1MEM STUDENT ASSESSMENT TASKS

CREATIVE CIRCLES 2

designing with 3D shapes

ASSESSMENT CRITERIA

CONCEPTS & TECHNIQUES

E	D	C	B	A
CT1 Limited knowledge or understanding of mathematical information or concepts.	CT1 Basic knowledge and some understanding of simple mathematical information and concepts in some familiar contexts.	CT1 Knowledge and understanding of simple mathematical information and concepts in familiar contexts.	CT1 Knowledge and understanding of mathematical information and concepts in familiar and some unfamiliar contexts.	CT1 Knowledge and understanding of mathematical information and concepts in familiar and unfamiliar contexts.
CT2 Attempted application of basic mathematical skills or techniques, with limited accuracy in solving routine problems.	CT2 Application of basic mathematical skills and techniques to find partial solutions to routine problems in some contexts.	CT2 Application of some mathematical skills and techniques to find solutions to routine problems in familiar contexts.	CT2 Effective application of mathematical skills and techniques to find mostly accurate solutions to routine and some complex problems in a variety of contexts.	CT2 Highly effective application of mathematical skills and techniques to find efficient and accurate solutions to routine and complex problems in a variety of contexts.
CT3 Some gathering and attempted representation of simple data in a familiar context.	CT3 Some gathering, representation, and basic interpretation of simple data in familiar contexts.	CT3 Gathering, representation, and interpretation of data in familiar contexts.	CT3 Gathering, representation, and interpretation of data in familiar and some unfamiliar contexts.	CT3 Gathering, representation, and interpretation of a range of data in familiar and unfamiliar contexts.
CT4 Attempted use of electronic technology to find a solution to a routine problem.	CT4 Some appropriate use of electronic technology to find solutions to routine problems.	CT4 Generally appropriate and some effective use of electronic technology to find solutions to routine problems.	CT4 Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems.	CT4 Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems.

REASONING & COMMUNICATION

RC1 Limited interpretation of mathematical results.	RC1 Some interpretation of mathematical results in some familiar contexts.	RC1 Generally accurate interpretation of mathematical results in familiar contexts.	RC1 Mostly accurate interpretation of mathematical results in familiar and some unfamiliar contexts.	RC1 Accurate interpretation of mathematical results in familiar and unfamiliar contexts.
RC2 Limited awareness of the use of mathematical reasoning in solving a problem.	RC2 Attempted use of mathematical reasoning to consider the appropriateness of solutions to routine problems.	RC2 Appropriate use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine problems.	RC2 Effective use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine and some complex problems.	RC2 Highly effective use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine and complex problems.
RC3 Limited use of mathematical notation, representations, or terminology.	RC3 Some use of familiar mathematical notation, representations, and terminology.	RC3 Generally appropriate use of familiar mathematical notation, representations, and terminology.	RC3 Mostly accurate use of appropriate mathematical notation, representations, and terminology.	RC3 Proficient and accurate use of appropriate mathematical notation, representations, and terminology.
RC4 Attempted communication of an aspect of mathematical information.	RC4 Attempted communication of simple mathematical ideas and information.	RC4 Appropriate communication of mathematical ideas and information.	RC4 Clear and appropriate communication of mathematical ideas and information to develop some logical arguments.	RC4 Clear and effective communication of mathematical ideas and information to develop logical and concise arguments.

TOPIC OVERVIEW

ESSENTIAL MATHEMATICS

SUBJECT: CREATIVE CIRCLES – DESIGNING WITH 3D SHAPES

ASSESSMENT TYPE: 2: FOLIO

DESCRIPTION: This project requires you to plan and produce a folio of work demonstrating your developing knowledge of cylinders, cones and other three dimensional shapes, and how they are used in design contexts. You will progressively develop proficiency in applying mathematical skills and techniques to find solutions to three dimensional shape problems including constructing shape nets.

This assignment has FIVE tasks:

- Task 1: 3D DESIGN ANALYSIS
- Task 2: SPOILT MILK
- Task 3: DESIGN A NUMERAL LANGUAGE
- Task 4: CIRCLES & FRACTIONS
- Task 5: CUTTING THE CHEESE

You will present your work in a folio up to 6 A4 pages in length.
You may select your work from the range of tasks you complete to create your folio.
As you work through the tasks in this assignment, you need to record all of your working to provide clear evidence of the steps you have taken to arrive at a solution.

ASSESSMENT CRITERIA:

CT1	Knowledge and understanding of mathematical information and concepts
CT3	Gathering, representation and interpretation of data
CT4	Use of electronic technology to find solutions
RC2	Use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions
RC4	Communication of mathematical ideas and information

1.

shape in design contexts

3D DESIGN ANALYSIS

Provide students with copies of a range of 3D design-works to select from. For example:

- 'Stamp', designed for Boliacom
- 'Pieces' from Manapan Furniture (Milinginbi)
- 'The Light Frame' by Herr Mandel
- Sustainable Powdered Paint (student project) by Saerona Shin, Academy of Art University

… or similar.

Task. Select two geometric 3D design-works to analyse.
These could be product design, package design, architectural design etc.
For each 3D design, analyse the maths behind the design by completing the following:

1. Identify all regular and irregular shapes used in this design – this could include enclosed shapes, implied shapes, or shapes implied through use of negative space.

2. Identify the faces, edges and vertexes in this design.

3. **Estimate** the interior angles of vertexes of each of key shapes.

4. Work your way through a problem solving process to **calculate** the interior angles of as many of the vertexes of identified shapes in the design as you can. Show all of your working.
   Some process suggestions that *might* help:
   - Find the centre of the faces of the shape
   - Draw a horizontal and vertical line through the centre of the faces
   - Draw a circle around the design
   - Identify any regular shapes
   - Identify any right angles, straight angles or parallel lines

5. Identify how this product has been composed to have a sense of internal harmony.
   This could include:
   - Identifying any structural lines used to balance the design
   - Use of repetition
   - Relationships between the sizes of various shapes

2.

SPOILED MILK

Scenario 1. Dairy product company 'My World' commission you to create the packaging for their milk and cream products. You need to learn the maths required to create the shape nets for these products using a ruler and a protractor.

- Milk is to be packaged in a rectangular cuboid that needs to hold 1 litre
- Cream is to be packaged in either a truncated pyramid or a triangular prism that needs to hold 350ml

Create a shape net for each package using the following process:

1. Determine the proportions of your package design – what will the height, width and depth of the package be? Does the package hold the correct volume?

2. What new knowledge and skills do you need to create your shape net?
   Document your learning process.

3. Draw your two shape nets using a ruler and a protractor. Show all of your working.

4. Recreate your shape net to-scale using the shape tools in Adobe Illustrator or similar.

Scenario 2. Dairy product company 'My World' comission you to create the packaging for their ice cream products - *a range of ice cream flavours sold in cylinder shaped tubs and a range of cone shaped novelty ice creams*. You need to learn the maths required to create the shape nets for these products using a ruler, a compass and a protractor.

- Tubs of ice cream are to be packaged in cylinders
- Novelty ice creams will be packaged in cone shapes

Create a shape net for each package using the following process:

1. Determine the proportions of your package design – what will the height, width and depth of the package be? How will you make your ratios visually appealing?

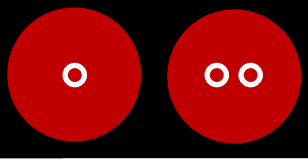
2. What new knowledge and skills do you need to able to create your shape net?
   Document your learning process.

3. Draw your two shape nets using a ruler, a compass and a protractor.
   Show all of your working.

4. Recreate your shape net to-scale using the shape tools in Adobe Illustrator or similar.

4.

DESIGN A NUMERAL LANGUAGE



Task. Create your own shape-based numeral system

1. Decide on a base or radix for your numeral system (how many digits will you work with?).
2. Use the shape tools in Adobe Illustrator or similar, or colour paper and scissors, to create a unique numeral system.
3. Consider: How will you represent zero?
4. Consider: How will you represent negative numbers?
5. Consider: How will you represent fractions?
6. Present your numeral system on an A4 page, with notes or bullet points explaining your system and the reasoning behind the decisions you have made.

4.

thinking in circles

SYMBOLISM OF FRACTIONS

Scenario 1. Dairy product company 'My World' want the design of their fruit ice cream packaging to include a pie graph showing how much of each ingredient they use.

'My World' make their own sweetened condensed milk using the following recipe:

- 12 cups milk
- 6 cups sugar
- 2 cups butter

They make a batch of fruit ice cream using the following recipe:

- 30 cups milk
- 40 cups cream
- 10 cups sweetened condensed milk
- 20 cups fruit

1. Record the quantities of each ingredient (milk, cream, fruit, sugar, butter) into an Excel spreadsheet, or similar.

2. Use Excel to create a pie graph depicting the percentages of each ingredient used. Add a title and data labels.

3. Write the quantities of each ingredient as a fraction out of 100.

4. Re-write the quantities of each ingredient as a fraction in its simplest form.

5. One cup equals 250ml. Fruit ice cream is sold in one litre 1000ml tubs.
   - Calculate how many tubs of ice cream are made in each batch
   - One tub of ice cream is what fraction of the total batch?

Scenario 2. Dairy product company 'My World' make a gourmet fruit icecream, sold in 400ml tubs, using the following recipe:

- 15 cups milk
- 45 cups cream
- 5 cups sweetened condensed milk
- 35 cups fruit

6. Repeat steps 1-5 using the gourmet ice cream recipe. Show all of your working.

5.

CUTTING THE CHEESE

Scenario Dairy product company 'My World' commission you to create the packaging for their cheese products. Their cheeses are all sold in segments cut from a cylindrical block. You need to learn the maths required to create the shape nets for these products using a ruler and a compass.

The cylindrical cheese blocks are all 12cm deep

- The diameter of a Cheddar cheese block is 30cm. This block is divided into quarters.
- The diameter of a Swiss cheese block is 25cm. This block is divided into sixths.
- The diameter of a Parmesan cheese block is 20cm. This block is divided into eighths.

Create a shape net for each package using the following process:

1. Determine the size of the cheese segment for each type of cheese – follow a process, using a ruler and a compass, to divide a circle into equal parts.
   Show your working.

2. Use your measurements from task 1 to calculate the proportions for each of your wedge shaped package designs – these will each need to be slightly bigger than the wedge of cheese they will be housing.
   Show your working.

3. Draw your three shape nets. Show all of your working.

4. Recreate your shape net to-scale using the shape tools in Adobe Illustrator or similar.