Apprenticeship and Workplace Mathematics 10 to 12 (2008)

APPRENTICESHIP AND WORKPLACE MATHEMATICS GRADE 10

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

Measurement	**General Outcome:** Develop spatial sense through direct and indirect measurement.
Specific 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.*
A1. Demonstrate an understanding of the Système International (SI) by: • describing the relationships of the units for length, area, volume, capacity, mass and temperature • applying strategies to convert SI units to imperial units. [C, CN, ME, V]	*(It is intended that this outcome be limited to the base units and the prefixes milli, centi, deci, deca, hecto and kilo.)* 1.1 Explain how the SI system was developed, and explain its relationship to base ten. 1.2 Identify the base units of measurement in the SI system, and determine the relationship among the related units of each type of measurement. 1.3 Identify contexts that involve the SI system. 1.4 Match the prefixes used for SI units of measurement with the powers of ten. 1.5 Explain, using examples, how and why decimals are used in the SI system. 1.6 Provide an approximate measurement in SI units for a measurement given in imperial units; e.g., 1 inch is approximately 2.5 cm. 1.7 Write a given linear measurement expressed in one SI unit in another SI unit. 1.8 Convert a given measurement from SI to imperial units by using proportional reasoning (including formulas); e.g., Celsius to Fahrenheit, centimetres to inches.
A2. Demonstrate an understanding of the imperial system by: • describing the relationships of the units for length, area, volume, capacity, mass and temperature • comparing the American and British imperial units for capacity • applying strategies to convert imperial units to SI units. [C, CN, ME, V]	2.1 Explain how the imperial system was developed. 2.2 Identify commonly used units in the imperial system, and determine the relationships among the related units. 2.3 Identify contexts that involve the imperial system. 2.4 Explain, using examples, how and why fractions are used in the imperial system. 2.5 Compare the American and British imperial measurement systems; e.g., gallons, bushels, tons. 2.6 Provide an approximate measure in imperial units for a measurement given in SI units; e.g., 1 litre is approximately 1/4 US gallon. 2.7 Write a given linear measurement expressed in one imperial unit in another imperial unit. 2.8 Convert a given measure from imperial to SI units by using proportional reasoning (including formulas); e.g., Fahrenheit to Celsius, inches to centimetres.

[C] Communication	**[PS]** Problem Solving
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Measurement (continued)	**General Outcome:** Develop spatial sense through direct and indirect measurement.
Specific 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.*
A3. Solve and verify problems that involve SI and imperial linear measurements, including decimal and fractional measurements. [CN, ME, PS, V]	*(It is intended that the four arithmetic operations on decimals and fractions be integrated into the problems.)* 3.1 Identify a referent for a given common SI or imperial unit of linear measurement. 3.2 Estimate a linear measurement, using a referent. 3.3 Measure inside diameters, outside diameters, lengths, widths of various given objects, and distances, using various measuring instruments. 3.4 Estimate the dimensions of a given regular 3-D object or 2-D shape, using a referent; e.g., the height of the desk is about three rulers long, so the desk is approximately three feet high. 3.5 Solve a linear measurement problem including perimeter, circumference, and length + width + height (used in shipping and air travel). 3.6 Determine the operation that should be used to solve a linear measurement problem. 3.7 Provide an example of a situation in which a fractional linear measurement would be divided by a fraction. 3.8 Determine, using a variety of strategies, the midpoint of a linear measurement such as length, width, height, depth, diagonal and diameter of a 3-D object, and explain the strategies. 3.9 Determine if a solution to a problem that involves linear measurement is reasonable.

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Measurement (continued)	**General Outcome:** Develop spatial sense through direct and indirect measurement.
Specific 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.*
A4. Solve problems that involve SI and imperial area measurements of regular, composite and irregular 2-D shapes and 3-D objects, including decimal and fractional measurements, and verify the solutions. [ME, PS, R, V]	*(It is intended that the four arithmetic operations on decimals and fractions be integrated into the problems.)* 4.1 Identify and compare referents for area measurements in SI and imperial units. 4.2 Estimate an area measurement, using a referent. 4.3 Identify a situation where a given SI or imperial area unit would be used. 4.4 Estimate the area of a given regular, composite or irregular 2-D shape, using an SI square grid and an imperial square grid. 4.5 Solve a contextual problem that involves the area of a regular, a composite or an irregular 2-D shape. 4.6 Write a given area measurement expressed in one SI unit squared in another SI unit squared. 4.7 Write a given area measurement expressed in one imperial unit squared in another imperial unit squared. 4.8 Solve a problem, using formulas for determining the areas of regular, composite and irregular 2-D shapes, including circles. 4.9 Solve a problem that involves determining the surface area of 3-D objects, including right cylinders and cones. 4.10 Explain, using examples, the effect of changing the measurement of one or more dimensions on area and perimeter of rectangles. 4.11 Determine if a solution to a problem that involves an area measurement is reasonable.

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Geometry	**General Outcome:** Develop spatial sense.
Specific 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.*
B1. Analyze puzzles and games that involve spatial reasoning, using problem-solving strategies. [C, CN, PS, R]	*(It is intended that this outcome be integrated throughout the course by using sliding, rotation, construction, deconstruction and similar puzzles and games.)* 1.1 Determine, explain and verify a strategy to solve a puzzle or to win a game; e.g., • guess and check • look for a pattern • make a systematic list • draw or model • eliminate possibilities • simplify the original problem • work backward • develop alternative approaches. 1.2 Identify and correct errors in a solution to a puzzle or in a strategy for winning a game. 1.3 Create a variation on a puzzle or a game, and describe a strategy for solving the puzzle or winning the game.
B2. Demonstrate an understanding of the Pythagorean theorem by: • identifying situations that involve right triangles • verifying the formula • applying the formula • solving problems. [C, CN, PS, V]	2.1 Explain, using illustrations, why the Pythagorean theorem only applies to right triangles. 2.2 Verify the Pythagorean theorem, using examples and counterexamples, including drawings, concrete materials and technology. 2.3 Describe historical and contemporary applications of the Pythagorean theorem. 2.4 Determine if a given triangle is a right triangle, using the Pythagorean theorem. 2.5 Explain why a triangle with the side length ratio of 3:4:5 is a right triangle. 2.6 Explain how the ratio of 3:4:5 can be used to determine if a corner of a given 3-D object is square (90º) or if a given parallelogram is a rectangle. 2.7 Solve a problem, using the Pythagorean theorem.

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Geometry (continued)	**General Outcome:** Develop spatial sense.
Specific 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.*
B3. Demonstrate an understanding of similarity of convex polygons, including regular and irregular polygons. [C, CN, PS, V]	3.1 Determine, using angle measurements, if two or more regular or irregular polygons are similar. 3.2 Determine, using ratios of side lengths, if two or more regular or irregular polygons are similar. 3.3 Explain why two given polygons are not similar. 3.4 Explain the relationships between the corresponding sides of two polygons that have corresponding angles of equal measure. 3.5 Draw a polygon that is similar to a given polygon. 3.6 Explain why two or more right triangles with a shared acute angle are similar. 3.7 Solve a contextual problem that involves similarity of polygons.
B4. Demonstrate an understanding of primary trigonometric ratios (sine, cosine, tangent) by: • applying similarity to right triangles • generalizing patterns from similar right triangles • applying the primary trigonometric ratios • solving problems. [CN, PS, R, T, V]	4.1 Show, for a specified acute angle in a set of similar right triangles, that the ratios of the length of the side opposite to the length of the side adjacent are equal, and generalize a formula for the tangent ratio. 4.2 Show, for a specified acute angle in a set of similar right triangles, that the ratios of the length of the side opposite to the length of the hypotenuse are equal, and generalize a formula for the sine ratio. 4.3 Show, for a specified acute angle in a set of similar right triangles, that the ratios of the length of the side adjacent to the length of the hypotenuse are equal, and generalize a formula for the cosine ratio. 4.4 Identify situations where the trigonometric ratios are used for indirect measurement of angles and lengths. 4.5 Solve a contextual problem that involves right triangles, using the primary trigonometric ratios. 4.6 Determine if a solution to a problem that involves primary trigonometric ratios is reasonable.

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Geometry (continued)	**General Outcome:** Develop spatial sense.
Specific 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.*
B5. Solve problems that involve parallel, perpendicular and transversal lines, and pairs of angles formed between them. [C, CN, PS, V]	5.1 Sort a set of lines as perpendicular, parallel or neither, and justify this sorting. 5.2 Illustrate and describe complementary and supplementary angles. 5.3 Identify, in a set of angles, adjacent angles that are not complementary or supplementary. 5.4 Identify and name pairs of angles formed by parallel lines and a transversal, including corresponding angles, vertically opposite angles, alternate interior angles, alternate exterior angles, interior angles on same side of transversal and exterior angles on same side of transversal. 5.5 Explain and illustrate the relationships of angles formed by parallel lines and a transversal. 5.6 Explain, using examples, why the angle relationships do not apply when the lines are not parallel. 5.7 Determine if lines or planes are perpendicular or parallel, e.g., wall perpendicular to floor, and describe the strategy used. 5.8 Determine the measures of angles involving parallel lines and a transversal, using angle relationships. 5.9 Solve a contextual problem that involves angles formed by parallel lines and a transversal (including perpendicular transversals).
B6. Demonstrate an understanding of angles, including acute, right, obtuse, straight and reflex, by: • drawing • replicating and constructing • bisecting • solving problems. [C, ME, PS, T, V]	6.1 Draw and describe angles with various measures, including acute, right, straight, obtuse and reflex angles. 6.2 Identify referents for angles. 6.3 Sketch a given angle. 6.4 Estimate the measure of a given angle, using 22.5°, 30°, 45°, 60°, 90° and 180° as referent angles. 6.5 Measure, using a protractor, angles in various orientations. 6.6 Explain and illustrate how angles can be replicated in a variety of ways; e.g., Mira, protractor, compass and straightedge, carpenter's square, dynamic geometry software. 6.7 Replicate angles in a variety of ways, with and without technology. 6.8 Bisect an angle, using a variety of methods. 6.9 Solve a contextual problem that involves angles.

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Number	**General Outcome:** Develop number sense and critical thinking skills.
Specific 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.*
C1. Solve problems that involve unit pricing and currency exchange, using proportional reasoning. [CN, ME, PS, R]	1.1 Compare the unit price of two or more given items. 1.2 Solve problems that involve determining the best buy, and explain the choice in terms of the cost as well as other factors, such as quality and quantity. 1.3 Compare, using examples, different sales promotion techniques; e.g., deli meat at $2 per 100 g seems less expensive than $20 per kilogram. 1.4 Determine the percent increase or decrease for a given original and new price. 1.5 Solve, using proportional reasoning, a contextual problem that involves currency exchange. 1.6 Explain the difference between the selling rate and purchasing rate for currency exchange. 1.7 Explain how to estimate the cost of items in Canadian currency while in a foreign country, and explain why this may be important. 1.8 Convert between Canadian currency and foreign currencies, using formulas, charts or tables.

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Number (continued)	**General Outcome:** Develop number sense and critical thinking skills.
Specific 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.*
C2. Demonstrate an understanding of income, including: • wages • salary • contracts • commissions • piecework to calculate gross pay and net pay. [C, CN, R, T]	2.1 Describe, using examples, various methods of earning income. 2.2 Identify and list jobs that commonly use different methods of earning income; e.g., hourly wage, wage and tips, salary, commission, contract, bonus, shift premiums. 2.3 Determine in decimal form, from a time schedule, the total time worked in hours and minutes, including time and a half and/or double time. 2.4 Determine gross pay from given or calculated hours worked when given: • the base hourly wage, with and without tips • the base hourly wage, plus overtime (time and a half, double time). 2.5 Determine gross pay for earnings acquired by: • base wage, plus commission • single commission rate. 2.6 Explain why gross pay and net pay are not the same. 2.7 Determine the Canadian Pension Plan (CPP), Employment Insurance (EI) and income tax deductions for a given gross pay. 2.8 Determine net pay when given deductions; e.g., health plans, uniforms, union dues, charitable donations, payroll tax. 2.9 Investigate, with technology, "what if …" questions related to changes in income; e.g., "What if there is a change in the rate of pay?" 2.10 Identify and correct errors in a solution to a problem that involves gross or net pay. 2.11 Describe the advantages and disadvantages for a given method of earning income; e.g., hourly wage, tips, piecework, salary, commission, contract work.

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Algebra	**General Outcome:** Develop algebraic reasoning.
Specific 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.*
D1. Solve problems that require the manipulation and application of formulas related to: • perimeter • area • the Pythagorean theorem • primary trigonometric ratios • income. [C, CN, ME, PS, R]	*(It is intended that this outcome be integrated throughout the course.)* 1.1 Solve a contextual problem that involves the application of a formula that does not require manipulation. 1.2 Solve a contextual problem that involves the application of a formula that requires manipulation. 1.3 Explain and verify why different forms of the same formula are equivalent. 1.4 Describe, using examples, how a given formula is used in a trade or an occupation. 1.5 Create and solve a contextual problem that involves a formula. 1.6 Identify and correct errors in a solution to a problem that involves a formula.

APPRENTICESHIP AND WORKPLACE MATHEMATICS GRADE 11

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

Measurement	**General Outcome:** Develop spatial sense through direct and indirect measurement.
Specific 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.*
A1. Solve problems that involve SI and imperial units in surface area measurements and verify the solutions. [C, CN, ME, PS, V]	1.1 Explain, using examples, the difference between volume and surface area. 1.2 Explain, using examples, including nets, the relationship between area and surface area. 1.3 Explain how a referent can be used to estimate surface area. 1.4 Estimate the surface area of a 3-D object. 1.5 Illustrate, using examples, the effect of dimensional changes on surface area. 1.6 Solve a contextual problem that involves the surface area of 3-D objects, including spheres, and that requires the manipulation of formulas.

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Measurement (continued)	**General Outcome:** Develop spatial sense through direct and indirect measurement.
Specific 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.*
A2. Solve problems that involve SI and imperial units in volume and capacity measurements. [C, CN, ME, PS, V]	2.1 Explain, using examples, the difference between volume and capacity. 2.2 Identify and compare referents for volume and capacity measurements in SI and imperial units. 2.3 Estimate the volume or capacity of a 3-D object or container, using a referent. 2.4 Identify a situation where a given SI or imperial volume unit would be used. 2.5 Solve problems that involve the volume of 3-D objects and composite 3-D objects in a variety of contexts. 2.6 Solve a problem that involves the capacity of containers. 2.7 Write a given volume measurement expressed in one SI unit cubed in another SI unit cubed. 2.8 Write a given volume measurement expressed in one imperial unit cubed in another imperial unit cubed. 2.9 Determine the volume of prisms, cones, cylinders, pyramids, spheres and composite 3-D objects, using a variety of measuring tools such as rulers, tape measures, calipers and micrometers. 2.10 Determine the capacity of prisms, cones, pyramids, spheres and cylinders, using a variety of measuring tools and methods, such as graduated cylinders, measuring cups, measuring spoons and displacement. 2.11 Describe the relationship between the volumes of: • cones and cylinders with the same base and height • pyramids and prisms with the same base and height. 2.12 Illustrate, using examples, the effect of dimensional changes on volume. 2.13 Solve a contextual problem that involves the volume of a 3-D object, including composite 3-D objects, or the capacity of a container. 2.14 Solve a contextual problem that involves the volume of a 3-D object and requires the manipulation of formulas.

[C] Communication	**[PS]** Problem Solving
[CN] Connections	**[R]** Reasoning
[ME] Mental Mathematics and Estimation	**[T]** Technology
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Geometry	**General Outcome:** Develop spatial sense.
Specific 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.*
B1. Solve problems that involve two and three right triangles. [CN, PS, T, V]	1.1 Identify all of the right triangles in a given illustration for a context. 1.2 Determine if a solution to a problem that involves two or three right triangles is reasonable. 1.3 Sketch a representation of a given description of a problem in a 2-D or 3-D context. 1.4 Solve a contextual problem that involves angles of elevation or angles of depression. 1.5 Solve a contextual problem that involves two or three right triangles, using the primary trigonometric ratios.
B2. Solve problems that involve scale. [PS, R, T, V]	2.1 Describe contexts in which a scale representation is used. 2.2 Determine, using proportional reasoning, the dimensions of an object from a given scale drawing or model. 2.3 Construct a model of a 3-D object, given the scale. 2.4 Draw, with and without technology, a scale diagram of a given object. 2.5 Solve a contextual problem that involves scale.
B3. Model and draw 3-D objects and their views. [CN, R, V]	3.1 Draw a 2-D representation of a given 3-D object. 3.2 Draw, using isometric dot paper, a given 3-D object. 3.3 Draw to scale top, front and side views of a given 3-D object. 3.4 Construct a model of a 3-D object, given the top, front and side views. 3.5 Draw a 3-D object, given the top, front and side views. 3.6 Determine if given views of a 3-D object represent a given object, and explain the reasoning. 3.7 Identify the point of perspective of a given one-point perspective drawing of a 3-D object. 3.8 Draw a one-point perspective view of a given 3-D object.

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Geometry (continued)	**General Outcome:** Develop spatial sense.
Specific 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.*
B4. Draw and describe exploded views, component parts and scale diagrams of simple 3-D objects. [CN, V]	*(It is intended that the simple 3-D objects come from contexts such as flat-packed furniture or sewing patterns.)* 4.1 Draw the components of a given exploded diagram, and explain their relationship to the original 3-D object. 4.2 Sketch an exploded view of a 3-D object to represent the components. 4.3 Draw to scale the components of a 3-D object. 4.4 Sketch a 2-D representation of a 3-D object, given its exploded view.

[C] Communication	**[PS]** Problem Solving
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Number	**General Outcome:** Develop number sense and critical thinking skills.
Specific 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.*
C1. Analyze puzzles and games that involve numerical reasoning, using problem-solving strategies. [C, CN, PS, R]	*(It is intended that this outcome be integrated throughout the course by using puzzles and games such as cribbage, magic squares and Kakuro.)* 1.1 Determine, explain and verify a strategy to solve a puzzle or to win a game; e.g., • guess and check • look for a pattern • make a systematic list • draw or model • eliminate possibilities • simplify the original problem • work backward • develop alternative approaches. 1.2 Identify and correct errors in a solution to a puzzle or in a strategy for winning a game. 1.3 Create a variation on a puzzle or a game, and describe a strategy for solving the puzzle or winning the game.
C2. Solve problems that involve personal budgets. [CN, PS, R, T]	2.1 Identify income and expenses that should be included in a personal budget. 2.2 Explain considerations that must be made when developing a budget; e.g., prioritizing, recurring and unexpected expenses. 2.3 Create a personal budget based on given income and expense data. 2.4 Collect income and expense data, and create a budget. 2.5 Modify a budget to achieve a set of personal goals. 2.6 Investigate and analyze, with or without technology, "what if …" questions related to personal budgets.

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Number (continued)	**General Outcome:** Develop number sense and critical thinking skills.
Specific 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.*
C3. Demonstrate an understanding of compound interest. [CN, ME, PS, T]	3.1 Solve a problem that involves simple interest, given three of the four values in the formula $I=Prt$. 3.2 Compare simple and compound interest, and explain their relationship. 3.3 Solve, using a formula, a contextual problem that involves compound interest. 3.4 Explain, using examples, the effect of different compounding periods on calculations of compound interest. 3.5 Estimate, using the Rule of 72, the time required for a given investment to double in value.
C4. Demonstrate an understanding of financial institution services used to access and manage finances. [C, CN, R, T]	4.1 Describe the type of banking services available from various financial institutions, such as online services. 4.2 Describe the types of accounts available at various financial institutions. 4.3 Identify the type of account that best meets the needs for a given set of criteria. 4.4 Identify and explain various automated teller machine (ATM) service charges. 4.5 Describe the advantages and disadvantages of online banking. 4.6 Describe the advantages and disadvantages of debit card purchases. 4.7 Describe ways that ensure the security of personal and financial information; e.g., passwords, encryption, protection of personal identification number (PIN) and other personal identity information.

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Number (continued)	**General Outcome:** Develop number sense and critical thinking skills.
Specific 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.*
C5. Demonstrate an understanding of credit options, including: • credit cards • loans. [CN, ME, PS, R]	5.1 Compare advantages and disadvantages of different types of credit options, including bank and store credit cards, personal loans, lines of credit, overdraft. 5.2 Make informed decisions and plans related to the use of credit, such as service charges, interest, payday loans and sales promotions, and explain the reasoning. 5.3 Describe strategies to use credit effectively, such as negotiating interest rates, planning payment timelines, reducing accumulated debt and timing purchases. 5.4 Compare credit card options from various companies and financial institutions. 5.5 Solve a contextual problem that involves credit cards or loans. 5.6 Solve a contextual problem that involves credit linked to sales promotions.

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Algebra	**General Outcome:** Develop algebraic reasoning.
Specific 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.*
D1. Solve problems that require the manipulation and application of formulas related to: • volume and capacity • surface area • slope and rate of change • simple interest • finance charges. [CN, PS, R]	1.1 Solve a contextual problem involving the application of a formula that does not require manipulation. 1.2 Solve a contextual problem involving the application of a formula that requires manipulation. 1.3 Explain and verify why different forms of the same formula are equivalent. 1.4 Describe, using examples, how a given formula is used in a trade or an occupation. 1.5 Create and solve a contextual problem that involves a formula. 1.6 Identify and correct errors in a solution to a problem that involves a formula.
D2. Demonstrate an understanding of slope: • as rise over run • as rate of change • by solving problems. [C, CN, PS, V]	2.1 Describe contexts that involve slope; e.g., ramps, roofs, road grade, flow rates within a tube, skateboard parks, ski hills. 2.2 Explain, using diagrams, the difference between two given slopes (e.g., a 3:1 and a 1:3 roof pitch), and describe the implications. 2.3 Describe the conditions under which a slope will be either 0 or undefined. 2.4 Explain, using examples and illustrations, slope as rise over run. 2.5 Verify that the slope of an object, such as a ramp or a roof, is constant. 2.6 Explain, using illustrations, the relationship between slope and angle of elevation; e.g., for a ramp with a slope of 7:100, the angle of elevation is approximately 4º. 2.7 Explain the implications, such as safety and functionality, of different slopes in a given context. 2.8 Explain, using examples and illustrations, slope as rate of change. 2.9 Solve a contextual problem that involves slope or rate of change.

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Algebra (continued)	**General Outcome:** Develop algebraic reasoning.
Specific 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.*
D3. Solve problems by applying proportional reasoning and unit analysis. [C, CN, PS, R]	3.1 Explain the process of unit analysis used to solve a problem (e.g., given km/h and time in hours, determine how many km; given revolutions per minute, determine the number of seconds per revolution). 3.2 Solve a problem, using unit analysis. 3.3 Explain, using an example, how unit analysis and proportional reasoning are related; e.g., to change km/h to km/min, multiply by 1h/60min because hours and minutes are proportional (constant relationship). 3.4 Solve a problem within and between systems, using proportions or tables; e.g., km to m or km/h to ft/sec.

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Statistics	**General Outcome:** Develop statistical reasoning.
Specific 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.*
E1. Solve problems that involve creating and interpreting graphs, including: • bar graphs • histograms • line graphs • circle graphs. [C, CN, PS, R, T, V]	1.1 Determine the possible graphs that can be used to represent a given data set, and explain the advantages and disadvantages of each. 1.2 Create, with and without technology, a graph to represent a given data set. 1.3 Describe the trends in the graph of a given data set. 1.4 Interpolate and extrapolate values from a given graph. 1.5 Explain, using examples, how the same graph can be used to justify more than one conclusion. 1.6 Explain, using examples, how different graphic representations of the same data set can be used to emphasize a point of view. 1.7 Solve a contextual problem that involves the interpretation of a graph.

APPRENTICESHIP AND WORKPLACE MATHEMATICS GRADE 12

[C] Communication	**[PS]** Problem Solving
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	[V] Visualization

Measurement	**General Outcome:** Develop spatial sense through direct and indirect measurement.
Specific 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.*
A1. Demonstrate an understanding of the limitations of measuring instruments, including: • precision • accuracy • uncertainty • tolerance and solve problems. [C, PS, R, T, V]	1.1 Explain why, in a given context, a certain degree of precision is required. 1.2 Explain why, in a given context, a certain degree of accuracy is required. 1.3 Explain, using examples, the difference between precision and accuracy. 1.4 Compare the degree of accuracy of two given instruments used to measure the same attribute. 1.5 Relate the degree of accuracy to the uncertainty of a given measure. 1.6 Analyze precision and accuracy in a contextual problem. 1.7 Calculate maximum and minimum values, using a given degree of tolerance in context. 1.8 Describe, using examples, the limitations of measuring instruments used in a specific trade or industry; e.g., tape measure versus Vernier caliper. 1.9 Solve a problem that involves precision, accuracy or tolerance.

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

Geometry	**General Outcome:** Develop spatial sense.
Specific 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.*
B1. Solve problems by using the sine law and cosine law, excluding the ambiguous case. [CN, PS, V]	1.1 Identify and describe the use of the sine law and cosine law in construction, industrial, commercial and artistic applications. 1.2 Solve a problem, using the sine law or cosine law, when a diagram is given.
B2. Solve problems that involve: • triangles • quadrilaterals • regular polygons. [C, CN, PS, V]	2.1 Describe and illustrate properties of triangles, including isosceles and equilateral. 2.2 Describe and illustrate properties of quadrilaterals in terms of angle measures, side lengths, diagonal lengths and angles of intersection. 2.3 Describe and illustrate properties of regular polygons. 2.4 Explain, using examples, why a given property does or does not apply to certain polygons. 2.5 Identify and explain an application of the properties of polygons in construction, industrial, commercial, domestic and artistic contexts. 2.6 Solve a contextual problem that involves the application of the properties of polygons.

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

Geometry (continued)	**General Outcome:** Develop spatial sense.
Specific 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.*
B3. Demonstrate an understanding of transformations on a 2-D shape or a 3-D object, including: • translations • rotations • reflections • dilations. [C, CN, R, T, V]	3.1 Identify a single transformation that was performed, given the original 2-D shape or 3-D object and its image. 3.2 Draw the image of a 2-D shape that results from a given single transformation. 3.3 Draw the image of a 2-D shape that results from a given combination of successive transformations. 3.4 Create, analyze and describe designs, using translations, rotations and reflections in all four quadrants of a coordinate grid. 3.5 Identify and describe applications of transformations in construction, industrial, commercial, domestic and artistic contexts. 3.6 Explain the relationship between reflections and lines or planes of symmetry. 3.7 Determine and explain whether a given image is a dilation of another given shape, using the concept of similarity. 3.8 Draw, with or without technology, a dilation image for a given 2-D shape or 3-D object, and explain how the original 2-D shape or 3-D object and its image are proportional. 3.9 Solve a contextual problem that involves transformations.

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

Number	**General Outcome:** Develop number sense and critical thinking skills.
Specific 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.*
C1. Analyze puzzles and games that involve logical reasoning, using problem-solving strategies. [C, CN, PS, R]	*(It is intended that this outcome be integrated throughout the course by using puzzles and games such as Sudoku, Mastermind, Nim and logic puzzles.)* 1.1 Determine, explain and verify a strategy to solve a puzzle or to win a game; e.g., • guess and check • look for a pattern • make a systematic list • draw or model • eliminate possibilities • simplify the original problem • work backward • develop alternative approaches. 1.2 Identify and correct errors in a solution to a puzzle or in a strategy for winning a game. 1.3 Create a variation on a puzzle or a game, and describe a strategy for solving the puzzle or winning the game.
C2. Solve problems that involve the acquisition of a vehicle by: • buying • leasing • leasing to buy. [C, CN, PS, R, T]	2.1 Describe and explain various options for buying, leasing and leasing to buy a vehicle. 2.2 Solve, with or without technology, problems that involve the purchase, lease or lease to purchase of a vehicle. 2.3 Justify a decision related to buying, leasing or leasing to buy a vehicle, based on factors such as personal finances, intended use, maintenance, warranties, mileage and insurance.

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

Number (continued)	**General Outcome:** Develop number sense and critical thinking skills.
Specific 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.*
C3. Critique the viability of small business options by considering: • expenses • sales • profit or loss. [C, CN, R]	3.1 Identify expenses in operating a small business, such as a hot dog stand. 3.2 Identify feasible small business options for a given community. 3.3 Generate options that might improve the profitability of a small business. 3.4 Determine the break-even point for a small business. 3.5 Explain factors, such as seasonal variations and hours of operation, that might impact the profitability of a small business.

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

Algebra	**General Outcome:** Develop algebraic reasoning.
Specific 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.*
D1. Demonstrate an understanding of linear relations by: • recognizing patterns and trends • graphing • creating tables of values • writing equations • interpolating and extrapolating • solving problems. [CN, PS, R, T, V]	1.1 Identify and describe the characteristics of a linear relation represented in a graph, table of values, number pattern or equation. 1.2 Sort a set of graphs, tables of values, number patterns and/or equations into linear and nonlinear relations. 1.3 Write an equation for a given context, including direct or partial variation. 1.4 Create a table of values for a given equation of a linear relation. 1.5 Sketch the graph for a given table of values. 1.6 Explain why the points should or should not be connected on the graph for a context. 1.7 Create, with or without technology, a graph to represent a data set, including scatterplots. 1.8 Describe the trends in the graph of a data set, including scatterplots. 1.9 Sort a set of scatterplots according to the trends represented (linear, nonlinear or no trend). 1.10 Solve a contextual problem that requires interpolation or extrapolation of information. 1.11 Relate slope and rate of change to linear relations. 1.12 Match given contexts with their corresponding graphs, and explain the reasoning. 1.13 Solve a contextual problem that involves the application of a formula for a linear relation.

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

Statistics	**General Outcome:** Develop statistical reasoning.
Specific 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.*
E1. Solve problems that involve measures of central tendency, including: • mean • median • mode • weighted mean • trimmed mean. [C, CN, PS, R]	1.1 Explain, using examples, the advantages and disadvantages of each measure of central tendency. 1.2 Determine the mean, median and mode for a set of data. 1.3 Identify and correct errors in a calculation of a measure of central tendency. 1.4 Identify the outlier(s) in a set of data. 1.5 Explain the effect of outliers on mean, median and mode. 1.6 Calculate the trimmed mean for a set of data, and justify the removal of the outliers. 1.7 Explain, using examples such as course marks, why some data in a set would be given a greater weighting in determining the mean. 1.8 Calculate the mean of a set of numbers after allowing the data to have different weightings (weighted mean). 1.9 Explain, using examples from print and other media, how measures of central tendency and outliers are used to provide different interpretations of data. 1.10 Solve a contextual problem that involves measures of central tendency.
E2. Analyze and describe percentiles. [C, CN, PS, R]	2.1 Explain, using examples, percentile ranks in a context. 2.2 Explain decisions based on a given percentile rank. 2.3 Explain, using examples, the difference between percent and percentile rank. 2.4 Explain the relationship between median and percentile. 2.5 Solve a contextual problem that involves percentiles.

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

Probability	**General Outcome:** Develop critical thinking skills related to uncertainty.
Specific 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.*
F1. Analyze and interpret problems that involve probability. [C, CN, PS, R]	1.1 Describe and explain the applications of probability; e.g., medication, warranties, insurance, lotteries, weather prediction, 100-year flood, failure of a design, failure of a product, vehicle recalls, approximation of area. 1.2 Calculate the probability of an event based on a data set; e.g., determine the probability of a randomly chosen light bulb being defective. 1.3 Express a given probability as a fraction, decimal and percent and in a statement. 1.4 Explain the difference between odds and probability. 1.5 Determine the probability of an event, given the odds for or against. 1.6 Explain, using examples, how decisions may be based on a combination of theoretical probability calculations, experimental results and subjective judgements. 1.7 Solve a contextual problem that involves a given probability.