 Year 12 Mathematics Standard 1

| MS-M5 Scale drawings | Unit duration |
| --- | --- |
| Measurement involves the application of knowledge, skills and understanding of numbers and geometry to quantify and solve problems in practical situations.Knowledge of measurement enables an understanding of basic daily situations involving rates and ratios, such as speed and the interpretation of maps and plans, effectively in a variety of situations.Study of measurement is important in developing students’ ability to solve problems related to two and three-dimensional models and representations and to work effectively with a variety of rates and ratios. | 2 weeks |

| Subtopic focus | Outcomes |
| --- | --- |
| The principal focus of this subtopic is to interpret and use scale drawings and use similarity in solutions to practical problems involving measurement.Students develop their ability to interpret and use house plans, designs and maps in the calculation of a range of measurements and solve related problems.Within this subtopic, schools have the opportunity to identify areas of Stage 5 content which may need to be reviewed to meet the needs of students. | A student:* Interprets the results of measurements and calculations and makes judgements about their reasonableness MS1-12-3
* Analyses simple two-dimensional and three-dimensional models to solve practical problems MS1-12-4
* Chooses and uses appropriate technology effectively and recognises appropriate times for such use MS1-12-9
* Uses mathematical argument and reasoning to evaluate conclusions, communicating a position clearly to others MS1-12-10

Related Life Skills outcomes: MALS6-3, MALS6-4, MALS6-13, MALS6-14 |

| Prerequisite knowledge | Assessment strategies |
| --- | --- |
| Students should be familiar with writing ratios in their simplest form; calculating quantities from a given ratio; writing and converting rates, as outlined in the Stage 4 and Stage 5.2 Ratios and Rates units. | * An investigative task based on students using the knowledge, understanding and skills they have developed in this topic to analyse and create a scaled project
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All outcomes referred to in this unit come from [Mathematics Standard Stage 6](https://syllabus.nesa.nsw.edu.au/mathematics-standard-stage6/) Syllabus
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Glossary of terms

| Term  | Description  |
| --- | --- |
| Ratio  | A ratio is a quotient or proportion of two numbers, magnitudes or algebraic expressions. It is often used as a measure of the relative size of two objects. For example the ratio of the length of a side of a square to the length of a diagonal is 1:$\sqrt{2}$ that is $\frac{1}{\sqrt{2}}$ |
| Scale factor | A scale factor is a number that scales, or multiplies, or reduces some quantity.If two or more figures are similar, their sizes can be compared. The scale factor is the ratio of the length of one side on one figure to the length of the corresponding side on the other figure. It is a measure of magnification or reduction, the change of size. |
| Elevation views | Elevation views are scale drawings showing what a building looks like from the front, back and sides. |

| **Sequence** | **Content** | **Suggested teaching strategies and resources**  | **Date and initial** | **Comments, feedback, additional resources used** |
| --- | --- | --- | --- | --- |
| Solving practical problems involving ratios(4 lessons) | * Solve practical problems involving ratio, for example, map scales, mixtures for building materials or cost per item AAM Critical and creative thinking icon  Information and communication technology capability icon
* Work with ratio to express a ratio in simplest form, to find the ratio of two quantities and to divide a quantity in a given ratio
* Use ratio to describe map scales
 | **Introducing Ratios*** A ratio is the quantitative relation between two amounts showing the number of times one value contains or is contained within the other. If ‘a’ and ‘b’ are two quantities, they can be expressed as ‘a:b’.
* A ratio has no units, such that $10 to $15 is written as 10:15.
* It can be expressed as a fraction. For example, 2:3 can be expressed as 2/3.
* The two quantities that are compared using ratios should be measured or represented using the same units. For example, litres and grams cannot be compared using ratios.
* The ratio must be expressed in the simplest form. 3:9 can be expressed as 1:3
* Whole numbers are preferred i.e. 2:3 instead of 1:1.5
* Students should be able to:
* Recognise ratios written in different forms, such as 6/4, 6:4 or 6 to 4
* Write a ratio in simplest form.
* Calculate amounts from a ratio. Sample problems could include: Concrete is formed by mixing cement, sand and gravel in the ratio 1:2:6. What volume of sand is needed to make 1.6m3 of concrete?
* Divide a quantity into a given ratio. Sample problems could include:
	+ Divide $300 in the ratio 2:3.
	+ A sum of money is divided in the ratio 2:3. The smaller sum is $3.60. Find the sum that was divided.
* Staff might like to show the video [Bad Date](https://www.youtube.com/watch?v=BZ1M01YBKhk) as a reminder/introduction to ratios

Solving practical problems using ratios * Student activity: [Ratios: In proportion](http://www.scootle.edu.au/ec/viewing/L8098/index.html) is an interactive activity where students complete customer orders for a large hardware store by interpreting the ratios. They work in the gardening department to fill orders for fertiliser, to the strength requested by customers. Further activities include the following Scootle resources, where DoE login is required:
* [In proportion: Rates and scales](http://www.scootle.edu.au/ec/pinobject?objectId=L8099&pin=SHRNOI&userid=182312)
* [In proportion: Variables in ratios](http://www.scootle.edu.au/ec/pinobject?objectId=L8101&pin=SHRNOI&userid=182312)
* Student activity: Possible student investigations could include:
* Using a scale model (such as a toy car or [Life size Barbie](http://www.cbsnews.com/news/life-size-barbies-shocking-dimensions-photo-would-she-be-anorexic/)) to determine the actual size of different aspects of the model.
* Students could watch the video about a scale model of the solar system. ([To Scale: The solar system](https://vimeo.com/139407849))
* For a recipe to be cooked for a dinner party, determine the amount needed for each ingredient and then determine the cost per person (based on the cost of the ingredient).
* Determining the cost of painting one or more of the Math’s classrooms.
* [Floor space ratio](https://yoursay.bmcc.nsw.gov.au/3633/documents/7501) and the golden ratio and how they are used in building
* Investigating different map scales including 1:10000, 1:25000 and 1:50000.
* Students to find examples of each map and determine who would use the map and why.
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| Using similar shapes to solve problems(2 lessons) | * Use the conditions for similarity of two-dimensional figures, including similar triangles, to solve related problems
* Use the linear scale factor for two similar figures to solve problems (ACMGM022)
 | **Similar Shapes*** Student activity: [Similar shapes](http://www.scootle.edu.au/ec/viewing/L2309/index.html) is an interactive activity where students compare the sizes and angles of a range of triangles, squares and rectangles.
* Student activity: Students watch the videos:
* [How tall is a tree?](https://www.youtube.com/watch?v=C9HmKB2QbFU)
* [Measuring the Berlin tv tower with a ruler](https://www.youtube.com/watch?v=yadjZTBDSR4)
* By measuring the shadow thrown by a metre-rule, students could then use similarity and shadow lengths to find the height of tall objects, such as a tree or flag pole in the school.

NESA exemplar questions* A sewer is required to have a fall of 1 in 40. How much deeper should one end be compared to the other in a 160-metre long trench?
* Jacques and a flagpole both cast shadows on the ground. The difference between the lengths of their shadows is 3 metres.

The diagram shows a flagpole 4 m high and a person 1.5 m high. The person is located 3 m from the flagpole. a line joins the top of the flagpole to the top of the person and continues to the ground.    The distance from the foot of the flagpole to the point where this line meets the ground is labelled 'shaddow of flagpole'.  The distance from the feet of the person to the point where the line meets the ground is labelled d m.What is the value of $d$, the length of Jacques’ shadow?Resource: ms-m5-nesa-exemplar-question-solutions.DOCX |  |  |
| Using scale drawings to solve problems(1 lesson) | * Obtain measurements from scale drawings, including but not limited to maps (including cultural mappings or models) or building plans, to solve problems AAM Aboriginal and Torres Strait Islander histories and cultures icon Critical and creative thinking icon
 | * A practical application of ratios is scale drawings. The scale determines the size of an object in a drawing or in real life. The closer the terms in the scale ratio are together, the closer the drawing is to the real size. So a 1:10 scale drawing would be bigger than a 1:100 scale drawing of the same object. Scale diagrams could include house plans and maps.

**Using maps*** Student activity: Students use [Google maps](https://www.google.com.au/maps) to find an island or country:
* Print the screen out and then determine the area of the land mass. Ensure the scale at the bottom is printed.
* Compare this value with the quoted size.
* This could also be done for a suburb or town boundaries.
* Student activity: Compare the area of Tasmania to the rest of the states in Australia. What is the ratio of Tasmania to the other states?
* Repeat the activity for the island/country above, but with the students’ houses.
* Student activity: Students use online mapping applications (such as [Google Earth](https://www.google.com/earth/) or [SIX maps](https://maps.six.nsw.gov.au/)) to search locations and use the scale to find the actual distance between two points on the map.
* Students could watch this video to learn how to use the [Google Earth Ruler Tool](https://www.youtube.com/watch?v=x8hzpMn-nNs)
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| Interpreting building plans(2 lessons) | * Obtain measurements from scale drawings, including but not limited to maps (including cultural mappings or models) or building plans, to solve problems AAM Aboriginal and Torres Strait Islander histories and cultures icon Critical and creative thinking icon
* Interpret commonly used symbols and abbreviations on building plans and elevation views
 | **Using building plans*** Students should be aware that millimetre is the standard unit of lengths on building plans.
* Student activity: Research building plans and create a list of symbols and abbreviations from building plans on the [build.com.au website](https://build.com.au/floor-plan-abbreviations-and-symbols).
* Student activity: Using building plans ([Coral Homes](https://coralhomes.com.au/), [Plans and elevations](http://www.yourhome.gov.au/house-designs/plans-and-elevations)), students could measure out the actual size of a house on the school oval.
* Student activity: Students accurately construct a scaled model of their classroom or another room using a building plan and/or elevation view. Resource: [How to draw a floor to scale](https://www.wikihow.com/Draw-a-Floor-Plan-to-Scale)
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| Using scale drawings for costing(1 lesson) | * Estimate and compare quantities, materials and costs using actual measurements from scale drawings, for example using measurements for packaging, clothing, cooking, painting, bricklaying and landscaping including sustainability issues AAM Sustainability icon Personal and social capability icon
 | **Using scale drawings for costing*** Student activity: Students could investigate the following:
* Finding the area of a house to be carpeted and the cost of purchasing the carpet. The dimensions of the room and the width of the carpet should be considered when deciding in which direction to lay the carpet in order to minimise wastage and the number of joins.
* Calculating the area to be painted and the cost of painting a room in a house.
* Calculating the volume of the rooms in a house and using a table to determine the appropriate-sized air conditioner for the house.
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Reflection and evaluation

Please include feedback about the engagement of the students and the difficulty of the content included in this section. You may also refer to the sequencing of the lessons and the placement of the topic within the scope and sequence. All ICT, literacy, numeracy and group activities should be recorded in the ‘Comments, feedback, additional resources used’ section.