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| Strand: Measurement | | Topic: Length, mass area and volume |
| Foundation Level: Level statement  Students are responding to and developing some everyday language associated with time, length, mass, area and volume. | | |
| Example learning outcomes:  Students show an awareness of everyday language related to measurement of length, mass, area and volume. | | |
| Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically | | |
| Students know:  everyday language that relates to length, mass, area and volume  appropriate responses to identify the attributes of length, mass, area and volume. | Students may:  participate in measurement activities to explore the characteristics and language involved in describing the attributes of a range of objects, such as large/small, full/empty, long/short, fat/skinny, tall/short  participate in activities involving length and respond to the related language by:   * rolling play dough into ‘snakes’ of various lengths * building with blocks and play equipment to create ‘long’ and ‘short’ fence lines * comparing heights or the length of feet or hands * investigating the distance from the classroom to the playground, the school to the shop, or home to the bus stop * investigating the lengths of items to be packed into lunch boxes, school bags or suitcases   participate in activities involving mass and respond to the related language by:   * lifting cups, dishes, toy buckets of sand and water * carrying ‘heavy’ and ‘light’ items when cooking, at meal times or when gardening * measuring ingredients for cooking activities * checking the heaviness of bags of shopping, sports equipment or school items   participate in activities involving area and respond to the related language by:   * buttering bread to the edges * covering all of a page with paint, all of a picture with glue, a fence with paint, a wall with paper, an area with a screen * covering a table with paper or a tablecloth * covering their bodies with towels or sun screen * covering the garden with mulch, or an area of ground with pavers * building enclosed spaces using blocks, play equipment or cardboard * tracing body shapes * mowing the grass in a set area   participate in activities involving volume and respond to the related language by:   * measuring ingredients for cooking activities * filling and emptying cups, dishes and toy buckets with sand or water * building sand castles with cups or buckets * building towers and constructions with blocks, boxes or play equipment * packing lunch boxes, school bags, suitcases or putting equipment away in containers or on shelves   participate in activities involving pouring and stopping and respond to the related language by:   * filling containers to a particular point or mark or filling a cup from a tap * pouring drinks into cups   participate in, or contribute to, roleplays, songs or games involving ideas and language related to length, mass, area and volume  indicate ways that familiar objects could be made heavier, lighter, longer, shorter, fatter, skinnier  respond or react to the various attributes (length, mass, area, volume) of a range of objects by:   * selecting appropriately sized containers for cooking, eating, storing * lifting a range of objects requiring different levels of effort * organising a hose of a particular length (e.g. long enough to reach from the tap to the garden) * selecting appropriate containers to carry heavy items or large amounts of material (e.g. wheelbarrow or bucket to carry soil or many pots of plants) * selecting a shopping trolley or shopping basket to carry groceries when they are too heavy or bulky to carry in hands * filling a blender, electric jug or saucepan to a given level * suggesting appropriate travel arrangements for distances to be travelled (e.g. walk to the corner shop, ride to school, catch a train to the city). | |

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| Level 1: Level statement  Students identify and distinguish between the attributes of length, mass, area and volume. They select an attribute to make comparisons between objects. They describe these comparisons using appropriate language. They use non-standard units when they estimate and measure length, mass, area and volume.  Students are developing an awareness of time and its relevance to their everyday lives. They sequence familiar events and relate specific events to days of the week and months of the year. They use comparative language to describe the duration of events or activities. | | |
| Core learning outcome: M 1.1  Students select the appropriate attribute to compare and order the size of objects and measure with non-standard units. | | |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | | **Core content** |
| Students know:  different attributes of measurement  ways to identify different attributes of measurement  how to compare and order the size of objects using different attributes of measurement  appropriate non-standard units for measuring different attributes  ways to measure with  non-standard units. | Students may:  identify and describe different attributes of measurement  select an attribute and compare objects by placing them side by side for length, laying one surface over another for area, hefting masses, and pouring the contents of a full container into another container  without spilling for volume  compare and order the lengths, masses, areas and volumes of selected objects  explain the relationship between different items using comparative language, such as ‘taller than’,  ‘heavier than’ and ‘smaller than’  use the same attribute to compare and order objects  use comparative terms to explain the placement of an additional object into an ordered sequence  indirectly compare objects by measuring with a single non-standard unit, such as a single length of streamer  measure using multiples of non-standard units. | Measurement terms and attributes  attributes   * length * mass * covering (area) * fill and pack (volume)   direct and indirect comparisons  descriptive and comparative terms associated with length, mass, area and volume  Units of measure  non-standard units  measuring instruments   * balance scales   Relationships |
| Investigations should occur in a range of contexts. For example, students could investigate:  arrangement of books on a shelf from tallest to shortest  the masses of classroom and personal objects  areas of foot- or handprints  volumes of containers of various sizes. | | |

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| Level 2: Level statement  Students use non-standard and some standard units to estimate, measure and order length, mass, area and volume. They understand that the larger the unit, the fewer required to measure an object, and that standard units provide consistency when measuring.  Students measure and compare durations of events and link these to familiar activities. They read hour and half-hour displays on analogue clocks and any time on digital displays.  They use calendars to locate and sequence events that are of significance to them over a year. | | |
| Core learning outcome: M 2.1  Students use non-standard and standard units to estimate, measure and order the size of objects. | | |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | | **Core content** |
| Students know:  how to select appropriate  non-standard units to measure objects  standard units for measuring different attributes  how to measure using standard units  the advantages of using standard units  ways of estimating the size  of objects  how to order the size of objects. | Students may:  identify an attribute to be measured  compare attributes directly or indirectly  develop personal referents, such as number of paces or hand spans to inform estimations  develop ‘mind pictures’ of units to inform estimations (e.g. “Create a mind picture of a metre. Is this piece of string longer or shorter?”)  select and use multiple uniform units or appropriate measuring instruments to measure different attributes  measure attributes by counting the non-standard or standard units used (e.g. length by placing items end to end with no gaps and no overlaps; mass by hefting objects, or balancing a pan balance; area by covering the surfaces of irregular and regular shapes with non-standard units having no gaps and no overlaps; volume by packing with blocks of uniform size)  explain the differences between estimations and actual measurements  compare the size of units used with the number required to measure the same object or surface  describe the result when different units (smaller or larger) are used to measure the same attribute  create different representations of the same measurement, such as coiling or folding a given length, reshaping the same mass of clay or dough, filling containers of different heights and/or shapes with the same volume, rearranging an area into different shapes  describe similarities and differences between representations of the same measurement  compare measurements when the same unit is used for measuring  classify measurements as being ‘more than’, ‘less than’, or ‘about the same as’ a particular unit  compare lengths, masses and volumes that are ‘more than’, ‘less than’ or ‘about the same as’  standard units  order objects and surfaces according to their measurements  describe the order of measurements using comparative language and give reasons for placements in  the sequence  explain the meaning of ‘standard’ and the advantages of using standard units  select the appropriate standard unit for the attribute to be measured  explain the relationships of some referents to historical units of measure, such as a cubit, or height expressed in hands or rod  choose the appropriate measuring instrument for the attribute to be measured  describe how to use a variety of measuring instruments as accurately as possible  measure to check estimations  use conventions when recording measurements. | Measurement terms and attributes  associated with the attributes of:   * length (height, width, depth, distance …) * mass (weighing) * area (covering) * volume (pouring, packing, layers)   Units of measure  metres (m)  centimetres (cm)  kilograms (kg) and parts of kilograms (half, quarter)  litres (L) and parts of litres (half, quarter)  non-standard units for volume  (e.g. layers of blocks)  measuring instruments   * rulers, tape measures * scales * area grids * litre jugs   personal referents  related historical units of measure  Relationships   * the larger the unit the fewer required to measure and vice versa * non-standard and standard units |
| Investigations should occur in a range of contexts. For example, students could investigate:  measurements used when cooking  the length, area, mass or volume of grocery or hardware items  the construction of a garden bed to grow vegetables for a class project  packaging required for burgers for a school fundraising day, such as the amount of wrapping paper required or size of boxes needed to hold the burgers. | | |

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| Level 3: Level statement  Students use equivalent forms of standard units to compare, order and measure. They select appropriate standard units to estimate and measure length, mass, area and volume.  They further develop their estimation skills by identifying and using a set of personal measurement referents.  Students interpret and use calendars, simple timetables and diaries to plan and record events in their daily lives. They know and use conventions related to reading and recording time.  They calculate the duration of events. | | |
| Core learning outcome: M 3.1  Students identify and use equivalent forms of standard units when measuring, comparing and ordering, and estimate using a range of personal referents. | | |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | | **Core content** |
| Students know:  a range of standard units  how to identify the size of standard units using prefixes  the relationships between equivalent forms of standard units  how to measure using standard units  how and when to convert to equivalent forms of standard units  how to compare and order standard units when measuring  a range of personal referents  how to estimate using a range of personal referents. | Students may:  select and use the appropriate instrument for measuring  read and interpret the graduations on a range of instruments and relate to a given measure  identify and describe standard units by referring to the meaning of the prefixes  describe the relationships between different standard units  translate measurements to equivalent forms  compare equivalent forms of the same measurements  use equivalent forms appropriately in a range of situations  use appropriate measuring instruments to measure length, mass, area and volume  measure attributes accurately  estimate measurements and check the reasonableness of the estimation  check calculations with different measuring instruments  compare and order lengths, masses and volumes based on measurements  use conventions when recording measurements  make comparisons between standard units, personal referents and related historical units of measure, such as a cubit, a stone or a chain  develop a set of personal referents including ‘mind pictures’ of units equivalent to standard units  use a range of personally meaningful referents when estimating  check estimations by measuring using standard units. | Measurement terms and attributes  boundaries  square units  metric prefixes   * milli-, centi-, kilo-   Units of measure  metres (m) and centimetres (cm)  grams (g) and kilograms (kg)  square centimetres (cm2)  square metres (m2)  millilitres (mL) and litres (L)  non-standard units for volume  (e.g. layers of blocks)  measuring instruments   * square centimetre grids   equivalent forms of standard units (e.g. 1.5 kg/1500 g; 600 mL/0.6 L)  personal referents  related historical units of measure  Relationships  the larger the unit the fewer required to measure and vice versa   * millilitres and litres * grams and kilograms   centimetres and metres |
| **Investigations should occur in a range of contexts. For example, students could investigate:**  the appropriate standard units to measure field events  changes in plant or body growth  the volume and/or area of materials needed to redecorate the classroom, such as carpet, curtains  the use of hand spans, arm lengths, floor tiles or grocery items to develop personal referents, such as 1 kg of sugar. | | |

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| Level 4: Level statement  *Students investigate ways to determine areas, volumes and lengths of boundaries and describe the relationships between the dimensions in general terms. They select and use the appropriate standard units when estimating and measuring.*  *Students use personal timetables, diaries, timelines and calendars to plan and organise events or activities of significance to them. They use 24-hour and 12-hour time.* | | |
| Core learning outcome: M 4.1  Students choose appropriate units when estimating and measuring and explain relationships between dimensions when investigating areas, volumes of prisms and lengths of boundaries of rectangles. | | |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | | **Core content** |
| Students know:  appropriate units to use when estimating and measuring different attributes  ways of estimating  why particular units are used to estimate and measure in different situations  how to measure using standard units  the different dimensions related to areas, volumes of prisms and lengths of boundaries of rectangles  the relationships between dimensions when investigating area, volumes of prisms and lengths of boundaries of rectangles. | Students may:  identify and describe an attribute to be measured  estimate using referents and record judgments  determine whether the measurement required should be exact or approximate  select the appropriate standard unit for measuring an attribute taking into account the size of the unit and the number of units required for measuring  select the appropriate measuring instrument related to an attribute (e.g. a ruler is appropriate for measuring the length of a bath but not the volume)  identify and explain relationships between dimensions where possible  translate measures to equivalent forms to assist calculations and explain the relationships between units  identify possible computation methods and strategies to calculate volumes of prisms, areas of rectangles, and lengths of boundaries of rectangles as required  record measurements using conventions related to the attribute being measured  check answers using alternative computation methods  make comparisons between standard units, referents and related historical units of measure, such as  yard, ton or league. | Measurement terms and attributes  perimeter  circumference  square and cubic units  Units of measure  millimetres (mm), centimetres (cm), metres (m) and kilometres (km)  tonnes (t) and kilograms (kg)  square metre (m²)  square centimetre (cm²)  cubic metre (m³)  cubic centimetre (cm³)  measuring instruments  related historical units of measure  Relationships  the larger the unit the fewer required to measure and vice versa   * metres, centimetres and millimetres * kilograms and tonnes * square centimetres and square metres   relationships between:   * length, width and area of rectangle * length, width and height, and volume of prism   length of side and perimeter |
| Investigations should occur in a range of contexts. For example, students could investigate:  lengths of boundaries when landscape gardening  the relationship between area, volume and lengths of boundaries for domestic or commercial situations  distances within the community to get from one place to another  amount of water used in sinks  designs of a training route and/or a cross-country race. | | |

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| Level 5: Level statement  Students identify and describe links between their own generalised methods and formulae used to calculate areas, volumes and lengths of boundaries.  Students solve realistic time-management problems and plan and manage use of time. They understand and consider the impact of different time zones within Australia. | | |
| Core learning outcome: M 5.1  Students develop formulae to calculate areas, volumes and lengths of boundaries where the relationships between dimensions are known, and investigate a range of other shapes to explain the relationships between dimensions. | | |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | | **Core content** |
| Students know:  how to use known relationships between dimensions to develop formulae  how to use formulae to solve problems involving perimeter and area of rectangles including squares and volumes of prisms  how to identify and explain the relationships between dimensions of a range of shapes. | Students may:   * describe the relationships between dimensions of common 2D and 3D shapes * represent the relationships in various forms including words or symbols * use known formulae for area of a rectangle to develop formulae for area of other shapes based on the relationships between length and width * select appropriate units of measure to solve life-related measurement problems * determine whether a situation requires an exact or approximate answer * use referents to estimate measurements to check the reasonableness of calculations * check that units of measure chosen are appropriate * identify and explain relationships between units of measurement * identify possible formula or formulae appropriate to a situation * make comparisons between standard units, referents and related historical units of measure, such as perch or acre. | Measurement terms and attributes  perimeter  circumference  diameter  radius  pi (π)  Units of measure  square metre (m²)  hectares (ha) and square kilometres (km²)  measuring instruments  historical units of measure  Relationships  the larger the unit the fewer required to measure and vice versa   * millilitres and cubic centimetres * hectares and square metres   relationships between:   * diameter and circumference of circle (pi) * length and width (height), and areas of triangles and parallelograms * areas of triangles and areas  of rectangles * areas of rectangles and areas  of parallelograms (same length, same width or height) * areas of circles and irregular shapes   formulae   * area of rectangle * volume of prism * perimeter of rectangles including squares |
| Investigations should occur in a range of contexts. For example, students could investigate:  life-related measurement problems for construction, interior design or fashion design  pool or paving designs based on length and area calculations  landscaping requirements  design of permaculture environments  size of parkland. | | |

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| Level 6: Level statement  Students explore and explain relationships within triangles. They select and use formulae to solve problems related to area, volume and length.  Students use a variety of timetables to plan, monitor, manage and record the use of time. They justify their decisions by identifying implications and consequences. They understand and consider the impact of different time zones within the world. | | |
| Core learning outcome: M 6.1  Students interpret, analyse and solve measurement problems and justify selections and applications of formulae. | | |
| **Elaborations — To support investigations that emphasise thinking, reasoning and working mathematically** | | **Core content** |
| Students know:  how to interpret and analyse measurement problems  formulae for different applications  how to apply formulae to solve measurement problems  how to develop a mathematical argument that justifies selections and applications of formulae. | Students may:  describe relationships between dimensions of right-angled triangles  interpret the problem then select the appropriate formulae to calculate areas and volumes and justify choice  represent formulae algebraically  apply formulae for circumference of circle, area of circles and triangles, and volumes of cylinders, pyramids and cones  explain Pythagoras’ theorem as the relationship between the side lengths of a right-angled triangle  identify problem situations that involve Pythagoras’ theorem  use Pythagoras’ theorem to calculate side lengths in right-angled triangles  explain the tangent ratio as being the relationship between the side lengths and related angle in a  right-angled triangle  identify problem situations that involve the tangent ratio  use the tangent ratio to calculate side lengths or the related angle in right-angled triangles. | Measurement terms and attributes  tangent  opposite and adjacent sides  hypotenuse  Units of measure  Relationships  within right-angled triangles   * Pythagoras’ theorem * tangent ratio   formulae   * circumference of circle * area of circle * area of triangle * volume of cylinder * volumes of pyramids and cones   compound shapes  objects |
| Investigations should occur in a range of contexts. For example, students could investigate:  measurements of geological drill cores, ice-cream cones or different sizes and shapes of tents  design of roof trusses  carpentry and construction projects requiring ‘squareness’  access ramps to freeways or buildings  angle of trajectory (in sporting activities)  steepness of roads and access pathways with reference to government safety guidelines. | | |