

Grade 6

[C] Communication	[PS] Problem Solving
[CN] Connections	[R] Reasoning
[ME] Mental Mathematics and Estimation	[T] Technology
	[V] Visualization

Strand: Number	General Learning Outcome: Develop number sense
Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
6.N.1. Demonstrate an understanding of place value for numbers <ul style="list-style-type: none"> ■ greater than one million ■ less than one-thousandth [C, CN, R, T]	<ul style="list-style-type: none"> ■ Explain how the pattern of the place value system (e.g., the repetition of ones, tens, and hundreds) makes it possible to read and write numerals for numbers of any magnitude. ■ Provide examples of where large numbers and small decimals are used (e.g., media, science, medicine, technology).
6.N.2. Solve problems involving large numbers, using technology. [ME, PS, T]	<ul style="list-style-type: none"> ■ Identify which operation is necessary to solve a problem and solve it. ■ Determine the reasonableness of an answer. ■ Estimate the answer and solve a problem. ■ Identify and correct errors in a solution to a problem that involves large numbers.
6.N.3. Demonstrate an understanding of factors and multiples by <ul style="list-style-type: none"> ■ determining multiples and factors of numbers less than 100 ■ identifying prime and composite numbers ■ solving problems involving factors or multiples [PS, R, V]	<ul style="list-style-type: none"> ■ Identify multiples for a number and explain the strategy used to identify them. ■ Determine all the whole-number factors of a number using arrays. ■ Identify the factors for a number and explain the strategy used (e.g., concrete or visual representations, repeated division by prime numbers or factor trees). ■ Identify common factors and common multiples for 2 or 3 numbers. ■ Provide an example of a prime number and explain why it is a prime number. ■ Provide an example of a composite number and explain why it is a composite number. ■ Sort a set of numbers as prime and composite. ■ Solve a problem involving factors, multiples, the largest common factor or the lowest common multiple. ■ Explain why 0 and 1 are neither prime nor composite.

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Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense
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Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
6.N.4. Relate improper fractions to mixed numbers. [CN, ME, R, V]	<ul style="list-style-type: none"> ■ Demonstrate using models that an improper fraction represents a number greater than 1. ■ Express improper fractions as mixed numbers. ■ Express mixed numbers as improper fractions. ■ Place a set of fractions, including mixed numbers and improper fractions, on a horizontal or vertical number line, and explain strategies used to determine position.
6.N.5. Demonstrate an understanding of ratio, concretely, pictorially, and symbolically. [C, CN, PS, R, V]	<ul style="list-style-type: none"> ■ Provide a concrete or pictorial representation for a ratio. ■ Write a ratio from a concrete or pictorial representation. ■ Express a ratio in multiple forms, such as 3:5, $\frac{3}{5}$, or 3 to 5. ■ Identify and describe ratios from real-life contexts and record them symbolically. ■ Explain the part/whole and part/part ratios of a set (e.g., for a group of 3 girls and 5 boys, explain the ratios 3:5, 3:8, and 5:8). ■ Solve a problem involving ratio.
6.N.6. Demonstrate an understanding of percent (limited to whole numbers), concretely, pictorially, and symbolically. [C, CN, PS, R, V]	<ul style="list-style-type: none"> ■ Explain that “percent” means “out of 100.” ■ Explain that percent is the ratio of a certain number of units to 100 units. ■ Use concrete materials and pictorial representations to illustrate a percent. ■ Record the percent displayed in a concrete or pictorial representation. ■ Express a percent as a fraction and a decimal. ■ Identify and describe percents from real-life contexts and record them symbolically. ■ Solve a problem involving percents.

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Strand: Number <i>(continued)</i>	General Learning Outcome: Develop number sense
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Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
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<p>6.N.7. Demonstrate an understanding of integers, concretely, pictorially, and symbolically. [C, CN, R, V]</p>	<ul style="list-style-type: none"> ■ Extend a horizontal or vertical number line by adding numbers less than zero and explain the pattern on each side of zero. ■ Place a set of integers on a horizontal or vertical number line and explain how integers are ordered. ■ Describe contexts in which integers are used (e.g., on a thermometer). ■ Compare two integers, represent their relationship using the symbols $<$, $>$, and $=$, and verify using a horizontal or vertical number line. ■ Order a set of integers in ascending or descending order.
<p>6.N.8. Demonstrate an understanding of multiplication and division of decimals (involving 1-digit whole-number multipliers, 1-digit natural number divisors, and multipliers and divisors that are multiples of 10), concretely, pictorially, and symbolically, by</p> <ul style="list-style-type: none"> ■ using personal strategies ■ using the standard algorithms ■ using estimation ■ solving problems <p>[C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Estimate a product using front-end estimation (e.g., for $15.205 \text{ m} \times 4$, think $15 \text{ m} \times 4$, so the product is greater than 60 m), and place the decimal in the appropriate place. ■ Estimate a quotient using front-end estimation (e.g., for $\\$26.83 \div 4$, think $24 \div 4$, so the quotient is greater than \$6), and place the decimal in the appropriate place. ■ Predict products and quotients of decimals using estimation strategies. ■ Identify and correct errors of decimal point placement in a product or quotient by estimating. ■ Solve a problem that involves multiplication and division of decimals using multipliers from 0 to 9 and divisors from 1 to 9. ■ Use mental math to determine products or quotients involving decimals when the multiplier or divisor is a multiple of 10 (e.g., $2.47 \times 10 = 24.7$; $31.9 \div 100 = 0.319$). ■ Model and explain the relationship that exists between an algorithm, place value, and number properties. ■ Determine products and quotients using the standard algorithms of vertical multiplication (numbers arranged vertically and multiplied using single digits which are added to form a final product) and long division (the multiples of the divisor are subtracted from the dividend). ■ Solve multiplication and division problems in context using personal strategies, and record the process. ■ Refine personal strategies, such as mental math, to increase their efficiency when appropriate (e.g., $4.46 \div 2$ think $446 \div 2 = 223$, and then use front-end estimation to determine the placement of the decimal 2.23).
<p>6.N.9. Explain and apply the order of operations, excluding exponents (limited to whole numbers). [CN, ME, PS, T]</p>	<ul style="list-style-type: none"> ■ Demonstrate and explain with examples why there is a need to have a standardized order of operations. ■ Apply the order of operations to solve multi-step problems with or without technology.

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	[V] Visualization

Strand: Patterns and Relations (Patterns)	General Learning Outcome: Use patterns to describe the world and solve problems.
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Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
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<p>6.PR.1. Demonstrate an understanding of the relationships within tables of values to solve problems. [C, CN, PS, R]</p>	<ul style="list-style-type: none"> ■ Generate values in one column of a table of values, values in the other column, and a pattern rule. ■ State, using mathematical language, the relationship in a table of values. ■ Create a concrete or pictorial representation of the relationship shown in a table of values. ■ Predict the value of an unknown term using the relationship in a table of values and verify the prediction. ■ Formulate a rule to describe the relationship between two columns of numbers in a table of values. ■ Identify missing elements in a table of values. ■ Identify and correct errors in a table of values. ■ Describe the pattern within each column of a table of values. ■ Create a table of values to record and reveal a pattern to solve a problem.
<p>6.PR.2. Represent and describe patterns and relationships using graphs and tables. [C, CN, ME, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Translate a pattern to a table of values and graph the table of values (limit to linear graphs with discrete elements). ■ Create a table of values from a pattern or a graph. ■ Describe, using everyday language, orally or in writing, the relationship shown on a graph.

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[CN] Connections	[R] Reasoning
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Strand: Patterns and Relations (Variables and Equations)	General Learning Outcome: Represent algebraic expressions in multiple ways.
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Specific Learning Outcomes
It is expected that students will:

Achievement Indicators
*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

<p>6.PR.3. Represent generalizations arising from number relationships using equations with letter variables. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Write and explain the formula for finding the perimeter of any rectangle. ■ Write and explain the formula for finding the area of any rectangle. ■ Develop and justify equations using letter variables that illustrate the commutative property of addition and multiplication (e.g., $a + b = b + a$ or $a \times b = b \times a$). ■ Describe the relationship in a table using a mathematical expression. ■ Represent a pattern rule using a simple mathematical expression, such as $4d$ or $2n + 1$.
<p>6.PR.4. Demonstrate and explain the meaning of preservation of equality, concretely, pictorially, and symbolically. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Model the preservation of equality for addition using concrete materials, such as a balance or using pictorial representations, and orally explain the process. ■ Model the preservation of equality for subtraction using concrete materials, such as a balance or using pictorial representations, and orally explain the process. ■ Model the preservation of equality for multiplication using concrete materials, such as a balance or using pictorial representations, and orally explain the process. ■ Model the preservation of equality for division using concrete materials, such as a balance or using pictorial representations, and orally explain the process. ■ Write equivalent forms of an equation by applying the preservation of equality, and verify using concrete materials [e.g., $3b = 12$ is the same as $3b + 5 = 12 + 5$ or $2r = 7$ is the same as $3(2r) = 3(7)$].

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Strand: Shape and Space (Measurement)	General Learning Outcome: Use direct or indirect measurement to solve problems.
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Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
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<p>6.SS.1. Demonstrate an understanding of angles by</p> <ul style="list-style-type: none"> ■ identifying examples of angles in the environment ■ classifying angles according to their measure ■ estimating the measure of angles using 45°, 90°, and 180° as reference angles ■ determining angle measures in degrees ■ drawing and labelling angles when the measure is specified <p>[C, CN, ME, V]</p>	<ul style="list-style-type: none"> ■ Provide examples of angles found in the environment. ■ Classify a set of angles according to their measure (e.g., acute, right, obtuse, straight, reflex). ■ Sketch 45°, 90°, and 180° angles without the use of a protractor, and describe the relationship among them. ■ Estimate the measure of an angle using 45°, 90°, and 180° as reference angles. ■ Measure, using a protractor, angles in various orientations. ■ Draw and label an angle in various orientations using a protractor. ■ Describe the measure of an angle as the measure of rotation of one of its sides. ■ Describe the measure of angles as the measure of an interior angle of a polygon.
<p>6.SS.2. Demonstrate that the sum of interior angles is</p> <ul style="list-style-type: none"> ■ 180° in a triangle ■ 360° in a quadrilateral <p>[C, R]</p>	<ul style="list-style-type: none"> ■ Explain, using models, that the sum of the interior angles of a triangle is the same for all triangles. ■ Explain, using models, that the sum of the interior angles of a quadrilateral is the same for all quadrilaterals.

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[C] Communication	[PS] Problem Solving
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[ME] Mental Mathematics and Estimation	[T] Technology
	[V] Visualization

Strand: Shape and Space (Measurement) <i>(continued)</i>	General Learning Outcome: Use direct or indirect measurement to solve problems.
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Specific Learning Outcomes
It is expected that students will:

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

- 6.SS.3. Develop and apply a formula for determining the
- perimeter of polygons
 - area of rectangles
 - volume of right rectangular prisms
- [C, CN, PS, R, V]

- Explain, using models, how the perimeter of any polygon can be determined.
- Generalize a rule for determining the perimeter of polygons.
- Explain, using models, how the area of any rectangle can be determined.
- Generalize a rule for determining the area of rectangles.
- Explain, using models, how the volume of any right rectangular prism can be determined.
- Generalize a rule for determining the volume of right rectangular prisms.
- Solve a problem involving the perimeter of polygons, the area of rectangles, or the volume of right rectangular prisms.

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[C] Communication	[PS] Problem Solving
[CN] Connections	[R] Reasoning
[ME] Mental Mathematics and Estimation	[T] Technology
	[V] Visualization

Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Learning Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
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Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
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6.SS.4. Construct and compare triangles, including <ul style="list-style-type: none"> ■ scalene ■ isosceles ■ equilateral ■ right ■ obtuse ■ acute in different orientations. [C, PS, R, V]	<ul style="list-style-type: none"> ■ Sort a set of triangles according to the length of the sides. ■ Sort a set of triangles according to the measures of the interior angles. ■ Identify the characteristics of a set of triangles according to their sides or their interior angles. ■ Sort a set of triangles and explain the sorting rule. ■ Draw a triangle (e.g., scalene). ■ Replicate a triangle in a different orientation and show that the two are congruent.
6.SS.5. Describe and compare the sides and angles of regular and irregular polygons. [C, PS, R, V]	<ul style="list-style-type: none"> ■ Sort a set of 2-D shapes into polygons and non-polygons, and explain the sorting rule. ■ Demonstrate congruence (sides to sides and angles to angles) in a regular polygon by superimposing. ■ Demonstrate congruence (sides to sides and angles to angles) in a regular polygon by measuring. ■ Demonstrate that the sides of a regular polygon are of the same length and that the angles of a regular polygon are of the same measure. ■ Sort a set of polygons as regular or irregular and justify the sorting. ■ Identify and describe regular and irregular polygons in the environment.

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[C] Communication	[PS] Problem Solving
[CN] Connections	[R] Reasoning
[ME] Mental Mathematics and Estimation	[T] Technology
	[V] Visualization

Strand: Shape and Space (Transformations)	General Learning Outcome: Describe and analyze position and motion of objects and shapes.
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Specific Learning Outcomes
It is expected that students will:

Achievement Indicators

*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

<p>6.SS.6. Perform a combination of transformations (translations, rotations, or reflections) on a single 2-D shape, and draw and describe the image. [C, CN, PS, T, V]</p>	<ul style="list-style-type: none"> ■ Demonstrate that a 2-D shape and its transformation image are congruent. ■ Model a set of successive translations, successive rotations, or successive reflections of a 2-D shape. ■ Model a combination of two different types of transformations of a 2-D shape. ■ Draw and describe a 2-D shape and its image, given a combination of transformations. ■ Describe the transformations performed on a 2-D shape to produce a given image. ■ Model a set of successive transformations (translation, rotation, or reflection) of a 2-D shape. ■ Perform and record one or more transformations of a 2-D shape that will result in a given image.
<p>6.SS.7. Perform a combination of successive transformations of 2-D shapes to create a design, and identify and describe the transformations. [C, CN, T, V]</p>	<ul style="list-style-type: none"> ■ Analyze a design created by transforming one or more 2-D shapes, and identify the original shape and the transformations used to create the design. ■ Create a design using one or more 2-D shapes and describe the transformations used.

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[C] Communication	[PS] Problem Solving
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Strand: Shape and Space (Transformations) <i>(continued)</i>	General Learning Outcome: Describe and analyze position and motion of objects and shapes.
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Specific Learning Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
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<p>6.SS.8. Identify and plot points in the first quadrant of a Cartesian plane using whole-number ordered pairs. [C, CN, V]</p>	<ul style="list-style-type: none"> ■ Label the axes of the first quadrant of a Cartesian plane and identify the origin. ■ Plot a point in the first quadrant of a Cartesian plane given its ordered pair. ■ Match points in the first quadrant of a Cartesian plane with their corresponding ordered pair. ■ Plot points in the first quadrant of a Cartesian plane with intervals of 1, 2, 5, or 10 on its axes, given whole-number ordered pairs. ■ Draw shapes or designs, given ordered pairs in the first quadrant of a Cartesian plane. ■ Determine the distance between points along horizontal and vertical lines in the first quadrant of a Cartesian plane. ■ Draw shapes or designs in the first quadrant of a Cartesian plane and identify the points used to produce them.
<p>6.SS.9. Perform and describe single transformations of a 2-D shape in the first quadrant of a Cartesian plane (limited to whole-number vertices). [C, CN, PS, T, V]</p>	<ul style="list-style-type: none"> ■ Identify the coordinates of the vertices of a 2-D shape (limited to the first quadrant of a Cartesian plane). ■ Perform a transformation on a given 2-D shape and identify the coordinates of the vertices of the image (limited to the first quadrant). ■ Describe the positional change of the vertices of a 2-D shape to the corresponding vertices of its image as a result of a transformation (limited to first quadrant).

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[C] Communication	[PS] Problem Solving
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Strand: Statistics and Probability (Data Analysis)	General Learning Outcome: Collect, display, and analyze data to solve problems.
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Specific Learning Outcomes
It is expected that students will:

Achievement Indicators
*The following set of indicators **may** be used to determine whether students have met the corresponding specific outcome.*

<p>6.SP.1. Create, label, and interpret line graphs to draw conclusions. [C, CN, PS, R, V]</p>	<ul style="list-style-type: none"> ■ Determine the common attributes (title, axes, and intervals) of line graphs by comparing a set of line graphs. ■ Determine whether a set of data can be represented by a line graph (continuous data) or a series of points (discrete data), and explain why. ■ Create a line graph from a table of values or set of data. ■ Interpret a line graph to draw conclusions.
<p>6.SP.2. Select, justify, and use appropriate methods of collecting data, including</p> <ul style="list-style-type: none"> ■ questionnaires ■ experiments ■ databases ■ electronic media <p>[C, PS, T]</p>	<ul style="list-style-type: none"> ■ Select a method for collecting data to answer a question, and justify the choice. ■ Design and administer a questionnaire for collecting data to answer a question and record the results. ■ Answer a question by performing an experiment, recording the results, and drawing a conclusion. ■ Explain when it is appropriate to use a database as a source of data. ■ Gather data for a question by using electronic media, including selecting data from databases.
<p>6.SP.3. Graph collected data and analyze the graph to solve problems. [C, CN, PS]</p>	<ul style="list-style-type: none"> ■ Select a type of graph for displaying a set of collected data, and justify the choice of graph. ■ Solve a problem by graphing data and interpreting the resulting graph.

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Strand: Statistics and Probability (Chance and Uncertainty)	General Learning Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.
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<p>6.SP.4. Demonstrate an understanding of probability by</p> <ul style="list-style-type: none"> ■ identifying all possible outcomes of a probability experiment ■ differentiating between experimental and theoretical probability ■ determining the theoretical probability of outcomes in a probability experiment ■ determining the experimental probability of outcomes in a probability experiment ■ comparing experimental results with the theoretical probability for an experiment <p>[C, ME, PS, T]</p>	<ul style="list-style-type: none"> ■ List the possible outcomes of a probability experiment, such as <ul style="list-style-type: none"> ■ tossing a coin ■ rolling a die with any number of sides ■ spinning a spinner with any number of sectors ■ Determine the theoretical probability of an outcome occurring for a probability experiment. ■ Predict the probability of an outcome occurring for a probability experiment by using theoretical probability. ■ Conduct a probability experiment, with or without technology, and compare the experimental results to the theoretical probability. ■ Explain that as the number of trials in a probability experiment increases, the experimental probability approaches theoretical probability of a particular outcome. ■ Distinguish between theoretical probability and experimental probability, and explain the differences.
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