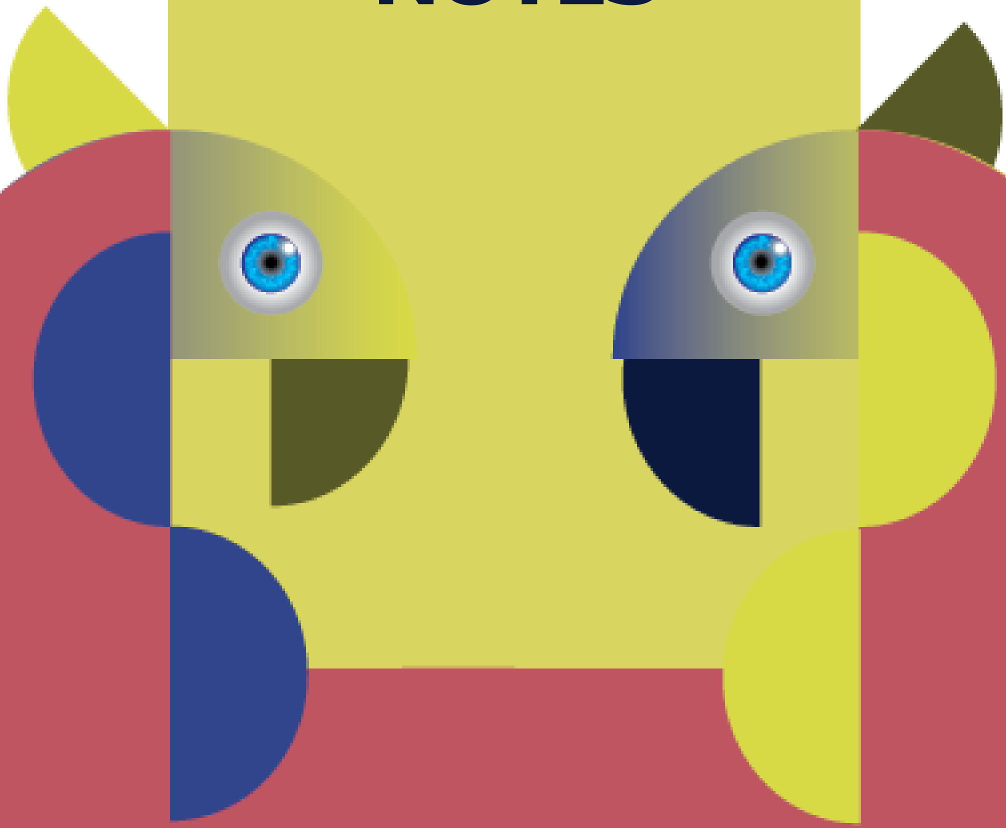
STAGE 1 ESSENTIAL MATHS

TEACHING NOTES



RATIO & SCALE

IN THE VISUAL ARTS

ESSENTIAL MATHEMATICS - OVERVIEW

LEARNING REQUIREMENTS

In this subject, students are expected to:

1. understand mathematical information and concepts
2. apply mathematical skills and techniques to solve practical problems in everyday contexts
3. develop skills in gathering, representing, and interpreting data relevant to everyday contexts
4. interpret results and use mathematical reasoning to draw conclusions and consider the appropriateness of solutions
5. make discerning use of electronic technology
6. communicate mathematically and present mathematical information in a variety of ways.

ASSESMENT TYPE 1: SKILLS & APPLICATION TASKS

Students apply mathematical concepts, processes, and strategies to find solutions to questions related to the subtopics chosen.

Skills and applications tasks should consist of a range of applications that enable students to demonstrate their understanding of mathematical information and concepts, and their skills and techniques in solving practical mathematical problems in everyday contexts.

Skills and applications tasks can be presented in different formats. The assessment conditions under which students undertake the skills and applications tasks may vary and should be guided by the cohort of students that are undertaking the subject. Flexibility in the style of the skills and applications task, and the time allocated to complete the task, should be considered.

Electronic technology may aid and enhance the solution of problems. The use of electronic technology and notes in the skills and applications task assessments is at the discretion of the teacher.

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

- concepts and techniques
- reasoning and communication.

AREA OF STUDY 2: FOLIO

Either individually or in a group, students undertake planning, apply their skills to gather, represent, and interpret data, and propose or develop a solution to a practical mathematical problem based in an everyday or workplace context. The subject of the problem may be derived from one or more subtopics, although it can also relate to a whole topic or across topics.

A mathematical problem may be initiated by the teacher, or by a student or group of students. Teachers should give students clear advice and instructions on setting and solving the mathematical problem, and support students' progress in arriving at a mathematical solution. Where students initiate the mathematical problem, teachers should give detailed guidelines on developing a problem based on a context, theme, or topic, and give clear direction about the appropriateness of each student's choice.

If a mathematical problem is undertaken by a group, students explore the problem and gather data together to develop a model or solution individually. Each student must submit an individual model or solution.

Students demonstrate their knowledge. They are encouraged to use a variety of mathematical and other software (e.g. statistical packages, spreadsheets, CAD, accounting packages) to solve their mathematical problem.

The folio tasks may take a variety of forms.

The format of a folio task may be written or multimodal.

The length of each folio task can vary. Some tasks may be short and others may be longer; however, no task should be more than six A4 pages if written, or the equivalent in multimodal form.

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

- concepts and techniques
- reasoning and communication.

ASSESSMENT

Assessment Type 1: Skills and Application Tasks

Assessment Type 2: Folio

For a 10 credit assessment

students provide evidence of their learning through **4** assessments:

- with at least 2 assessment from Assessment Type 1: Skills and Application Tasks
- and at least 1 assessment from Assessment Type 2: Folio

- Each assessment type should have a weighting of at least 20%.

For a 20 credit assessment

students provide evidence of their learning through **8** assessments:

- with at least 4 assessment from Assessment Type 1: Skills and Application Tasks
- and at least 2 assessment from Assessment Type 2: Folio

- Each assessment type should have a weighting of at least 20%.

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

E	D	C	B	A
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 of 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.

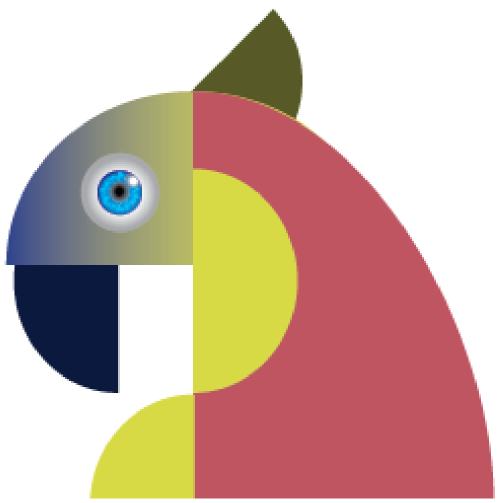
CT2 Application of mathematical skills and techniques to find solutions to practical problems in context.

RC1 Interpretation of mathematical results.

RC2 Use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions.

WEIGHTING: 25%

DUE DATE:



WHAT IS A RATIO?

WHAT IS A RATIO?

A ratio is a mathematical description of a quantitative relationship between two or more numbers. In simple terms, a ratio tells us how many of one thing there is compared with how many of another thing there is (or the quantity of one thing compared with the quantity of another thing).
When recording a ratio, we place a colon (**:**) between each number in the relationship.

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

Once we know a ratio we can simplify it, right down to 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.
Both 30 and 60 can be divided by 10 to create a ratio of 3:6.
But 3:6 can be simplified even further.
We can divide by 3 to make the simplest form of the ratio - 1:2.
30:60, 3:6 and 1:2 all represent the same ratio.
1:2 is the simplest form of the ratio.
This ratio describes the relationship between the number of boys in the school compared with the number of girls in the school - 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

Sometimes it's hard to simplify a ratio because the numbers we are working with are complex. If the 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.
This creates a ratio of 33:61.
We can't divide this ratio and still have two whole numbers.
But we can generalise that 33:61 is more or less equal to 30:60, or 1:2
If there are 33 boys at a school and 61 girls it is still fairly accurate to say that for every boy at the school there are two girls.
The ratio of boys to girls at the school more or less equals 1:2

33:61
≈30:60
≈1:2

WHAT'S THE DIFFERENCE BETWEEN FRACTIONS AND RATIOS?

Sometimes ratios can be represented as fractions. A fraction describe a part of something in relation to the whole, or a part of a group of things in relation to the whole group.

For example, there might be 30 boys in a school with 90 pupils.
We could record this as a fraction and say that 1/3 of the students in the school are boys.
This looks a lot like saying that the ratio of boys to school pupils is 1:3.

- ***So what's the difference?***

Put simply, a fraction can only represent parts of the same thing (in this case pupils in the school)
Ratios are different in that they can represent a relationship between two completely different things.

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

Because ratios describe relationships between distinct things, we don't add or subtract ratios.

SECTION 1: RATIO

1. Akama buys 3 packets of iceblocks. 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 iceblocks, 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:

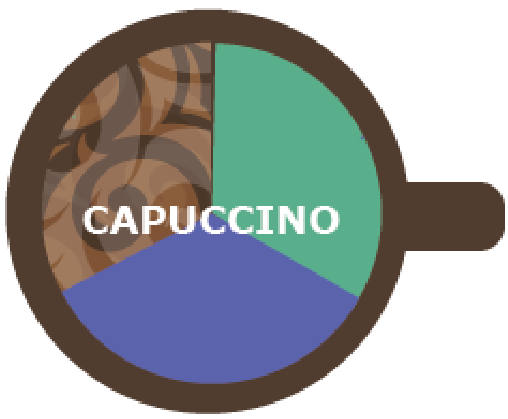
1 : 7	=	: 14	=	: 21	=	4 :	=	5 :	=	: 42
1 : 2	=	: 4	=	3 :	=	4 :	=	5 :	=	6 :
1 : 8	=	: 16	=	: 24	=	4 :	=	: 40	=	6 :
2 : 5	=	: 10	=	: 15	=	8 :	=	: 25	=	: 30
5 : 9	=	10 :	=	15 :	=	20 :	=	25 :	=	: 54
1 : 3	=	: 9	=	4 :	=	: 27	=	5 :	=	: 30

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	:	:

6. **DESIGN EXTENSION TASK**
To help Mallana remember the coffee recipes, create graphics showing the ratios for each coffee recipe.
Option 1: Work by hand
Option 2: Use the Shape and Pathfinder tools in Illustrator to create the graphics

Example



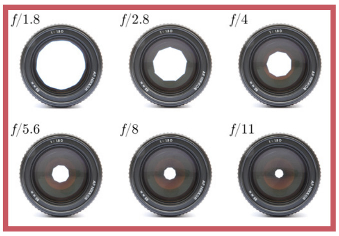
SECTION 2: RATIOS & PHOTOGRAPHY

INTRODUCTION

In this section we will have a look at how maths and ratios are used in cameras and photography. You can take a photography without knowing any of this, but the more you understand how a camera works, the more control you will have over the look of your photographs.

DRAWING WITH LIGHT

- The word photograph essential means 'light drawing', with 'photo' meaning light and 'graphic' meaning drawing). A camera is a mechanical tool that creates an image, or graphic, on a light sensitive surface. To create a photograph, the light entering a camera needs to be controlled. Modern cameras have a digital light sensor at the rear of the camera. This sensor can be adjusted to be more sensitive, or less sensitive, to light using the 'ISO' settings.
- The shutter, or aperture, is a mechanical component in your camera body that opens and closes to create a round hole that allows light to enter the camera and reach the light sensor. The amount of time the hole is open for is called the 'shutter speed'. Usually the shutter is only open for a fraction of a second. The longer the shutter is open, the more light passes through to the light sensor.
- To allow even more control over the light entering the camera, the shutter can opened to a range of different sizes. These are known as aperture settings, or f-stop settings. When the hole is larger, more light passes through to the light sensor. When the hole is smaller, less light passes through to the light sensor.
- Something that might, at first, seem backwards about the numbering of the f-stop setting is that the higher the f-stop number, the smaller the opening in the aperture. This is because the f-stop isn't just a measurement of the diameter of the aperture opening, it represents a ratio; the relationship between the focal length of a lens and the diameter of the aperture opening.

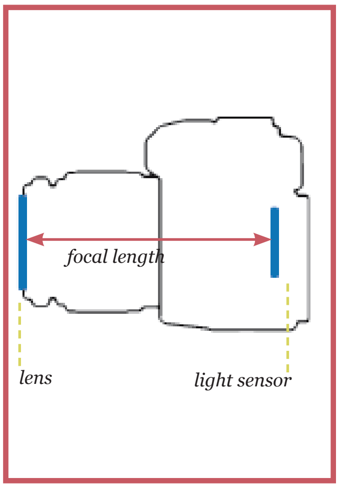


What is 'focal length of a lens'?

- At the front of your camera there is a lens. This is a shaped piece of glass that focuses the light as it enters the camera. 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. If you have an adjustable lens, for example a 35 -100mm lens, you will see the lens move forwards and backwards as you adjust the settings. This is increasing or reducing the gap between the lens and the light sensor.

  If you have a camera on your phone, this will all be in miniature – the lens will be tiny and so will the gap. The lens won't be adjustable, but your cameras software will allow you to zoom in and out.



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 IAMETER 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______

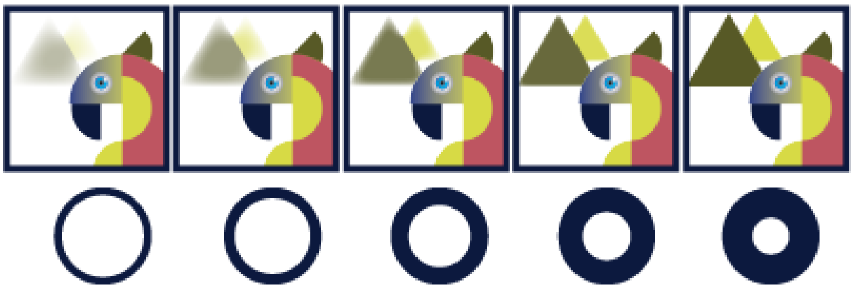
SECTION 2: RATIOS & PHOTOGRAPHY

APERTURE AND DEPTH OF FIELD

When you make a change to your aperture or f-stop setting, this affects something called the 'depth of field', a term used to describe how much of a photograph is 'in focus' (not blurry). There is only ever really one point in space that is perfectly in focus (known as the focal point). Changing the aperture setting changes how much of what is in front of, or behind that focal point is in focus.

As stated earlier, when you change the aperture setting you are changing the diameter of the hole that is letting light into your camera. This has an impact on focus. If the aperture hole is large, the depth of field, or area that is in focus, is small. The area in front of and behind your focal point will become blurry very quickly. Alternatively, if the aperture opening is small, the area in front of and behind your focal point will remain in focus. The photograph is said to have a larger 'depth of field'.

Depth of field is also affected by how close to, or far away you stand from the thing you are photographing (the subject of your photograph).The further you stand from your subject, the greater the depth of field will be. As you get closer to your subject, you will need to use smaller aperture settings to get the same amount of focus.



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.

DID YOU KNOW?

Using the standard settings on most cameras:

- ***each f-stop setting lets in half as much or twice as much light as the setting next to it***
- ***each shutter speed setting lets in half as much or twice as much light as the setting next to it***
- ***each ISO (sensitivity of light sensor)setting lets in half as much or twice as much light as the setting next to it***

Disclaimer: some cameras work in thirds or quarters

This means that, if you need to drop down one f-stop setting in order to get the required depth of field, you can compensate by raising either the ISO or shutter speed setting by one setting. The same amount of light will enter the camera.

Using the information provided above, complete the table below so that the same amount of light enters your camera on each f-stop setting

f-STOP	I.S.O.	SHUTTER SPEED
f/1'4	100	1/1000*th of a second*
f/2	100	1/____*th of a second*
f/2'8	________	1/500*th of a second*
f/4	200	1/____*th of a second*
f/5'6	200	1/____*th of a second*
f/8	________	1/125*th of a second*

SECTION 2: RATIOS & PHOTOGRAPHY

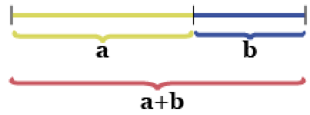
THE GOLDEN RATIO - A SPECIAL RATIO

A special ratio, known as the Golden Ratio (or the divine proportion), occurs repeatedly throughout nature. Golden Ratio is a ratio of 1:1.618. This ratio has strong visual appeal and creates a strong sense of balance and proportion. In the centuries since its discovery, golden ratio has been repeatedly used by artists, architects, designers and, more recently, photographers to create beauty in compositions.

In mathematics the golden ratio is represented by the Greek letter 'phi', which looks like this - Φ(uppercase), or this - φ(lowercase).

1:1.618

φ:1.618

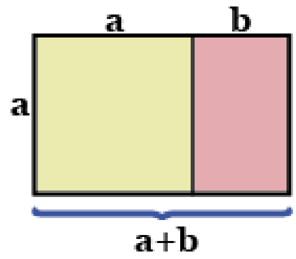


$$\frac{a}{b} = \frac{a+b}{a} = 1.618\ldots = \varphi$$

WHY 1:1.618?

It seems that clever mathematicians have discovered and re-discovered the Golden Ratio many times throughout history. For example, this ratio is used in the making of the ancient pyramids of Egypt.

What mathemeticians discovered, is that this ratio could be used to divide a line into two parts so that the longer part divided by the smaller part is also equal to the whole length divided by the longer part. This creates a ratio that, as we have already stated already exists throughout the natural world. This is why the Golden Proportion is also called the Divine Proportion, as its origin was atributed to God.



THE GOLDEN RECTANGE - A SPECIAL RECTANGLE

When the Golden Ratio is used to create the height and width proportions of a rectange, the rectange created is know as a Golden Rectange. The Golden Rectange is considered to be the most beautifully proportioned rectange.

THE FIBONACCI SEQUENCE AND THE FIBONACCI (OR GOLDEN) SPIRAL

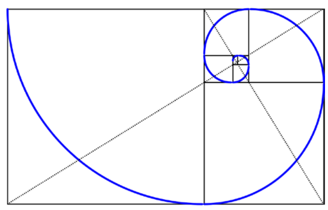
Fibonacci was a 12th Century mathematician who discovered a sequence of numbers while investigating the breeding patterns of rabbits. He discovered that, starting with 0 and 1, you could add the last two numbers in the sequence to create the next number in the sequence.

This creates the following self-perpetuating number sequence:

0 1 1 2 3 5 8 13 21 34 55 89 144...etc.

If the same number sequence is used to create a sequence of joined squares, they result in a self-perpetuating sequence of Golden Rectangles.

The Fibonacci Spiral. or Golden Spiral, is created by drawing a continuous line of quarter circles that run from corner to corner of each square in the Fibonacci sequence. This spiral is also found throughout nature.



Fortunately for us, we don't have to discover this golden ratio, golden rectangle or golden spiral again. We don't even need to be able to fully understand it. We just need to know that it is really useful for creating strong compositions.

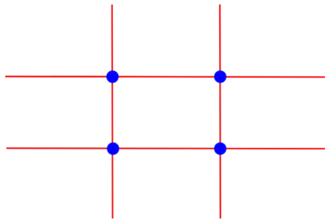
12. Use the internet to find instructions on how to draw a Fibonacci spiral.
Follow the instructions to draw your own Fibonacci spiral.
You could follow this link: https://www.youtube.com/watch?v=qTw_qay54W

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 place 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.

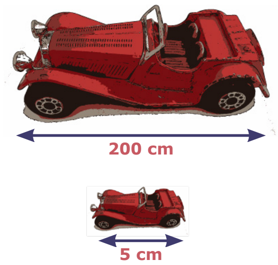
11. Take your own photographs that have been composed using the 'rule of thirds'.
Make a copy of your best photograph and stick a copy into the box below.
Make visual notes to show how you have used the rule of thirds.

WHAT IS SCALE?

WHAT IS SCALE?

Scale is a description of a relationship between the size of one thing and the size of another thing. In simple terms, scale tells us how much bigger or smaller something is when compared with another thing. This relationship can be described as a ratio, which can then be converted to a **SCALE FACTOR.**

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 finding two equivalent or corresponding parts on the two objects you are comparing. By measuring each of these two parts you can establish a ratio. This can then be converted into a scale factor.

> *For example, if you have a toy car and a full size car of the same model, you can take a measurement for the length of each.*
> *If the toy car is 5 cm in length and the real car is 200 cm in length the ratio is 5:200 or, in its simplest form, 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

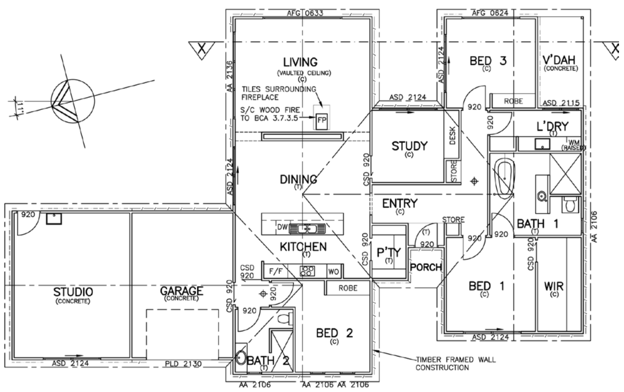
WHAT IS A SCALE DIAGRAM?

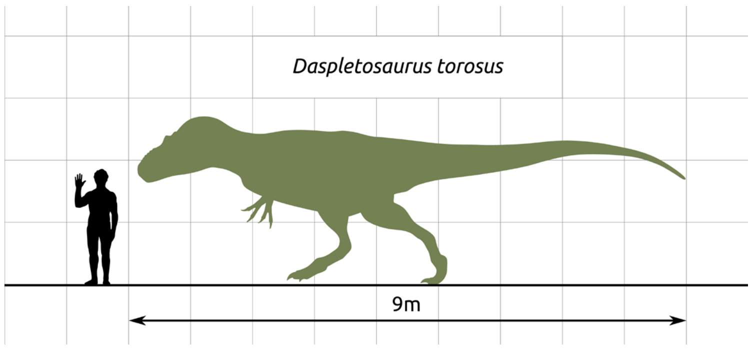
A scale diagram is a drawing of an object that has been carefully measured and accurately reduced or enlarged using a consistent scale factor.

Because all of the measurements are accurate, we can use the scale factor identified in the diagram to work out the measurements of the original object.

House plans are scale diagrams that are drawn by architects and then used by builders to gain accurate measurements to build a house.

> *If a house plan has a ratio of 1:100, this means that a builder needs to multiply the length of items by a scale factor of 100 to get the correct measurements for the house.*





HOW TO CALCULATE USING SCALE MEASUREMENTS

If you can measure an image in a scale diagram, and you know the scale factor, follow this formula:

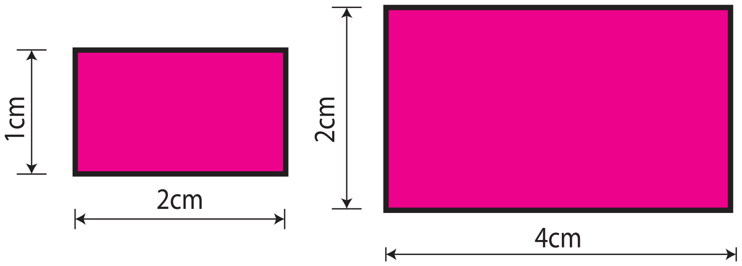
size of image x scale factor = size of actual

If you know the actual size of an object and you are creating a scale diagram, decide on the scale factor you want to use and follow this formula:

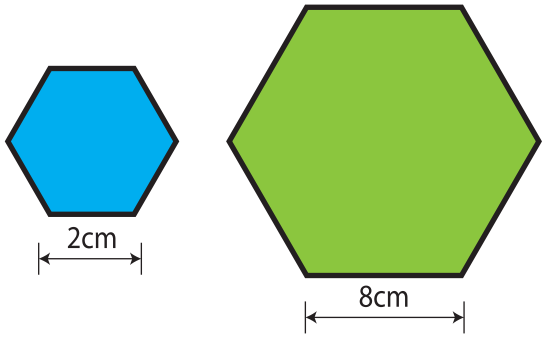
size of actual ÷ scale factor = size of image

SECTION 3: SCALE

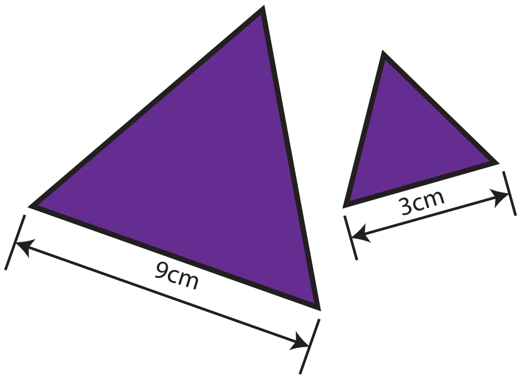
13. Find the scale factor for each of the following: (write your answer as a ratio in it's simplest form)



RATIO	RATIO IN SIMPLEST FORM
:	:

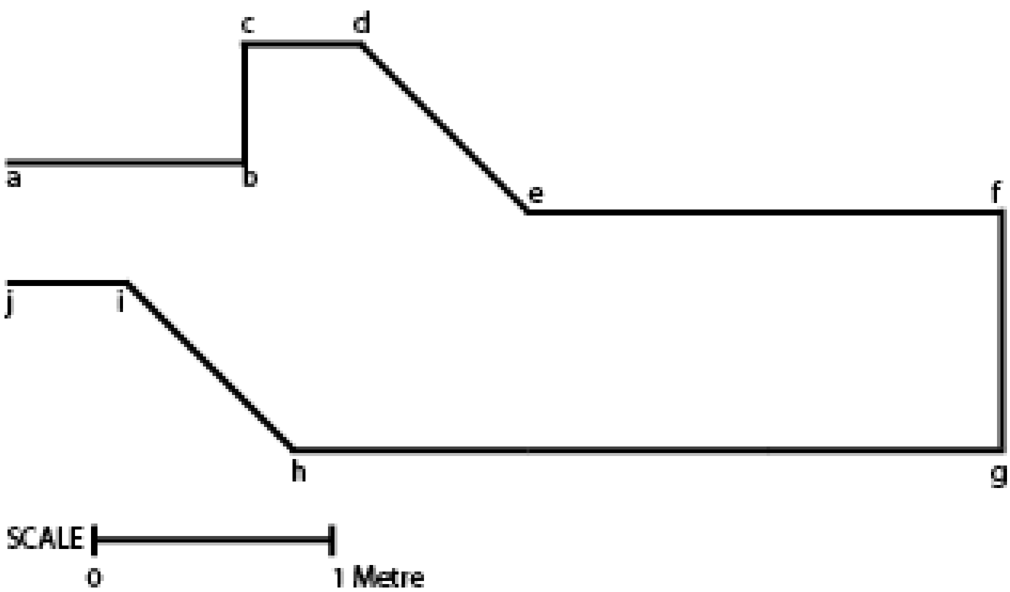


RATIO	RATIO IN SIMPLEST FORM
:	:



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

Scale and proportion are key pictorial elements used in art-making.
The term 'scale' refers to the relative size of one object compared to another, or the size of an object relative to its environment. 'Scale' can also refer to the relative size of an object in an artwork compared with its actual size.
The term 'proportion' is similar to scale, but refers to the relative size of a part of something in relation to the whole thing.

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 an be used to establish hierarchy, with more important characters depicted larger and less important characters smaller
- scale is also used to create an illusion of spacial 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 Surrealist artwork that manipulates scale for psychological effect
c. an Ancient Egyptian heiroglyphic that uses scale to establish hierarchy
d. an artwork that uses scale to create the illusion of spatial depth

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

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 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	RATIO IN ITS SIMPLEST FORM
Comb			:	:
Bottle			:	:
Boomerang			:	:
Hot Air Balloon			:	:
Airstrip Sign			:	:

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