

# Numbers Up! Baggin' the Dragon

Correlation with the  
Victorian Essential Learning Standards

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Discipline-based Learning Strand

**Mathematics**

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# Level 1

## Learning focus

As students work towards the achievement of Level 1 standards in Mathematics, they manipulate and play with objects to develop links between a simulated environment, their experiences, everyday language and mathematical activity.

In *Space*, students manipulate and investigate the properties of basic two- and three-dimensional shapes. They use the properties of point, line, edge and surface to identify everyday objects and pictures. They recognise inside and outside. They participate in activities in which they follow simple verbal instructions to locate items.

In *Measurement, chance and data*, students learn to compare common objects using terms such as *longer*, *heavier* and *fuller*.

When *Working mathematically*, students undertake activities to develop skills in making correspondences. They create and explore number patterns using counters or other objects. They take risks by making and exploring conjectures relating to patterns, shapes and measurements (for example, 'the next shape in a sequence will be...').

## Standards

### **Space**

At Level 1, students use and recognise points, lines and curves. They identify basic two-dimensional shapes such as circles and squares and three-dimensional solids and objects such as boxes. They sort geometric objects according to simple descriptions. They place and orientate shapes according to simple descriptions such as *next to*, *beside*, *in front of*, *behind*, *over* and *under*.

They follow simple instructions to move and place shapes and objects in familiar situations in relation to what they can see.

### **Measurement, chance and data**

At Level 1, students compare length, area, capacity and mass of familiar objects using descriptive terms such as *longer*, *taller*, *larger*, *holds more* and *heavier*. They make comparative measurements between different objects.

They recognise the continuity of time and the natural cycles such as day/night and the seasons. They recognise the correct sequence of days of the week. They compare activities that take different amounts of time to complete.

### **Working mathematically**

At Level 1, students use diagrams and materials to investigate mathematical and real life situations. They explore patterns in number and space.

They test simple conjectures. They make estimates and predictions, and check their work with respect to computations and constructions in *Number*, *Space*, and *Measurement*, *chance and data*.

# Level 2

## Learning focus

As students work towards the achievement of Level 2 standards in Mathematics, they begin to use mathematical symbols and language to describe their mathematical explorations of daily life.

In *Space*, students participate in activities which focus on identification of key features of shapes and solids. They learn to name familiar two- and three- dimensional shapes. They visualise and describe the effect of transformations (for example turns). They use mirrors and folding to investigate symmetry of shapes and pictures. Students learn to follow directions, informal maps, diagrams and routes to locations.

In *Measurement, chance and data*, students learn to use uniform (for example, same-sized squares) informal measurement units. They recognise time units (second, minute, hour, day, week, and month) and investigate basic time patterns and cycles. They learn to tell the time using analogue and digital clocks.

Students respond to questions dealing with data collection. They use pictographs and bar graphs in responding to questions.

When *Working mathematically*, students learn to use a combination of everyday language and mathematical statements and symbols to describe sets of numbers, shapes, objects and patterns. They interpret the data of daily activities and familiar events in pictures, diagrams and maps.

Students test the truth of conjectures by attempting to find examples or counter-examples.

## Standards

### **Space**

At Level 2, students recognise lines, surfaces and planes, corners and boundaries; familiar two-dimensional shapes including rectangles, rhombuses and hexagons, and three dimensional shapes and objects including pyramids, cones, and cylinders. They arrange a collection of geometric shapes, such as a set of attribute blocks, into subsets according to simple criteria, and recognise when one set of shapes is a subset of another set of shapes. They recognise symmetry, asymmetry, and congruence in these shapes and objects. They apply simple transformations to shapes (turn). They specify location as a relative position,

including left and right, and interpret simple diagrams and maps involving a small number of points, objects or locations.

### **Measurement, chance and data**

At Level 2, students make, describe and compare measurements of length, area, volume, mass and time using informal and formal units. They judge relative capacity of familiar objects and containers by eye and make informal comparisons of weight. They describe temperature using qualitative terms (for example, *cold*, *warm*, *hot*). Students use formal units such as hour and minute for time, litre for capacity and the standard units of metres, kilograms and seconds.

Students recognise the key elements of the calendar and place in sequence days, weeks and months. They describe common and familiar time patterns and such as the time, duration and day of events and tell the time using a digital or an analogue clock.

Students collect simple categorical and numerical data (count of frequency) and present and use this data in pictographs and simple bar graphs.

### **Working mathematically**

At Level 2, students make and test simple conjectures by finding examples and counter examples and informally decide whether a conjecture is likely to be true.

# Level 3

## Learning focus

As students work towards the achievement of Level 3 standards in Mathematics, they recognise and explore patterns in numbers and shapes. They increasingly use mathematical terms and symbols to describe computations, measurements and characteristics of objects.

In *Space*, students sort lines, shapes and solids according to key features. They explore nets of three-dimensional shapes by counting edges, faces and vertices. They investigate simple transformations (reflections, slides and turns) in designs. They explore the concept of angle as turn. They use grid references (for example, A5 on a street directory) to specify location and compass bearings to describe directions. They use maps to locate places.

In *Measurement, chance and data*, students measure the attributes of everyday objects and events using formal (for example, metres and centimetres) and informal units (for example, pencil lengths). Students tell the time using analogue and digital clocks. Students use simple frequency graphs. They use simple two-way tables to sort non-numerical data.

In *Structure*, students learn to use and describe simple algorithms for computations. They use simple rules to generate number patterns (for example, 'the next term in the sequence is two more than the previous term').

They create and complete number sentences using whole numbers, decimals and fractions.

When *Working mathematically*, students use mathematical symbols (for example, division, the words *and*, *or* and *not*). Students develop and test ideas (conjectures) across the content of mathematical experience.

Students learn to recognise practical applications of mathematics in daily life, including travel and time of day. They identify the mathematical nature of problems for investigation. They choose and use learned facts, procedures and strategies to find solutions.

## Standards

### **Space**

At Level 3, students recognise and describe the directions of lines as vertical, horizontal or diagonal. They recognise angles are the result of rotation of lines with a common end-point.

They recognise and describe polygons. They recognise and name common three-dimensional shapes such as spheres, prisms and pyramids. They identify edges, vertices and faces. They use two-dimensional nets, cross-sections and simple projections to represent simple three-dimensional shapes. They follow instructions to identify shapes and patterns in tangram-like puzzles. They locate and identify places on maps and diagrams. They use travel directions and describe positions using simple compass directions (for example, N for North) and grid references on a street directory.

### **Measurement, chance and data**

At Level 3, students estimate and measure length, area, volume, capacity, mass and time. They recognise and use different units of measurement including informal (for example, paces), formal (for example, centimetres) and standard metric measures (for example, metre) in appropriate contexts. They read linear scales (for example, tape measures) and circular scales (for example, bathroom scales) in measurement contexts. They read digital time displays and analogue clock times. They recognise different types of data: non-numerical (categories), separate numbers (discrete), or points on an unbroken number line (continuous). They interpret column or bar graphs.

### **Structure**

At Level 3, students use number properties in combination to facilitate computations (for example,  $7 + 10 + 13 = 10 + 7 + 13 = 10 + 20$ ). They multiply using the distributive property of multiplication over addition (for example,  $13 \times 5 = (10 + 3) \times 5 = 10 \times 5 + 3 \times 5$ ). They use lists, tables and grids to show the possible combinations of two attributes. They recognise samples as subsets of the population under consideration (for example, pets owned by class members as a subset of pets owned by all children). They solve number sentences with missing numbers.

### **Working mathematically**

At Level 3, students apply number skills to everyday contexts. They recognise the mathematical structure of problems and use appropriate strategies (for example, recognition of sameness, difference and repetition) to find solutions.

Students test the truth of mathematical statements and generalisations.

- Shape properties
- Transformations (the effect of reflections and turns on a shape).
- Measurement (the relationship between size and capacity of a container).

# Level 4

## Learning focus

As students work towards the achievement of Level 4 standards in Mathematics, they describe their investigations with correct mathematical terms, symbols and notations. They use mathematical procedures to construct and systematically investigate conjectures or hypotheses.

In *Number*, students use patterns and arrays to develop understanding of multiples. They explore decimals, ratios and percentages as equivalent forms of fractions (for example,  $\frac{3}{4}$  metre = 75cm).

In *Space*, students identify and sort shapes by properties such as parallel and perpendicular lines (for example, quadrilaterals). They use the ideas of angle, size and scale to describe the features of shapes and solids. They identify symmetry by reflection or rotation. They identify two-dimensional drawings and nets as representations of solids (for example, prisms, pyramids, cylinders and cones). They identify and describe relative and absolute location on grids and maps.

In *Measurement, chance and data*, students estimate and measure lengths (including perimeter), area (including surface area), volumes, capacity and time (including duration) in metric units. They determine and use the level of accuracy required for the purpose of the measurement. They develop simple procedures to determine the perimeter and area of simple shapes (for example, counting squares in a grid to determine area).

Students estimate and describe the chance of random events using words, percentages and fractions or decimals between 0 and 1. They estimate probability through simulations of chance events (for example, randomly selecting a marble from a bag).

Students recognise different data types such as categorical and numerical, discrete and continuous. They use grouped and ungrouped data presented as simple frequency tables and histograms. They calculate and interpret measures of centre (mean, median and mode) and spread (range) for ungrouped data.

In *Structure*, students use tables to test the validity of statements involving the quantifiers *none*, *some* and *all*. Students create number sequences by computing the next term from the previous term or terms.

Students develop function rules for the terms in sequences based on their position in the sequence. Students recognise that the 'identity' for each operation has no effect: the

number 0 for addition and subtraction, and 1 for multiplication and division. They solve equations using words and symbols.

When *Working mathematically*, students make and test conjectures and generalisations about numbers, shapes and mathematical structure. For example:

- in *Space*, the properties of shapes
- in *Measurement, chance and data*, the probability of outcomes in games of chance

Students identify and investigate real life and practical applications of mathematics. They pose and solve mathematical problems using a range of strategies (for example, find a pattern, work backwards). They solve new problems based on familiar problem structures.

## Standards

### **Space**

At Level 4, students classify and sort shapes and solids (for example, prisms, pyramids, cylinders and cones) using the properties of lines (orientation and size), angles (less than, equal to, or greater than  $90^\circ$ ), and surfaces. They create two-dimensional representations of three-dimensional shapes and objects. They identify shapes and nets of solids. They describe the features of shapes that remain the same (for example, angles) or change (for example, side length) when a shape is enlarged or reduced. They apply a range of transformations to shapes.

Students describe relative and absolute location of objects in maps. They use compass directions, coordinates and distance, and conventional symbols that describe routes between places shown on maps.

### **Measurement, chance and data**

Level 4, students use metric units to estimate and measure length, perimeter, area, surface area, mass, volume, capacity, time and temperature. They measure angles in degrees. They measure as accurately as needed for the purpose of the activity. They convert between metric units of length, capacity and time (for example, L–mL, sec–min).

Students describe and calculate probabilities using fractions and decimals between 0 and 1. They calculate probabilities for chance outcomes. They simulate chance events (for example, the chance that a family has three girls in a row).

Students distinguish between categorical and numerical data and classify numerical data as discrete (from counting) or continuous (from measurement). They respond to questions using appropriate displays (for example, a pie chart for eye colour data and a histogram for

grouped data of student heights). They calculate and interpret measures of centrality (mean, median, and mode) and data spread (range).

## **Structure**

At Level 4 students form and specify sets of numbers, shapes and objects according to given criteria and conditions (for example, the properties of different types of quadrilaterals).

Students construct and use rules for sequences based on the previous term, recursion (for example, the next term is three times the last term plus two), and by formula (for example, a term is three times its position in the sequence plus two).

Students establish equivalence relationships between mathematical expressions using properties such as the distributive property for multiplication over addition (for example,  $3 \times 26 = 3 \times (20 + 6)$ ).

Students recognise that addition and subtraction, and multiplication and division are inverse operations. They use words and symbols to form simple equations. They solve equations by trial and error.

## **Working mathematically**

At Level 4, students recognise and investigate the use of mathematics in real situations (for example, determination of test results as a percentage).

Students develop and test conjectures. They understand that a few successful examples are not sufficient proof and recognise that a single counter-example is sufficient to invalidate a conjecture.

Students use the mathematical structure of problems to choose strategies for solutions. They select, devise and interpret appropriate solutions. Students engage in investigations involving mathematical modelling.

# Level 5

## Learning focus

As students work towards the achievement of Level 5 standards in Mathematics, they use mathematical models to explore the physical world.

In *Number*, students use mental and visual methods for computations, including multiple operations to provide answers for practical situations.

In *Space*, students select shapes and regular polygons according to given specifications. They explore the properties of angles formed by intersecting straight lines. They use ideas of congruency and similarity to create and describe designs. They identify nets for common three-dimensional shapes that construct corresponding geometric objects. They identify and use two-dimensional perspective drawings of three-dimensional objects.

Students interpret and use a range of familiar and common maps of locations, using plans and grids. They explore the patterns formed by following procedures involving simple transformations or movements around grids.

In *Measurement, chance and data*, students use metric units to estimate and measure length, perimeter, area, surface area, mass, volume, capacity, angle in shapes and solids, time, and temperature. They convert metric units into smaller or larger units as required. They judge the accuracy of their estimates by measurement. They use mensuration formulas (for example, for area and perimeter of circles, area and perimeter of triangles and parallelograms, and the surface area and volume of prisms and cylinders). They solve problems involving simple rates (per unit time or area).

They calculate theoretical probabilities. Students use samples in order to make inferences and predictions about a population or future event. They make use of a variety of data presentations. They calculate and interpret summary statistics (mean, median, mode and range).

In *Structure*, students use number properties (commutative, associative and distributive) in calculations across the content of mathematical experience. They test logical equivalence of sentences.

Students use the opposite of any integer for addition, and the inverse of any rational number for multiplication (reciprocal) to rearrange formulas and simple algebraic expressions and to solve equations. They use linear and other simple functions of a single variable, to explore number patterns and provide models for practical situations. They

represent functions by tables of values, ordered pairs, graphs and rules applied over a given domain. They solve equations with a sequence of inverse operations.

When *Working mathematically*, students generalise from multiple examples and informally justify those generalisations. They use linear and other simple mathematical models to explore practical situations. They make and test predictions from these models.

## Standards

### **Space**

At Level 5, students use constructions of two-dimensional and simple three-dimensional shapes that specify length, angle and adjacency. They use the properties of parallel lines to calculate angles that are supplementary, corresponding, allied (co-interior) and alternate. They describe and apply the angle properties of regular and irregular polygons, in particular, triangles and quadrilaterals. They use two-dimensional nets that construct a simple three-dimensional object such as a prism or a platonic solid. They recognise congruence of shapes and solids. They use single-point perspective to make a two dimensional representation of a simple three-dimensional object.

Students use coordinates to identify position in the plane. They use lines, grids and bearings to specify location and direction on plans and maps.

### **Measurement, chance and data**

At Level 5, students measure length, perimeter, area, surface area, mass, volume, capacity, angle, time and temperature using suitable units for these measurements in context. They interpret and use measurement formulas for the area and perimeter of circles, triangles and parallelograms and simple composite shapes. They calculate the surface area and volume of prisms and cylinders.

Students estimate the accuracy of measurements and give suitable lower and upper bounds for measurement values.

Students calculate theoretical probabilities by dividing the number of possible successful outcomes by the total number of possible outcomes.

Students use displays of discrete and continuous data (grouped and ungrouped), including those with larger data sets. They use representations of data in a variety of graphical forms including Venn diagrams, Carroll diagrams, stem and leaf plots, column graphs, bar charts and histograms. They calculate summary statistics for measures of centre (mean, median, mode) and spread (range, and mean absolute difference), and make simple inferences based on this data.

## Structure

At Level 5, students use Venn diagrams to show the relationships of intersection, union, inclusion (subset) and complement between the sets. They test the validity of statements formed by the use of the connectives *and*, *or*, *not*, and the quantifiers *none*, *some* and *all*. They apply these to the specification of sets defined in terms of one or two attributes.

Students apply the commutative, associative, and distributive properties in mental and written computation (for example,  $24 \times 60$  can be calculated as  $20 \times 60 + 4 \times 60$  or as  $12 \times 12 \times 10$ ).

Students recognise and apply simple geometric transformations of the plane such as translation, reflection and rotation and combinations of the above, including their inverses.

They identify element and inverse of rational numbers for the operations of addition and multiplication (for example,  $1/2 + -1/2 = 0$  and  $2/3 \times 3/2 = 1$ ).

Students use inverses to rearrange simple mensuration formulas, and to find equivalent algebraic expressions (for example, if  $P = 2L + 2W$ , then  $W = P/2 - L$ . If  $A = \pi r^2$  then  $r = \sqrt{A/\pi}$  for  $r > 0$ ).

They solve simple equations (for example,  $5x + 7 = 23$ ,  $1.4x - 1.6 = 8.3$ , and  $4x^2 - 3 = 13$ ) using tables, graphs and inverse operations. They recognise and use inequality symbols.

Students represent a function by a table of values, a graph, and by a rule. They describe and specify the independent variable of a function and its domain, and the dependent variable and its range. They construct tables of values and graphs for linear functions. They use linear and other functions such as  $f(x) = 2x - 4$ ,  $xy = 24$ ,  $y = 2^x$  and  $y = x^2 - 3$  that model various situations.

## Working mathematically

At Level 5, students formulate conjectures and follow simple mathematical deductions (for example, if the side length of a cube is doubled, then the surface area increases by a factor of four, and the volume increases by a factor of eight).

Students use variables in general mathematical statements. They substitute numbers for variables (for example, in equations, identities and formulas).

Students explain and calculate geometric propositions (for example, by varying the location of key points and/or lines in a construction).

Students develop simple mathematical models for real situations. They develop generalisations by abstracting the features from situations and expressing these in words and symbols. They predict using interpolation (working with what is already known) and extrapolation (working beyond what is already known).

# Level 6

## Learning focus

As students work towards the achievement of Level 6 standards in Mathematics, they extend their use of mathematical models to a wide range of familiar and unfamiliar contexts.

In *Number*, students investigate familiar and unfamiliar situations and contexts involving the use of all types of real numbers. They apply mental and visual forms of computation as appropriate. They compute using large or small numbers expressed in scientific notation. They apply the concepts of rounding to a given number of decimal places.

In *Space*, students investigate the properties of angles formed when lines (including parallel lines) intersect. They learn how space is enclosed in two and three dimensions, and systematically investigate the properties of boundaries and regions on surfaces with shapes such as polygons and circles, prisms and polyhedra (including the platonic solids). They learn to use the concepts of congruency and similarity to compare the size and shape of polygons. They investigate the properties of similar triangles.

Students investigate the relationship between position, length and angle using the Pythagorean relationship and trigonometry of right-angled triangles. They explore simple combinations of rotations, translations and reflections as transformations of geometric shapes in the plane. They investigate the paths (loci) formed by points, lines and shapes. Students use maps to investigate location and distances between places.

In *Measurement, chance and data*, students measure and estimate perimeter, area, surface area, mass, volume, capacity, angle, and the rates of speed. They use and convert units to suit the purpose of measurements. They use formulas (including trigonometry) to calculate perimeters, areas, angles in shapes, and the surface areas and volumes of solids. They use degrees, when applicable, for units of measurement of angles.

Students apply probability concepts to aspects of chance in life-like situations. They represent event spaces that show the nature of events and their probabilities, and use these representations to assist in the computation of the probabilities of independent and dependent events.

In *Structure*, students use the discrete and continuous data sets. Students apply algebraic properties (for example, associative, commutative, inverse and distributive) to expressions, formulas and equations.

Students work with functions (for example, linear, quadratic and exponential) and their graphs. They solve simultaneous linear equations using algebraic, numerical and graphical approaches.

When *Working mathematically*, students test propositions, and use formal mathematical arguments to test their truth, modifying them as required. They solve problems in a wide range of practical and theoretical contexts.

## Standards

### **Number**

At Level 6, students carry out arithmetic computations involving natural numbers, integers and finite decimals using mental and/or written algorithms. They perform computations involving very large or very small numbers in scientific notation (for example,  $0.0045 \times 0.000028 = 4.5 \times 10^{-3} \times 2.8 \times 10^{-5} = 1.26 \times 10^{-7}$ ).

Students carry out computations to a required accuracy in terms of decimal places and/or significant figures.

### **Space**

At Level 6, students recognise and describe boundaries, surfaces and interiors of common plane and three-dimensional shapes, including cylinders, spheres, cones, prisms and polyhedra. They recognise the features of circles (centre, radius, diameter, chord, arc, semi-circle, circumference, segment, sector and tangent) and use associated angle properties.

Students explore the properties of spheres.

Students use the conditions for shapes to be congruent or similar.

### **Measurement, chance and data**

At Level 6, students estimate and measure length, area, surface area, mass, volume, capacity and angle. They select and use appropriate units, converting between units as required. They calculate constant rates such as average speed. They interpret and use mensuration formulas for calculating the perimeter, surface area and volume of familiar two- and three-dimensional shapes and simple composites of these shapes. Students use Pythagoras' theorem and trigonometric ratios (sine, cosine and tangent) to obtain lengths of sides, angles and the area of right-angled triangles.

Students calculate summary statistics for centrality (mode, median and mean), spread (box plot, inter-quartile range) and association (by-eye estimation of the line of best fit from a scatter plot).

### **Structure**

At Level 6, students apply the algebraic properties (associative, commutative, identity, inverse and distributive) to computation with number, to rearrange formulas, rearrange and simplify algebraic expressions involving real variables. They verify the equivalence or otherwise of algebraic expressions (linear, square, cube).

Students identify and represent linear and quadratic functions in graphs (all four quadrants of the Cartesian coordinate system) with consideration of independent and dependent variables, domain and range.

They recognise and explain the roles of the relevant constants in the relationships  $f(x) = ax + c$ , with reference to gradient and y axis intercept,  $f(x) = a(x + b)^2 + c$  and  $f(x) = ca^x$ .

They solve equations of the form  $f(x) = k$ , where  $k$  is a real constant (for example,  $x(x + 5) = 100$ ) and simultaneous linear equations in two variables (for example,  $\{2x - 3y = -4$  and  $5x + 6y = 27\}$ ) using algebraic, and numerical methods (systematic guess, check and refine or bisection).

### **Working mathematically**

At Level 6, students choose and use mathematical models and procedures to investigate and solve problems set in a wide range of practical and theoretical contexts (for example, measurement formulas for the volumes of various three dimensional objects).