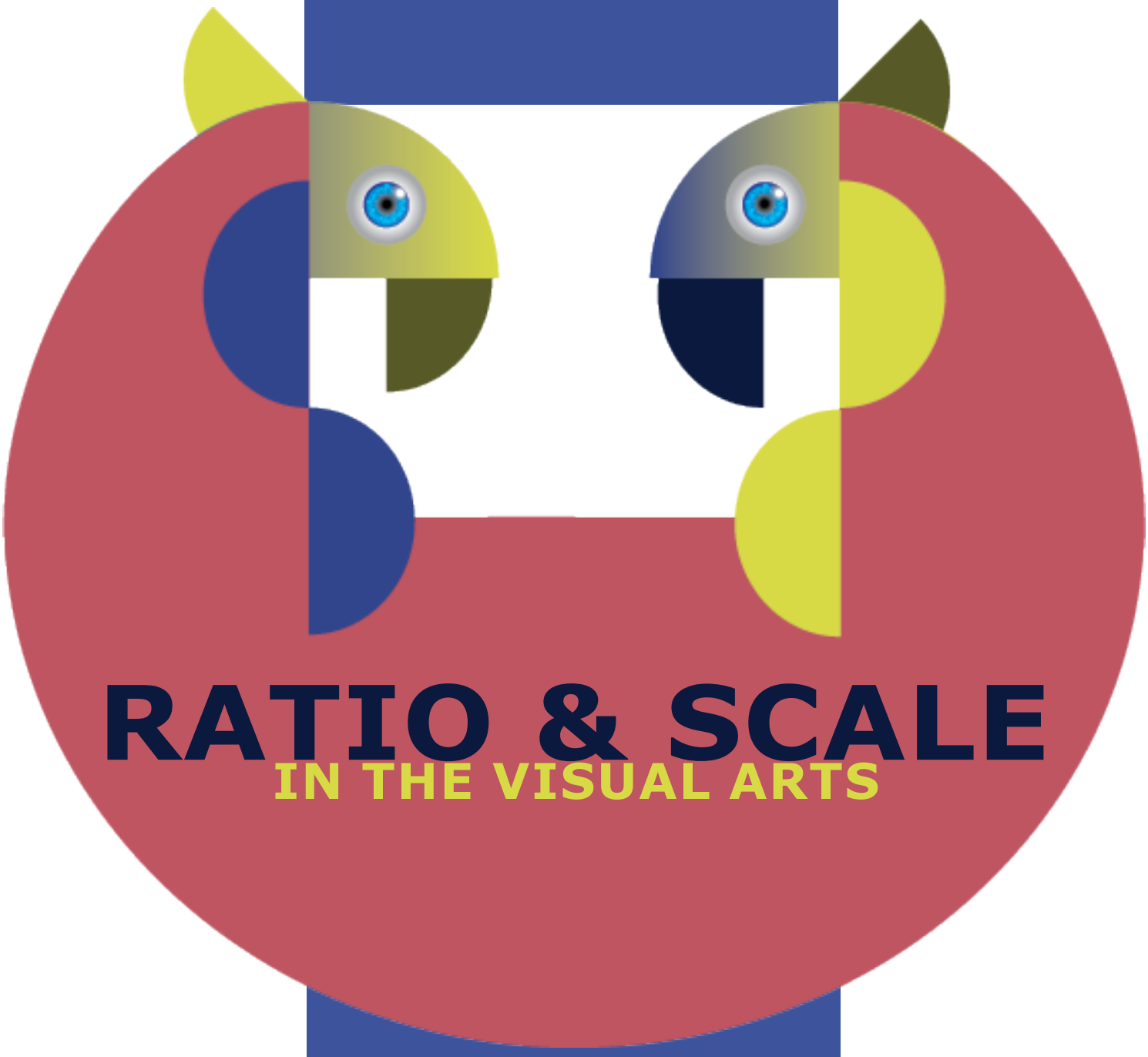
STAGE 1 ESSENTIAL MATHS

STUDENT ASSESSMENT TASKS



RATIO & SCALE

IN THE VISUAL ARTS

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

SUBJECT: ESSENTIAL MATHEMATICS

ASSESSMENT TYPE: 1: SKILLS & APPLICATIONS

DESCRIPTION: Through this project you will develop your understanding or ratio and scale and ways ratio and scale are used in art and photography. You will progressively develop proficiency in applying mathematical skills and techniques to find solutions to a range of ratio and scale problems.

This assignment has three sections, each divided into two subsections:

- Section 1: RATIOS
- Section 2: RATIOS & PHOTOGRAPHY
- Section 3: SCALE
- Section 4: CREATIVE USE OF SCALE IN THE VISUAL ARTS

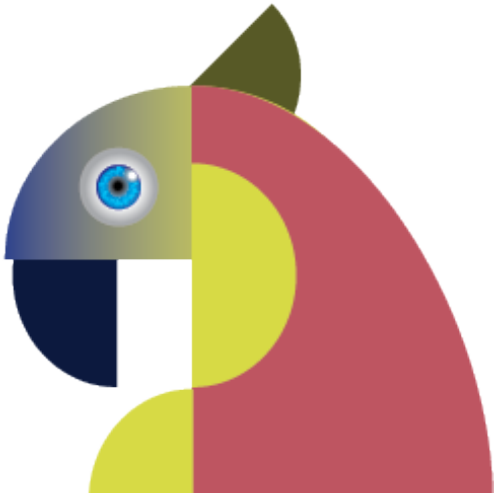
As you work through problems you need to provide clear evidence of all calculations.

ASSESSMENT CRITERIA:

CT1	Knowledge and understanding of mathematical information and concepts.
CT2	Application of mathematical skills and techniques to find solutions to practical problems in context.
RC1	Interpretation of mathematical results.
RC2	Use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions.

WEIGHTING: 25%

DUE DATE:



LESSON NOTES: WHAT IS A RATIO?

WHAT IS A RATIO?

A ratio tells us how many of one thing there is compared with how many of another thing there is.

When recording a ratio, we place a colon (**:**) between each number.

- *For example, if there are 30 boys at your school and 60 girls the ratio of boys to girls would be recorded as 30:60.*

30:60

EXPRESSING A RATIO IN ITS' SIMPLEST FORM

This means using the smallest whole numbers we can to describe the ratio.

- *For example, our ratio of boys to girls was 30:60.*
- *This can be divided by 10 to create a ratio of 3:6.*
- *Which can divide by 3 to make the simplest form of the ratio - 1:2.*
- *In other words, for every boy at the school there are 2 girls at the school.*

30:60

30÷10=3, 60÷10=6
= 3:6

3÷3=1, 6÷3=2
= 1:2

The symbol **=** means 'equals'
The symbol **≈** means 'is more-or- less equal to'

If numbers don't reduce exactly, sometimes it is OK to generalise so that we can make the ratio simpler.

- *For example, say there were 33 boys at a school and 61 girls.*
- *We can't make this ratio any simpler and still have two whole numbers.*
- *But we can generalise that 33:61 is more or less equal to 30:60, or 1:2*
- *It is still fairly accurate to say that for every boy at the school there are two girls.*

33:61
≈30:60
≈1:2

WHAT'S THE DIFFERENCE BETWEEN FRACTIONS AND RATIOS?

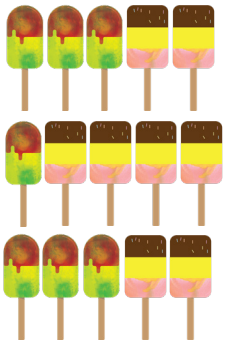
A fraction can only represent parts of the same thing.

Ratios can represent a relationship between two completely different things.

- *For example, if the school provides every student with 3 pens, we can say that students are provided with pens at a ratio of 3:1.*
- *We can't describe this as a fraction because pens and students are distinct things.*
- *You can't divide students into pens and say that 3 pens equals one student.*

SECTION 1: RATIO

1. Akama buys 3 packets of ice blocks. Each packet contains 5 iceblocks in 2 different flavours. Identify the ratios:



In packet 1, what is the ratio of  to  :

In packet 2, what is the ratio of  to  :

In packet 3, what is the ratio of  to  :

Across all 3 packets of ice blocks, what is the ratio of  to  :

2. Ekala is making lemonade.
One measure of lemonade syrup is made using the juice of 3 lemons and 1 tablespoon of sugar.

a. Express the lemonade syrup recipe as a ratio of lemons to tablespoons of sugar.

b. If Ekala has 24 lemons and she want to make them all into syrup, how many tablespoons of sugar will she need?

c. If Ekala only has 3 tablespoons of sugar, how many lemons can she use?

d. If Ekala has 10 lemons and 5 tablespoons of sugar. After she makes the lemonade syrup, how many tablespoons of sugar will she have left over?

3. To make the lemonade syrup into lemonade, Ekala now needs to add 2 cups of water to 1 measure of lemonade syrup.

e. Express the recipe for lemonade as a ratio of water to syrup.

f. Express the recipe for lemonade as a ratio of water to lemons to sugar.

SECTION 1: RATIO

4. Beginning with the ratio in its simplest form, work out the equivalent ratios:

1 : 7	=	: 14	=	: 21	=	4 :	=	5 :	=	: 42
1 : 2	=	: 4	=	3 :	=	4 :	=	5 :	=	6 :
1 : 8	=	: 16	=	: 24	=	4 :	=	: 40	=	6 :
2 : 5	=	: 10	=	: 15	=	8 :	=	: 25	=	: 30
5 : 9	=	10 :	=	15 :	=	20 :	=	25 :	=	: 54
1 : 3	=	: 9	=	4 :	=	: 27	=	5 :	=	: 30

5. Mallana works in a coffee shop and needs to know recipes for a range of different coffees.
Describe each coffee recipe as a ratio and then write the ratio in its simplest form.

COFFEE NAME	RECIPE	DESCRIBED AS A RATIO	IN ITS SIMPLEST FORM
CAPPUCCINO	60*ml* espresso 60*ml* steamed milk 60*ml* foamed milk	: :	: :
DRY CAPPUCCINO	60*ml* espresso 120*ml* foamed milk	:	:
AMERICANO	60*ml* espresso 90*ml* hot water	:	:
CAFÉ CREME	60*ml* espresso 30*ml* cream	:	:
MOCHA	60*ml* espresso 60*ml* chocolate 60*ml* steamed milk	: :	: :
FLAT WHITE	60*ml* espresso 120*ml* steamed milk	:	:
LATÉ	60*ml* espresso 30*ml* steamed milk	:	:
DOUBLE LATÉ	120*ml* espresso 240*ml* steamed milk	:	:

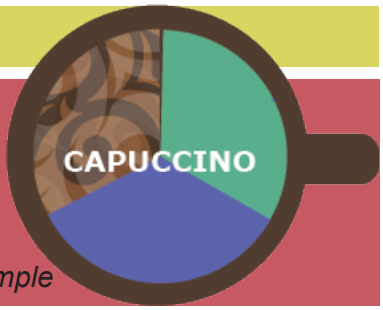
SECTION 1: RATIO

6. **DESIGN TASK**

To help Mallana remember the coffee recipes, create graphics showing the ratios for each coffee recipe.

Option 1: Work by hand using scissors, colour paper and glue.

Option 2: Use the Shape and Pathfinder tools in Illustrator to create the graphics



Example

LESSON NOTES: RATIOS & PHOTOGRAPHY

INTRODUCTION

In this section we will have a look at how ratios are used in cameras and photography.

SHUTTER SPEED AND APERTURE

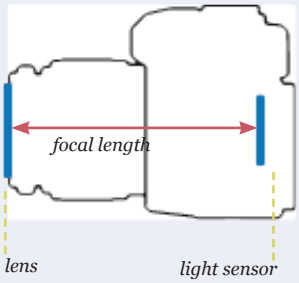
- When you take a photograph, an image is captured by a light sensor.
- The shutter, or aperture opens and closes to allow light to reach the light sensor.
- The amount of time the shutter is open for is called the '**shutter speed**'.
- The shutter can also be opened to a range of different sizes, known as **aperture settings**, or **f-stop settings**.
- The larger the hole, the more light passes through to the light sensor.

WHAT IS AN APERTURE OR F-STOP SETTING?

- The f-stop setting represents a ratio: the relationship between the diameter of the aperture opening and the focal length of a lens.

The 'focal length' of a lens is a measurement of the distance between the lens at the front of your camera and the light sensor at the back.

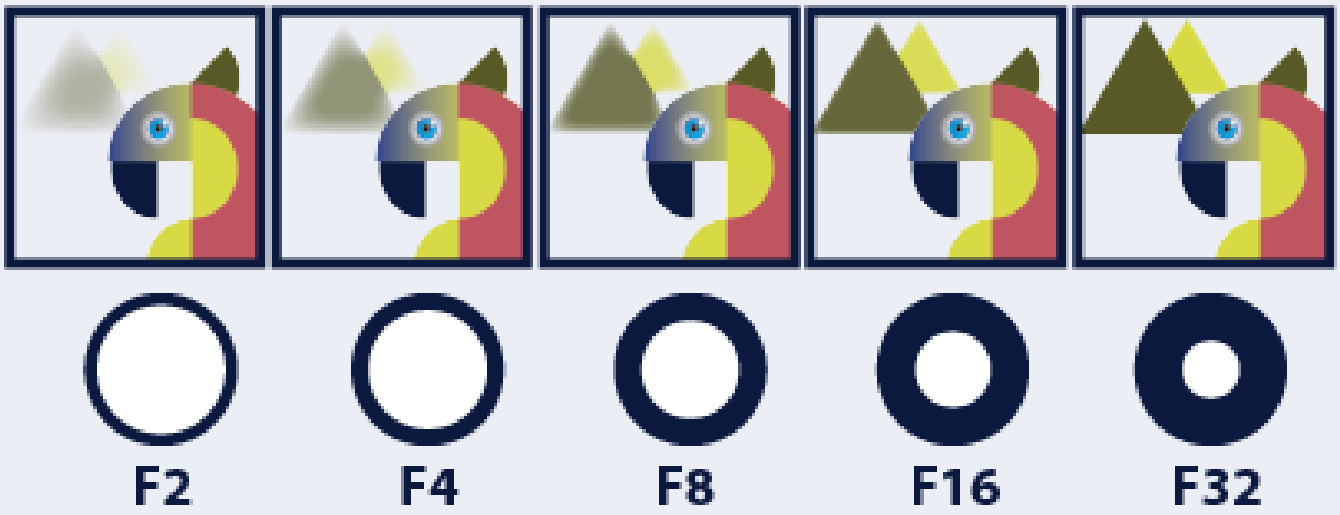
- For example, if you have a 50mm lens on your camera, this means there is a gap of 50mm between the lens and the light sensor.



APERTURE AND DEPTH OF FIELD

When you make a change to your aperture settings (f-stop), this changes the '**depth of field**', - how much of a photograph is 'in focus' (not blurry).

- If the aperture hole is larger, the area in focus will be small.
- If the aperture hole is smaller, the area in focus will be larger.



SECTION 2: RATIOS & PHOTOGRAPHY

7. PRACTICAL EXERCISE

To see how the depth of field changes as you adjust f-stop settings, visit this online demonstration:

- *http://camerasim.com/apps/original-camerasim/web/*

1. Adjust the Aperture /f-stop setting to take photographs at four different Aperture setting.
2. Paste your four photographs on the page below.

f-stop ☐

f-stop ☐

f-stop ☐

f-stop ☐

As the f-stop represents the ratio between the focal length of the lens and the diameter of the aperture opening, we can use the following formula to work out an f-stop setting:

LENS FOCAL LENGTH ÷ DIAMETER OF APERTURE OPENING = F-STOP

or LENS FOCAL LENGTH ÷ F-STOP = DIAMETER OF APERTURE OPENING

or F-STOP X DIAMETER OF APERTURE OPENING = LENS FOCAL LENGTH

As a mathematical formula this is represented as:

$$N = \frac{f}{D}$$

where N = f-stop, f = focal length and D = diameter

8. Use the formulas provided above to complete the table below:

LENS FOCAL LENGTH	APERTURE DIAMETER	F-STOP
18mm	1.64mm	F
35mm	mm	F2
mm	12.5mm	F4
100mm	mm	F8
150mm	17.8mm	F

EXTENSION TASK: GOLDEN RATIO

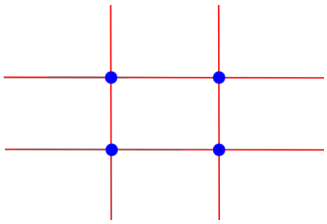
9. Working in pairs, find an answer to the following question: *What is the 'Golden Ratio' ?*
Then conduct a short inquiry into one of the following topics:

- Golden Ratio in nature
- Golden Ratio and the human body
- Fibonacci spirals in nature
- Use of Golden Ratio in art or architecture
- Who was Fibonacci and how did rabbits help him discover the Fibonacci Sequence

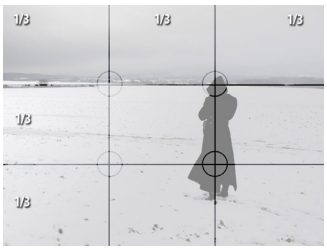
Summarise your learning in a short Power Point presentation with illustrations and up to 150 words.

SECTION 2: RATIOS & PHOTOGRAPHY

THE RULE OF THIRDS



Cameras take rectangular photographs with a ratio of 2:3. This is very close to the proportions of a golden rectangle, 1 : 1.618). By dividing the rectangular camera frame into thirds horizontally and vertically, a grid of nine smaller 2:3 rectangles is created. As the grid breaks the larger photo frame up into thirds horizontally and vertically, using this grid to create photographs is referred to as using the 'rule of thirds'.



The rule of thirds is frequently used by photographers to create strong compositions. Photographers use the rule of thirds grid to incorporate golden ratios into their compositions, often by placing their subject at the intersection points of these horizontal and vertical lines. The viewfinder on most cameras can be set to show a 'Rule of Thirds' grid.

10. Find and record two examples of photographs that have been composed using the 'rule of thirds'.
Make a copy of each photograph and make visual notes to show how the rule of thirds has been used.

11. If you have a camera, take your own photographs that have been composed using the 'rule of thirds'.
Make a copy of your best photograph and stick a copy into the box below.
Make visual notes to show how you have used the rule of thirds.

EXTENSION TASK: DRAW A FIBONACCI SPIRAL

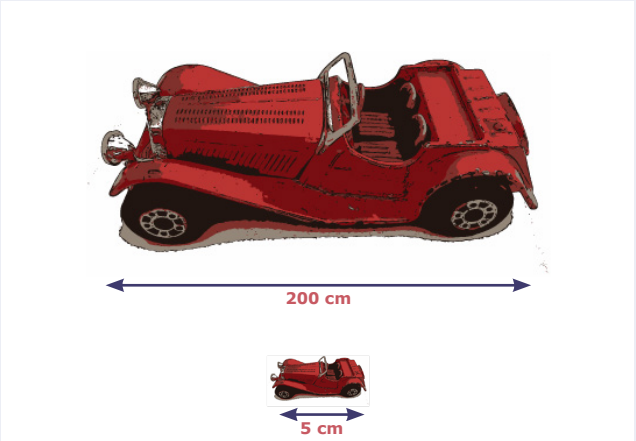
12. Use the internet to find instructions on how to draw a Fibonacci spiral.
Follow the instructions to draw your own Fibonacci spiral.
You could follow this link: https://www.youtube.com/watch?v=qTw_qay54W

LESSON NOTES: WHAT IS SCALE?

WHAT IS SCALE?

Scale describes how much bigger or smaller one thing is when compared with another thing.

A **scale factor** is a ratio comparing the difference in scale between two things.



HOW DO I WORK OUT A SCALE FACTOR?

A scale factor can be worked out by measuring two equivalent parts on the two objects you are comparing.

- *For example, if a toy car is 5 cm in length and the real car is 200 cm the ratio is 5:200*
- *In its simplest form this is 1:40*
- *The scale factor between the toy car and the real car is 40.*
- *This means that the real car is 40 times larger than the toy car.*

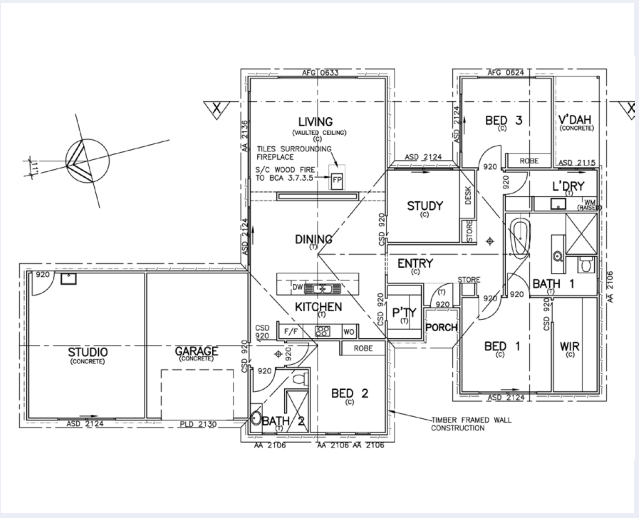
5:200
= 1:40

scale factor = 40

WHAT IS A SCALE DIAGRAM?

A scale diagram is a drawing of an object that has been reduced or enlarged using a consistent scale factor. We can use the scale factor identified in the diagram to work out the measurements of the original object.

- *If a house plan has a ratio of 1:100, a builder needs to multiply measurements by a scale factor of 100.*



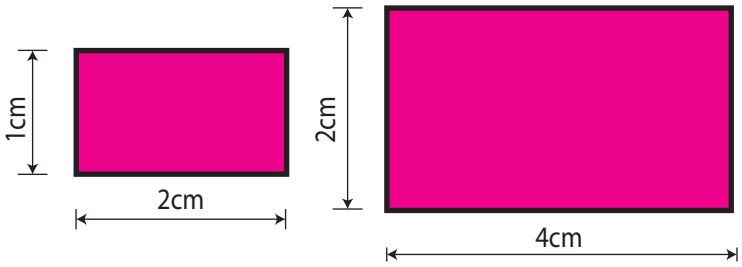
HOW TO CALCULATE USING SCALE MEASUREMENTS

scale measurement x scale factor = size of actual object

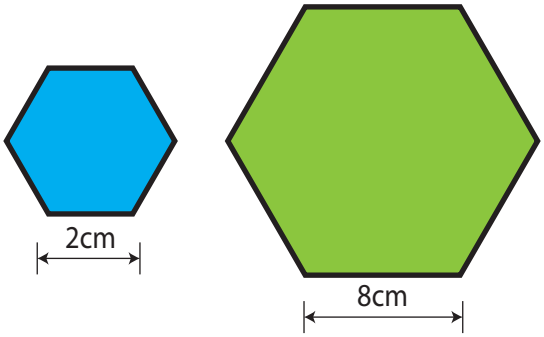
size of actual object ÷ scale factor = scale measurement

SECTION 3: SCALE

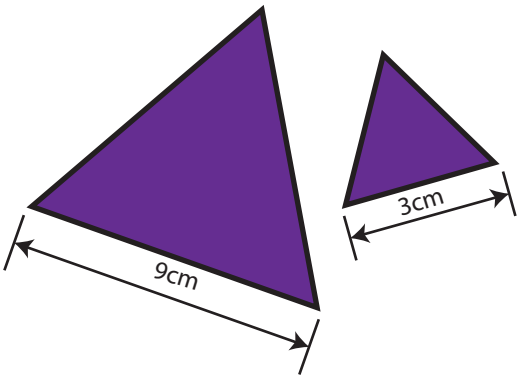
13. Find the scale factor for each of the following: (write your answer as a ratio in it's simplest form)



RATIO	RATIO IN SIMPLEST FORM
:	:

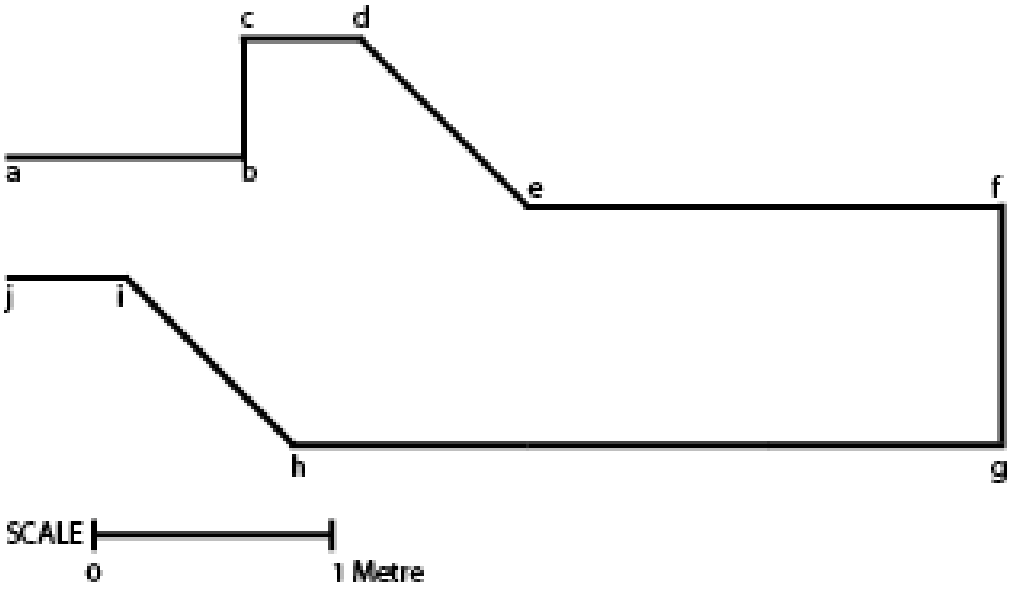


RATIO	RATIO IN SIMPLEST FORM
:	:



RATIO	RATIO IN SIMPLEST FORM
:	:

14. Use the scale provided to work out the actual lengths of the lines in the diagram below:



a - b	metres
b - c	metres
c - d	metres
d - e	metres
e - f	metres
f - g	metres
g - h	metres
h - i	metres
i - j	metres

SECTION 3: SCALE

15. Use grid paper and a ruler to create a scale plan diagram of an existing room plus the furniture in it. Identify your scale factor.

SECTION 4: CREATIVE USE OF SCALE IN THE VISUAL ARTS

Throughout the history of art, scale has been used for a variety of purposes:

- sometimes artists maintain consistent scale relationships in artworks to create a sense of realism or naturalism
- sometimes artists deliberately manipulate scale to create impact, or for emotional or psychological effect
- scale can be used to establish hierarchy, with more important characters depicted larger and less important characters smaller
- scale can be used to create an illusion of spatial depth, with objects progressively reducing in size to create the illusion that they are receding into the distance.

16. Find and record an example of an artwork that does each of the following:

a. an artwork with consistent scale
b a Surrealist artwork that manipulates scale for psychological effect
c. an Ancient Egyptian hieroglyphic that uses scale to establish hierarchy
d. an artwork that uses scale to create the illusion of spatial depth

SECTION 4: CREATIVE USE OF SCALE IN THE VISUAL ARTS

17. Estimate the scale of the objects depicted in this photomontage compared with their correct size.

In the artwork below, the artist has deliberately changed the scale of objects to create an unreal, dreamlike image.

Complete the table below by following these steps:

1. Estimate the actual size of each of the following objects - comb, bottle, boomerang, hot air balloon, airstrip sign

For a scale reference, assume that the bed is 2 metres long

2. Estimate the size of each object as it is depicted in the painting
3. Record the ratio of the original object compared to size of the object as depicted in the painting
4. Express the ratio in its simplest form

OBJECT	ESTIMATED *ACTUAL* SIZE OF OBJECT	ESTIMATED *DEPICTED* SIZE OF OBJECT	RATIO ACTUAL : DEPICTED	RATIO IN ITS SIMPLEST FORM
Comb			:	:
Bottle			:	:
Boomerang			:	:
Hot Air Balloon			:	:
Airstrip Sign			:	:

SECTION 4: CREATIVE USE OF SCALE IN THE VISUAL ARTS

18. Estimate the length and width of this monumental sculpture by Australian artist Ron Mueck.

Showing your working, follow these steps:

- Measure the height of an actual human head (yours or a friends)
- Measure the head-height of the silhouette of the gallery-goer to establish a scale ratio
- Measure the length and width of the sculpture head in the photograph
- Multiply your measurements by the scale factor to estimate the actual length and width of the sculpture
- Express the width to height as a ratio in its' simplest form.

SECTION 4: CREATIVE USE OF SCALE IN THE VISUAL ARTS

19. Make a miniature head using plasticine or clay.
Work out the scale factor of your sculpture compared to an actual head

Showing your working, follow these steps:

- Measure the height of an actual human head (yours or a friends)
- Measure the head-height of your sculpture head
- Divide the height of an actual head by the head-height of your sculpture to find the scale factor