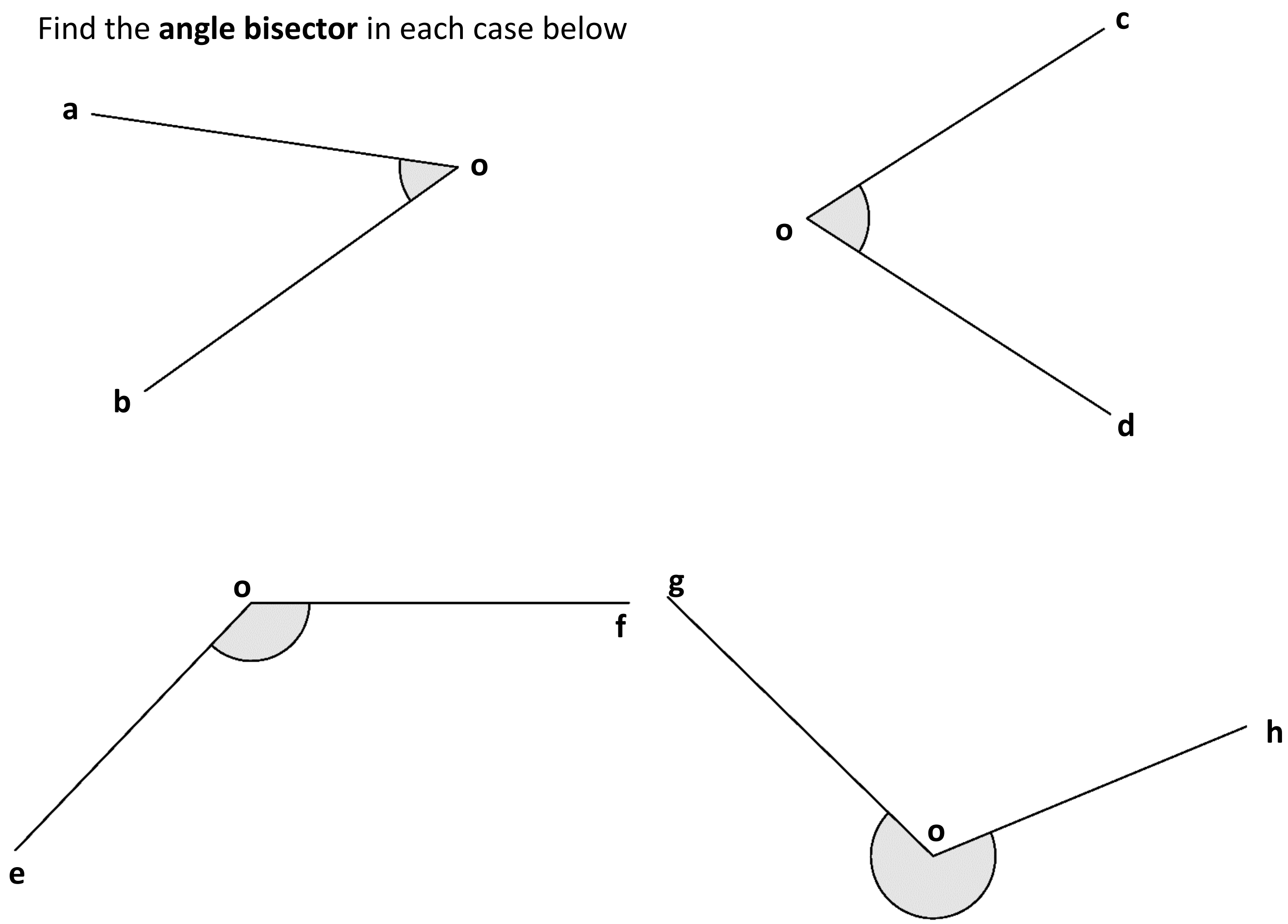
Using **tracing paper** sketch the outline of each shape listed above using the provided images.

Bisecting line segments and angles*

Find the **perpendicular bisector** for each of the following line segments.

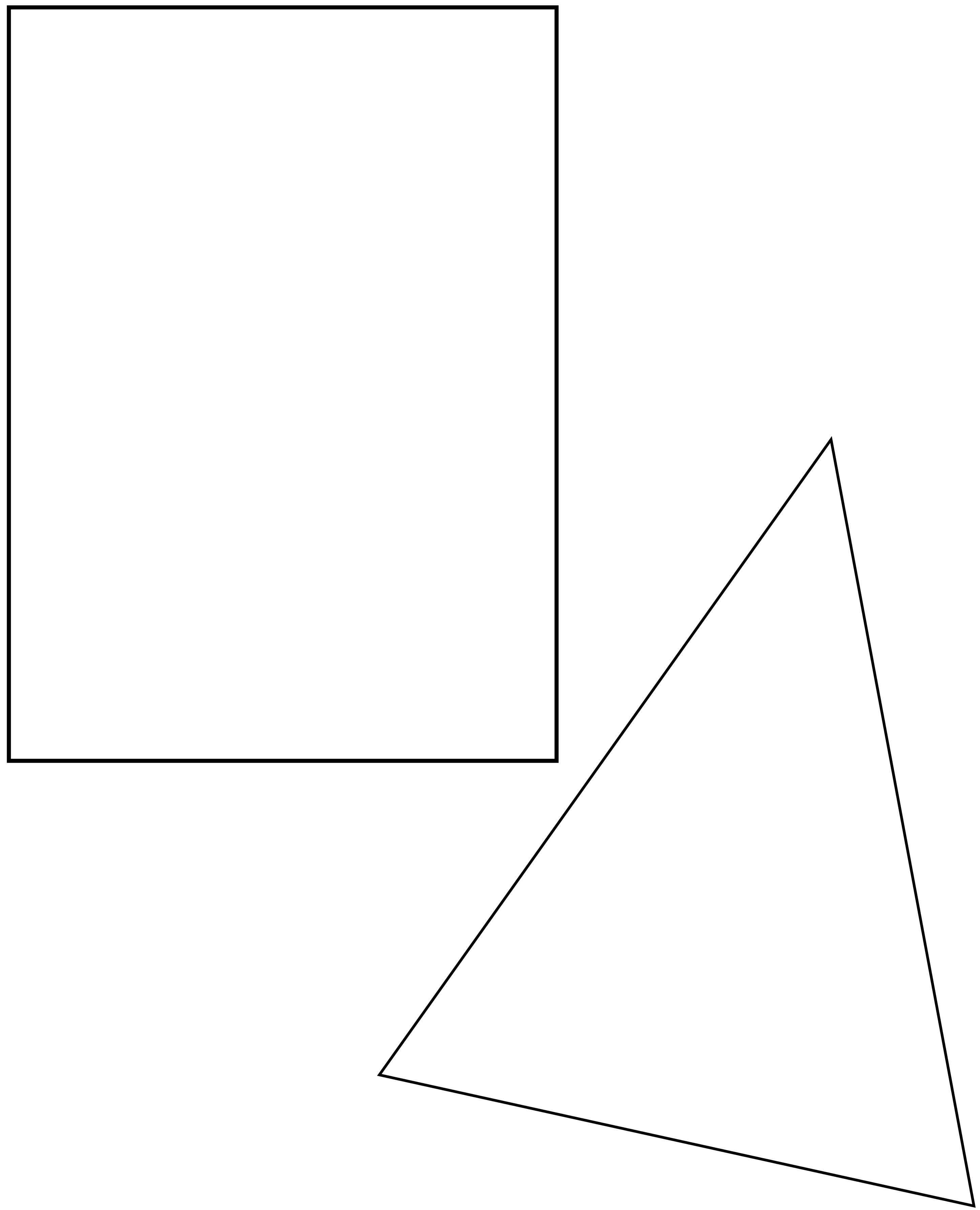


Find the **angle bisector** in each case below



Shown below are a rectangle and isosceles triangle. These are outlines of material to design and make paper aeroplanes. Using your drawing equipment, draw in the fold lines needed to make the aeroplanes.

Shade or colour the aeroplanes. Cut out the designs and test your aeroplanes!



*Students studying Mathematics will encounter these constructions in their lessons and it is suggested that this crossover be discussed with members of your school's mathematics department

Shown in **figure 1** below is a logo for a cricket club. Also shown is an incomplete drawing of the logo, **figure 2**. Find the centre of the missing stump in **figure 2** by finding the midpoint of the line ab. All construction must be clearly shown

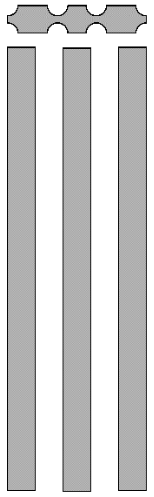


Figure 1

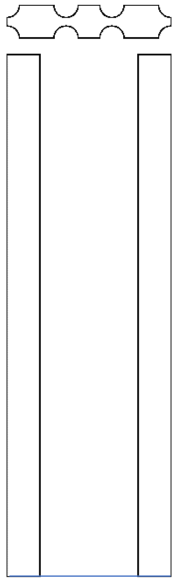
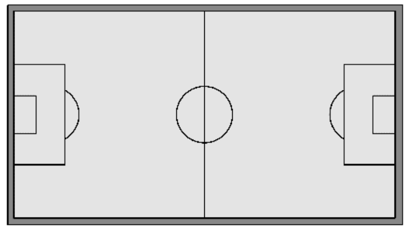
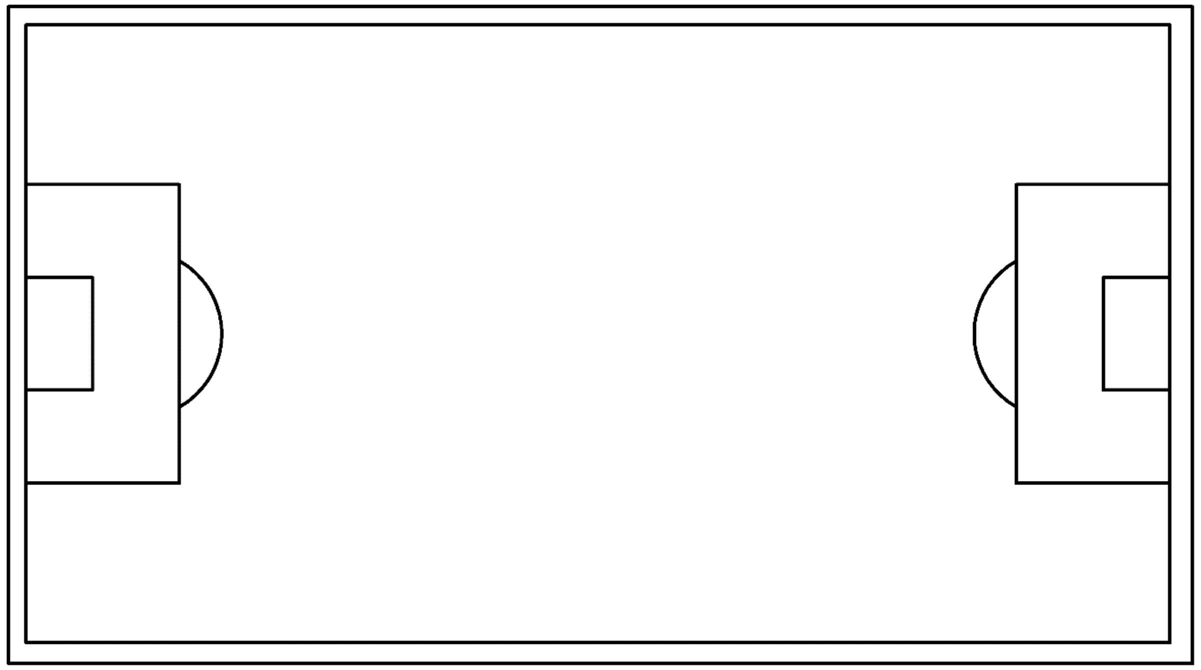
a  b

Figure 2

The outline plan for lining a soccer pitch is shown below. An incomplete drawing of the pitch is also shown. Draw in the missing midfield line and centre circle. All construction must be clearly shown.





The design for a sail on a yacht is shown below in **figure 1**. It is based on a triangle and a circle. The circle is known as an '**incircle**'. Complete the drawing in **figure 2**.
All constructions must be clearly shown.*

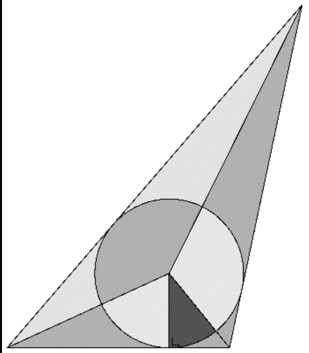


Figure 1

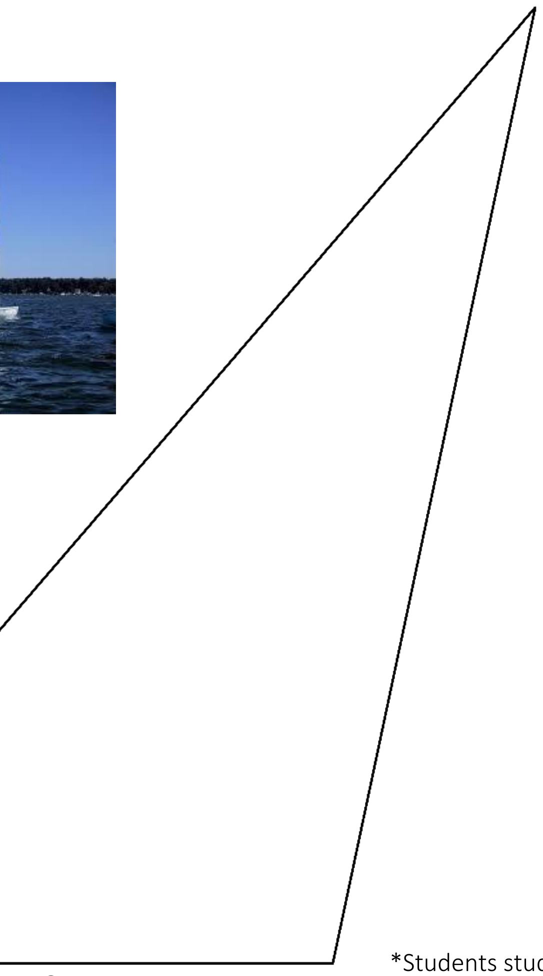
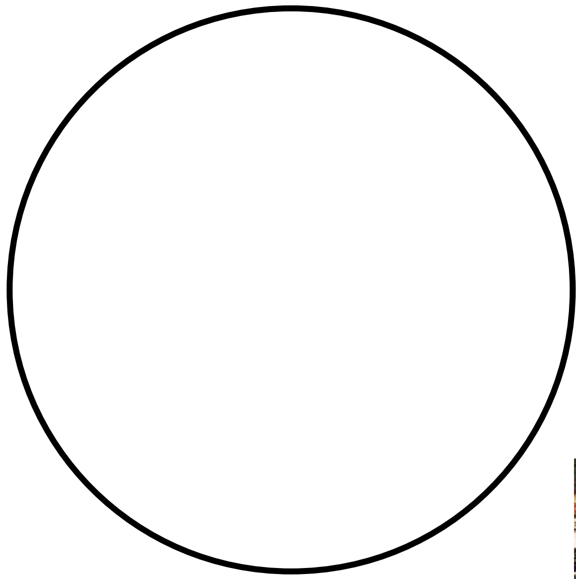


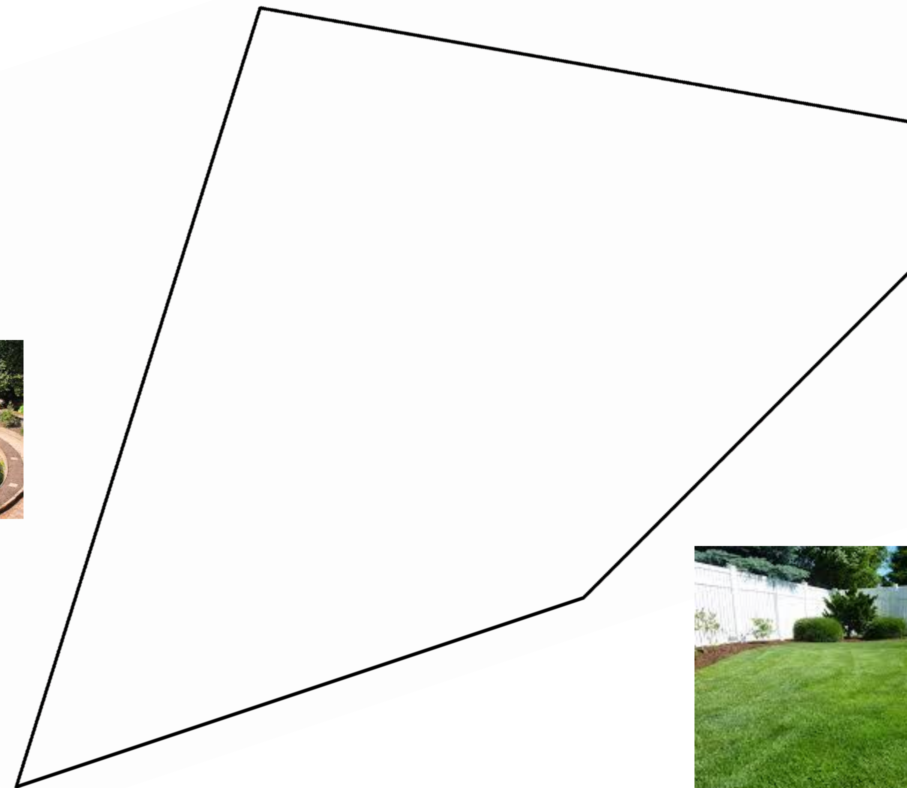
Figure 2



The outline plan of a circular garden pond is shown above. It is proposed to put a fountain in the centre of the pond. Find the centre of the pond. All construction must be clearly shown.*

The outline plan of a garden is shown below. It is proposed to lay a footpath from corner A to corner B. The footpath must be equidistant from the edges of the garden. Draw in the centreline of this footpath. All construction must be clearly shown.

b



a

*Students studying Mathematics will encounter these constructions in their lessons and it is suggested that this crossover be discussed with members of your school's mathematics department

Tangram Challenge

A tangram is a seven-piece puzzle which originated in China. It is basically a jigsaw that is made up of geometric shapes that can be cut from a single square as shown in figure 1. The shapes are a square, 2 large triangles, 2 small triangles, 1 medium triangle and a rhomboid. The medium-sized triangle and the square and the rhomboid are all twice the area of the small triangles; the area of the large triangles is four times the area of the smaller triangles.

Using the diagram in **figure 1** as a guide, complete the tangram layout in **figure 2**.

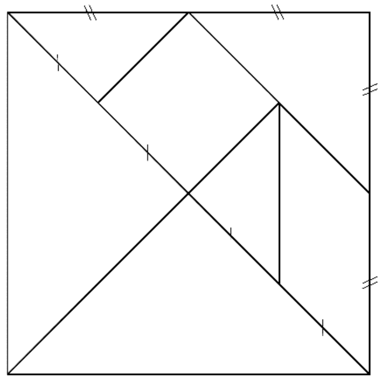


Figure 1

Identify the following:

Diagonal	Bisector
Parallel	Horizontal
Vertical,	90° Angle
45°Angle	Isosceles
Parallelogram	

Figure 2

How many triangles can you see?

On a 140mm piece of square card draw out the Tangram puzzle and carefully cut out the pieces as shown in **figure 3**. Complete the exercises on the next page using the tangram pieces. The first few exercises have the outline of the shapes put in to help you.

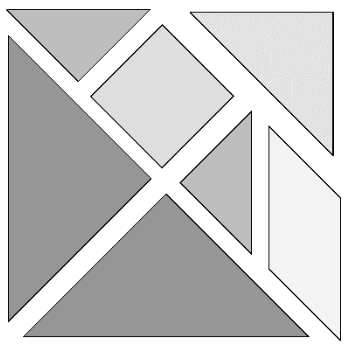
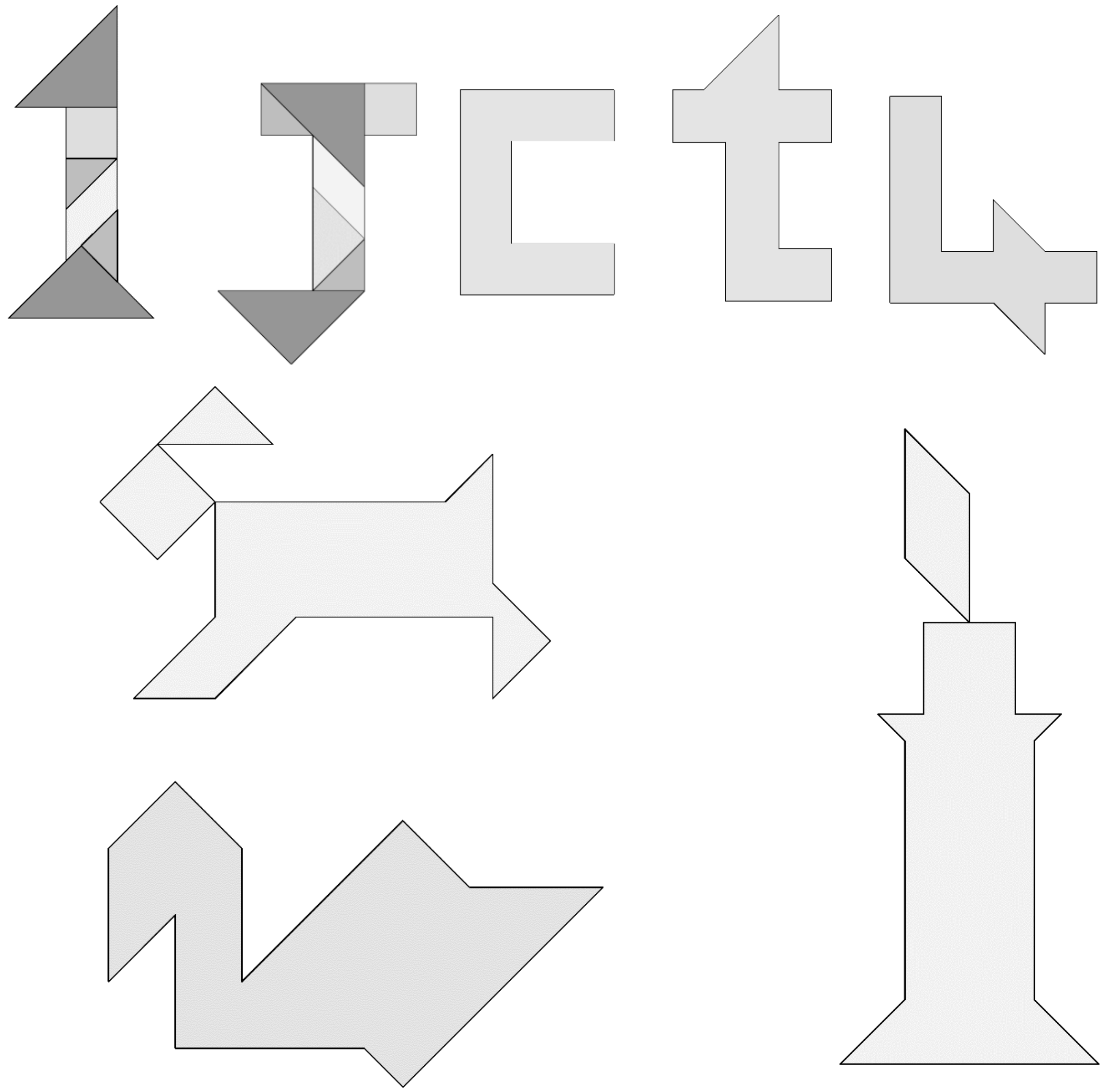


Figure 3

Complete the following exercises using the tangram pieces you have cut out. The first one is completed for you.



Create a list of geometric properties for each of the four shapes below. Can you create each shape using **all** the tangram pieces? Use your list to verify the shapes you have created have the correct geometric properties

Shape	Rectangle	Parallelogram	Isosceles Triangle	Trapezium
Geometric properties of shapes use sketches, symbols or text				

Group	A	B	C	D
Object 1	2VX X51	YVB BYG	WKP PXM	BL5 5YX
Object 2	JYJ JM5	EX6 Q2M	920 EB0	55M LPB
Object 3	R64 DQ5	P4P 1G2	EXR 6XY	0VX PVK
Object 4	NVP YVM	P4P 1W8	MY8 8WM	1YQ Q0B
0 = This represents the number zero and shows up as Ø in the app screen				

Activity 1 – Using your device, merge cube and table of codes;

Sketch the orthographic views of the objects in the colour coded boxes.

Object 1

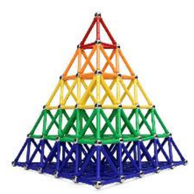
Object 2

Object 3

Object 4

Activity 2 – Sketch a 3D representation of the objects from activity 1.

Activity 3 – As a group construct a 3D model of object 1.



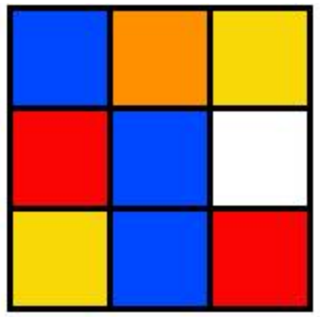
QR code for Padlet

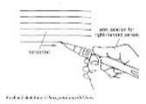
Overview Links Activity

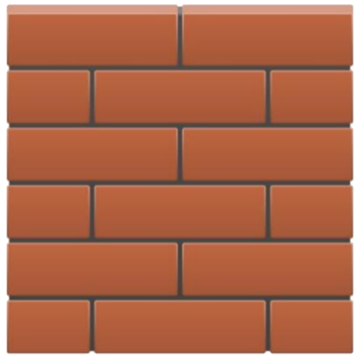
In **table 1** below, outline examples from today's workshop where you feel you may have engaged with or seen relevant examples of learning for the Statements of Learning (SOL) shown below. With the key skills for junior cycle, highlight any elements within each skill that you feel you engaged with through the course of the day.

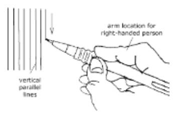
TABLE 1: LINKS BETWEEN JUNIOR CYCLE GRAPHICS AND THE STATEMENTS OF LEARNING

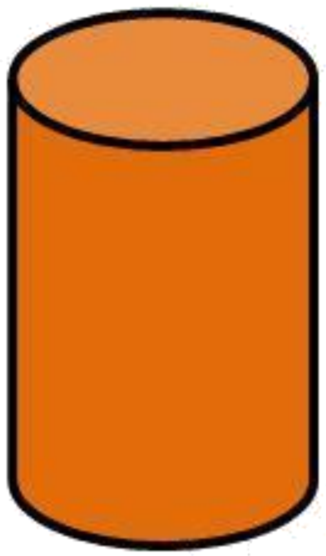
The statement	Examples of relevant learning
SOL 15: Recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning	
SOL 19: Values the role and contribution of science and technology to society, and their personal, social and global importance	
SOL 20: Uses appropriate technologies in meeting a design challenge	
SOL 21: Applies practical skills as she/ he develops models and products using a variety of materials and technologies	
SOL 23: Brings an idea from conception to Realisation	
SOL 24: Uses technology and digital media tools to learn, work and think collaboratively and creatively in a responsible and ethical manner	



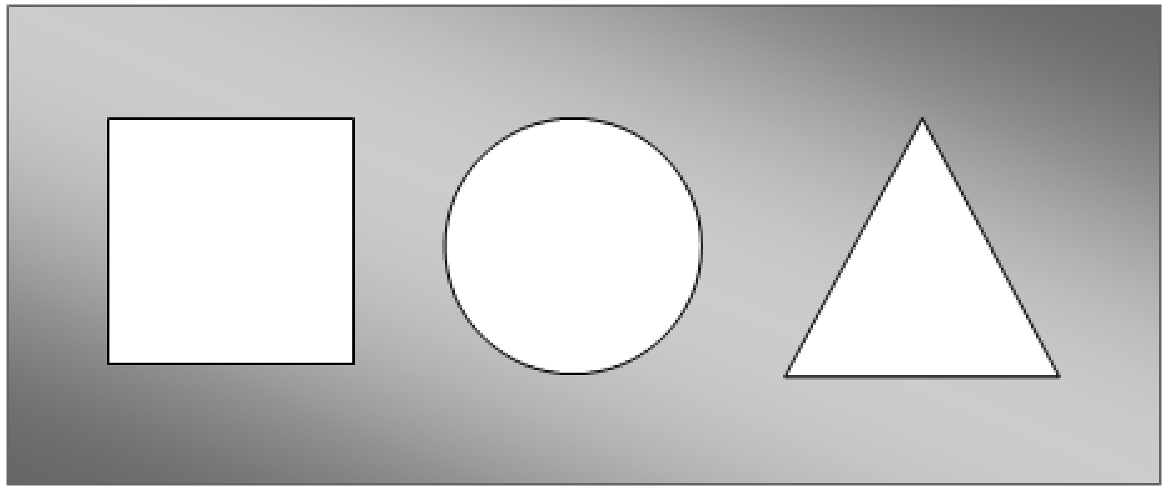




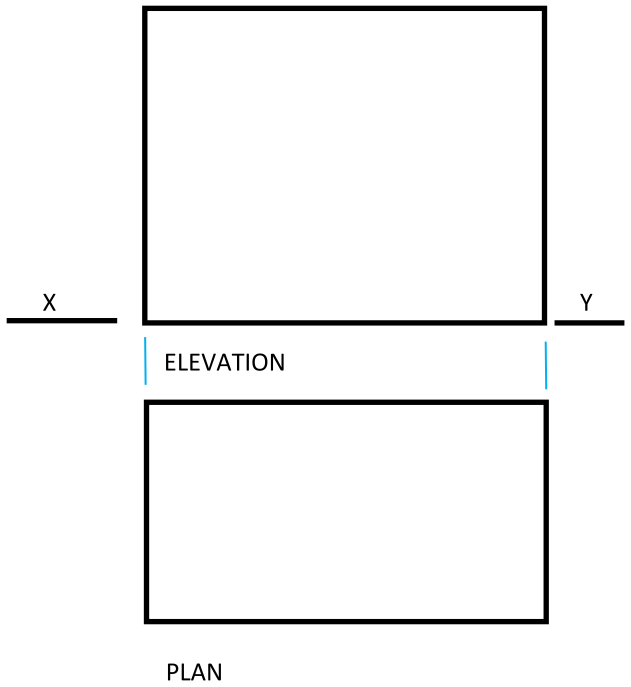




Sketch a single 3D object that fits tightly through all 3 slots.



Sketch in 3D, objects that would have the elevation and plan shown



Consider the age, stage and prior learning of the students.

What learning do we want to focus on?

Explore both the strands and elements when choosing learning outcomes.

Identify the learning outcomes for your unit of learning.

Identify the key learning for students using action verbs to support your thinking.

Consider how we will assess and report evidence of learning

Develop ideas for how students could experience this learning.

How will I know they are learning?

Using your own classroom context, what methodologies and resources will support students in experiencing the learning outcomes.

Ensure assessment aligns with the learning outcomes and their action verbs

AGE and STAGE

* First unit of learning in Graphics
* Early September

PRIOR LEARNING

- Awareness of shapes
- Horizontal, Vertical etc.
- Primary school Maths 2D shapes + 3D objects
- Arts and Crafts

FOCUS OF LEARNING

* Regular shapes in their World
* Freehand sketching, Pencil Control
* Colour and Rendering

Possible LEARNING OUTCOMES

STRAND 1	STRAND 2	STRAND 3
1.2, 1.4	2.5	3.7, 3.1
1.12 1.9	2.12	3.4, 3.2
1.5 1.10	2.11	3.9, 3.5, 3.12

LEARNING OUTOMES FOR THIS UNIT + KEY LEARNING

1.2 Analyse – graphical information

1.10 Understand – properties of geometric shapes

2.5 Develop – Using Freehand sketching

3.1 Recognise – 2D + 3D shapes + objects

3.7 Use – CAD

3.9 Apply – render to enhance

ACTION VERB ⇒ KEY LEARNING

- Recognition of geometric shapes, everyday and Natural World
- Converting polygons to prisms 3D → 2D
- Identify symmetry and shape
- Communicate using:
  - Freehand sketching
  - CAD USE

ASSESSMENT

* Tracing of polygons / shapes on worksheet
* Use of CAD
* "Headbanz" assessment of sketching to communicate

POSSIBLE LEARNING EXPERIENCES

- Pencil Walk 2.5
- Graph paper sketching 2.5
- CAD Modelling 1.2 3.7
- "Headbanz" activity / game 3.9 2.5
- Shape "orienteering" 1.2
- Tracing of shapes 3.1
- Video on sketching 2.5
- Setsquare drawing 1.10
- Shapes Poster 3.1

KNOWING THEY ARE LEARNING

- Teacher observation
- "Headbanz" game
- CAD MODELS
- Worksheet completion.

LEARNING EXPERIENCES

2.5 – Pencil Walk – Video on sketching

1.2 + 1.10 Tracings and board drawing on grid paper

1.10 3.1 Shapes poster for homework 2D

2.5 + 3.9 "Headbanz" activity and worksheets

3.7 CAD modelling

ASSESSMENT

* "Headbanz" game score
* CAD models
* Observation of worksheets with feedback

REFLECTION

* Students build on Arts/Crafts prior learning 2D + 3D from primary maths.
* "Headbanz" game will need good classroom organisation

Consider the age, stage and prior learning of the students.

What learning do we want to focus on?

Explore both the strands and elements when choosing learning outcomes.

AGE / STAGE

SEPTEMBER 1ST YEAR

PRIOR KNOWLEDGE / LEARNING

- BASIC EQUIPMENT SKILLS
- COMMON 2D GEOMETRIC SHAPES - POLYGONS, CIRCLES, TRIANGLES

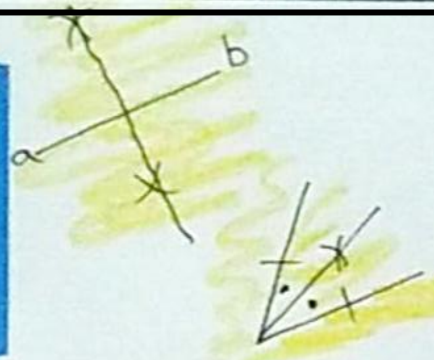
LEARNING TO FOCUS ON

* BASIC GEOMETRIC CONSTRUCTIONS
  - FUNDAMENTAL CONCEPTS & PRINCIPLES
* SPATIAL REASONING / ABILITY
  - MANIPULATION OF BASIC 2D SHAPES TO PROBLEM SOLVE

Identify the learning outcomes for your unit of learning.

Identify the key learning for students using action verbs to support your thinking.

Consider how we will assess and report evidence of learning



LEARNING OUTCOMES & KEY LEARNING

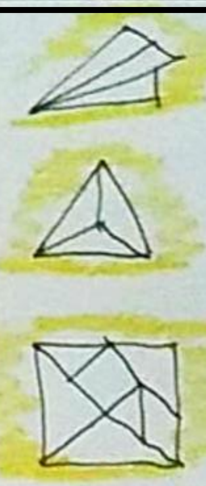
* 1·3 3·10 DERIVE, INVESTIGATE, APPLY
  - WORKING FROM 3D TO 2D TO DERIVE SOLUTIONS TO GEOMETRIC PROBLEMS
* 1·12 1·6 CONSTRUCT, APPLY
  - DEMONSTRATE AN UNDERSTANDING OF PRINCIPLES EXPLORED ABOVE BY CONSTRUCTING SOLUTIONS IN ACCORDANCE WITH GRAPHICAL CONVENTIONS - CONSOLIDATE BOARD SKILLS
* 3·3 1·1 DEMONSTRATE, VISUALISE
  - DEMONSTRATE SPATIAL UNDERSTANDING THROUGH MANIPULATION OF REGULAR 2D SHAPES
* 1·10 UNDERSTAND
  DEMONSTRATE AN UNDERSTANDING OF GEOMETRIC PROPERTIES OF COMMON 2D SHAPES

ASSESSMENT

- CREATION OF 3D MODELS
- COMPLETE 2D SOLUTIONS ON WORKSHEETS

Develop ideas for how students could experience this learning.

How will I know they are learning?



* 1·3 3·10
  - USING 3D EXAMPLES / MODELS TO DERIVE 2D SOLUTIONS
  - PAPER PLANE / PAPER FOLDING TO DERIVE PROOF / REASONING BEHIND PRINCIPLE / CONCEPT OF BISECTING LINES & ANGLES
  - TERMINOLOGY
* 1·12 1·6
  - WORKSHEETS WITH EXAMPLES OF EVERYDAY CONTEXT / SITUATIONS INVOLVING GEOMETRIC PROBLEMS
    ↳ APPLY PRINCIPLES FROM 1·3 & 3·10
* 1·1 3·3 1·10
  - TANGRAM ACTIVITY
  - CONSTRUCTION & PRINCIPLES FROM ABOVE TO CREATE
  - PHYSICAL MODEL CREATED BY STUDENTS FROM CARD
  - WORKSHEET WITH CHALLENGES (DIFFERENTIATION)
  - PROPERTIES OF COMMON 2D SHAPES

Using your own classroom context, what methodologies and resources will support students in experiencing the learning outcomes.

Ensure assessment aligns with the learning outcomes and their action verbs

* 1·3 3·10
  - PAIRWORK ON PAPER PLANE
  - USE OF DRAWING EQUIPMENT TO PROVE CONCEPT / PRINCIPLE
* 1·6 1·12
  - COMPLETE WORKSHEETS
  - ACCURATE REPRESENTATION OF SOLUTIONS
* 1·1 2·3 1·10
  - CREATE TANGRAM
  - MANIPULATION OF SHAPES
  - LIST PROPERTIES OF 2D SHAPES & CREATE MODELS OF SAME USING TANGRAM PIECES

REFLECTION

* STUDENTS APPLY KNOWLEDGE FROM EARLIER UNITS TO LIST PROPERTIES OF SHAPES
* PAIRWORK TO SOLVE PROBLEMS & ANALYSE SOLUTIONS

Consider the age, stage and prior learning of the students.

What learning do we want to focus on?

Explore both the strands and elements when choosing learning outcomes.

Identify the learning outcomes for your unit of learning.

Identify the key learning for students using action verbs to support your thinking.

Consider how we will assess and report evidence of learning

Develop ideas for how students could experience this learning.

How will I know they are learning?

Using your own classroom context, what methodologies and resources will support students in experiencing the learning outcomes.

Ensure assessment aligns with the learning outcomes and their action verbs

1.2 1.9
2.2 2.8
3.3 3.5

RESOURCES

- MERGE CUBES
- WOODEN ORTHOGRAPH MODELS
- MAGNETIC MODELLING SET
- PLANES OF REFERENCE MODELS
- PADLET
- MERGE CUBE VIEWER APP
- A3 HANDOUT

AGE AND STAGE

1ST YEAR STUDENTS
TERM 2 JAN/FEB

PRIOR LEARNING

- SKETCHING USING GRID PAPER [SQUARE + ISOMETRIC]
- MODELLING WITH CARD AND MAGNETS
- BASICS OF SHAPES 2D+3D
- WORK COMPLETE ON 3D REPRESENTATIONS – OBLIQUE – ISOMETRIC

FOCUS

3D OBJECTS TO 2D CONVENTIONS

SPATIAL REASONING AND VISUALISATION OF OBJECTS

GROUP WORK

EXPLORE

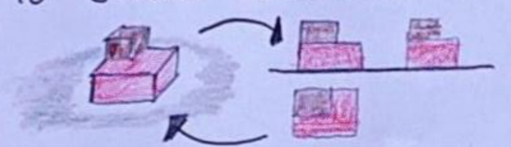
1.2 ~~1.6~~
~~1.4~~ 1.9
2.2 ~~2.7~~
2.8
3.3 3.5

1.2, 1.9
ANALYSE VIRTUAL MODELS FOR THE CREATION OF 2D SOLUTIONS USING ORTHOGRAPHIC PROJECTION

2.2, 2.8
CREATING 3D REPRESENTATIONS THROUGH SKETCHING GIVEN A 2D SOLUTION

2.2, 3.3
DEMONSTRATE SPATIAL REASONING SKILLS BY CREATING A MODEL GIVEN A 2D SOLUTION

3.5
ANALYSE THEIR WORK AND THE WORK OF OTHERS BY COMPARISON TO GIVEN SOLUTIONS



ANALYSE
REPRESENT
CONSTRUCT
ACTION VERBS
DEMONSTRATE
EVALUATE

3.3, 1.9
TEACHER DISCUSSION AND CREATING A MODEL OF THE PLANES OF REFERENCE.

1.2, 1.9
CREATING 2D SKETCHES ON GRAPH PAPER OF THE VIRTUAL MODELS. [ORTHOGRAPHIC VIEWS]

3.3
CONSTRUCT A MODEL GIVEN THE ORTHOGRAPHIC VIEWS

2.2, 2.8
CREATING 3D REPRESENTATIONS GIVEN 2D SOLUTIONS.

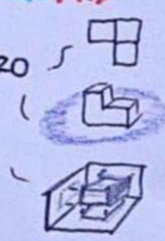
3.5
TEACHER OBSERVATION AND FEEDBACK ON STUDENT DISCUSSIONS, SKETCHES AND INTERACTIONS THROUGHOUT

METHODOLOGIES

- WHOLE CLASS TEACHING
- TEACHER DEMO
- CREATING SKETCHES
- SELF + PEER ASSESSMENT
- MODEL MAKING
- DISCOVERY LEARNING
- USING PHYSICAL AIDS
- AUGMENTED REALITY
- GROUP WORK
- PAIR WORK
- USING DEVICES
- PADLET QR SCANNER

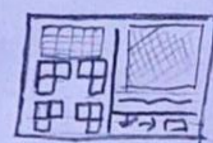
1.2 1.8

1. 3.3, 1.9 INTRO



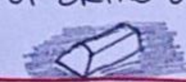
2. 1.2 INTRO TO AUGMENTED REALITY

3. GROUP WORK SKETCH ORTHOGRAPHIC VIEWS USING MERGE CUBE TAKE 1 SET OF COPIES



4. 3.5 CORRECT IN GROUPS AND EVALUATE USING SOLUTIONS

5. 2.8, 2.2 SWAP PAGES BETWEEN GROUPS AND CREATE 3D REPRESENTATIONS OF ORTHO VIEWS



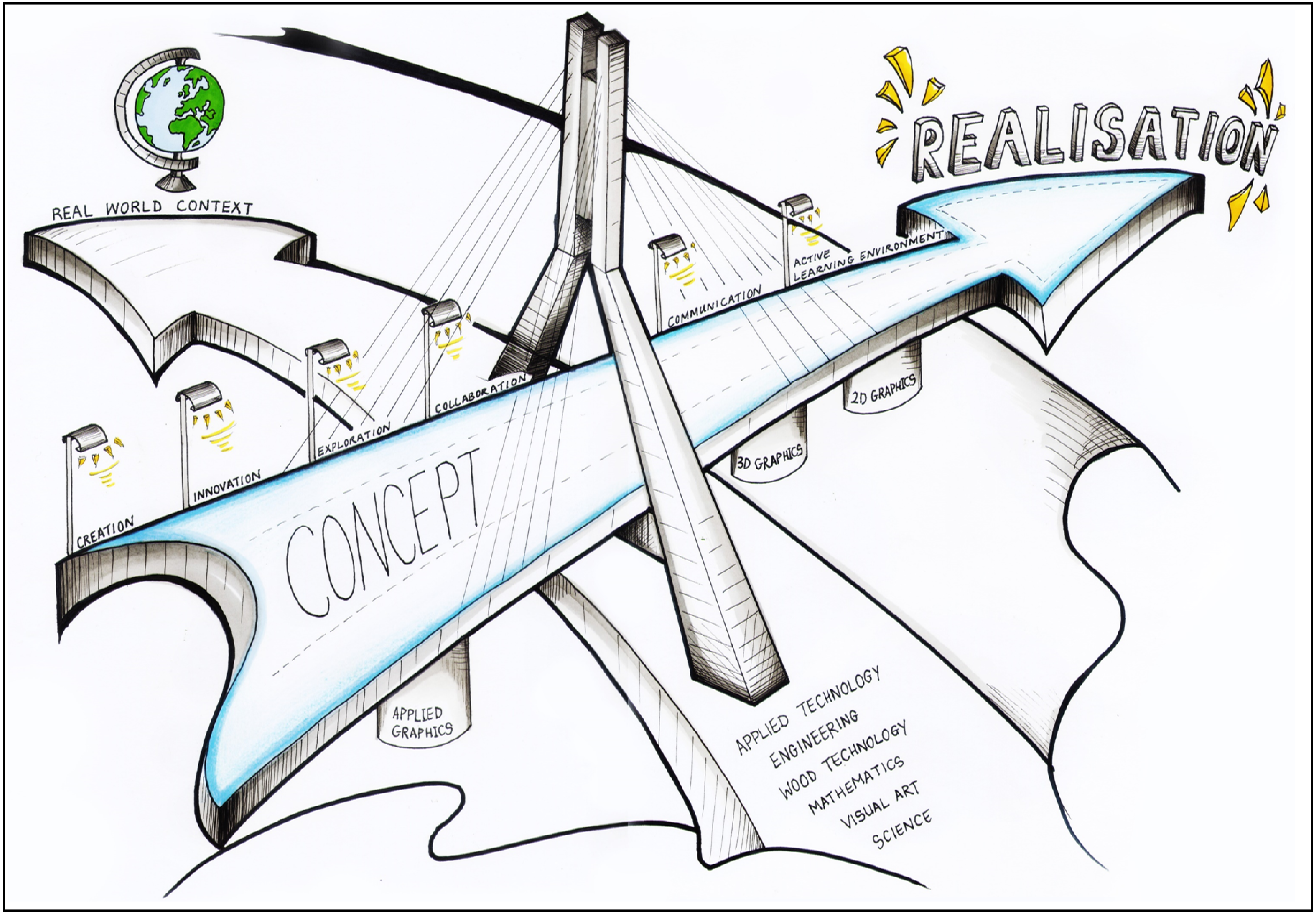
6. 2.2 3.3 CREATE MODELS OF ORTHOGRAPHIC VIEWS.

REFLECTION

- STUDENTS WILL BE USING SHADING, SKETCHING IN GRID PAPER AND 3D REPRESENTATIONS [PICTORIAL] FROM PREVIOUS UNITS.
- CHANGE "INTRO TO AR" TO DISCOVERY LEARNING WHEN DOING AGAIN. [EBI - EVEN BETTER IF]
- [WWW - WHAT WORKED WELL]
  GROUP WORK IN ANALYSING AND CORRECTING 2D SOLUTIONS.

An tSraith Shóisearach do Mhúinteoirí
Junior CYCLE for teachers

JUNIOR CYCLE FOR TEACHERS JCT An tSraith Shóisearach do Mhúinteoirí


REALISATION
REAL WORLD CONTEXT
CREATION
INNOVATION
EXPLORATION
COLLABORATION
COMMUNICATION
ACTIVE LEARNING ENVIRONMENT
CONCEPT
2D GRAPHICS
3D GRAPHICS
APPLIED GRAPHICS
APPLIED TECHNOLOGY
ENGINEERING
WOOD TECHNOLOGY
MATHEMATICS
VISUAL ART
SCIENCE

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Notes:

Back to school...next steps

What I must do...

What I could do...

What new strategies could I use in my classroom...

An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

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