NBCC Skilled Trades and Work-Ready Math 120

Support Document

2020

NBCC

New Nouveau Brunswick

2020
Department of Education and Early Childhood Development
Curriculum Branch

Acknowledgments

The Department of Education and Early Childhood Development of New Brunswick (EECD) gratefully acknowledges the contributions of the following groups and individuals toward the development of the NBCC Skilled Trades and Work-Ready Math 120 curriculum support document:

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- Tim Grattan, Educator (ASD-N), Blackville High School
- Nadine Mullin, Educator (ASD-S), Harborview High School
- New Brunswick Community College
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1. Introduction

1.1 Mission and Vision of Educational System

The New Brunswick Department of Education and Early Childhood Development is dedicated to providing the best public education system possible, wherein all students have a chance to achieve their academic best. The mission statement for New Brunswick schools is:

> *Each student will develop the attributes needed to be a lifelong learner, to achieve personal fulfillment and to contribute to a productive, just and democratic society.*

1.2 New Brunswick Global Competencies

New Brunswick Global Competencies provide a consistent vision for the development of a coherent and relevant curriculum. The statements offer students clear goals and a powerful rationale for school work. They help ensure that provincial education systems' missions are met by design and intention. The New Brunswick Global Competencies statements are supported by curriculum outcomes.

New Brunswick Global Competencies are statements describing the knowledge, skills and attitudes expected of all students who graduate high school. Achievement of the New Brunswick Global Competencies prepares students to continue to learn throughout their lives. These Competencies describe expectations not in terms of individual school subjects but in terms of knowledge, skills and attitudes developed throughout the curriculum. They confirm that students need to make connections and develop abilities across subject boundaries if they are to be ready to meet the shifting and ongoing demands of life, work and study today and in the future.

See Appendix 5.1.

2. Pedagogical Components

2.1 Pedagogical Guidelines

Diverse Cultural Perspectives

It is important for teachers to recognize and honour the variety of cultures and experiences from which students are approaching their education and the world. It is also important for teachers to recognize their own biases and be careful not to assume levels of physical, social or academic competencies based on gender, culture, or socio-economic status.

Each student's culture will be unique, influenced by their community and family values, beliefs, and ways of viewing the world. Traditional aboriginal culture views the world in a much more holistic way than the dominant culture. Disciplines are taught as connected to one another in a practical context, and learning takes place through active participation, oral communication and experiences. Immigrant students may also be a source of alternate world views and cultural understandings. Cultural variation may arise from the differences between urban, rural and isolated communities. It may also arise from the different value that families may place on academics or athletics, books or media, theoretical or practical skills, or on community and church. Providing a variety of teaching and assessment strategies to build on this diversity will provide an opportunity to enrich learning experiences for all students.

Universal Design for Learning

The curriculum has been created to support the design of learning environments and lesson plans that meet the needs of all learners. Specific examples to support Universal Design for Learning for this curriculum can be found in the appendices.

See Appendix 5.2

2.2 Pedagogical Guidelines

Assessment Practices

Assessment is the systematic gathering of information about what students know and are able to do. Student performance is assessed using the information collected during the evaluation process. Teachers use their professional skills, insight, knowledge, and specific criteria that they establish to make judgments about student performance in relation to learning outcomes. Students are also encouraged to monitor their own progress through self-assessment strategies, such as goal setting and rubrics.

Research indicates that students benefit most when assessment is regular and ongoing and is used in the promotion of learning (Stiggins, 2008). This is often referred to as formative assessment. Evaluation is less effective if it is simply used at the end of a period of learning to determine a mark (summative evaluation).

Summative evaluation is usually required in the form of an overall mark for a course of study, and rubrics are recommended for this task. Sample rubrics templates are referenced in this document, acknowledging teachers may have alternative measures they will apply to evaluate student progress.

Some examples of current assessment practices include:

• Questioning	• Projects and Investigations
• Observation	• Checklists/Rubrics
• Conferences	• Responses to texts/activities
• Demonstrations	• Reflective Journals
• Presentations	• Self and peer assessment
• Role plays	• Career Portfolios
• Technology Applications	• Projects and Investigations

Formative Assessment

Research indicates that students benefit most when assessment is ongoing and is used in the promotion of learning (Stiggins, 2008). Formative assessment is a teaching and learning process that is frequent and interactive. A key component of formative assessment is providing ongoing feedback to learners on their understanding and progress. Throughout the process adjustments are made to teaching and learning.

Students should be encouraged to monitor their own progress through goal setting, co-constructing criteria and other self-and peer-assessment strategies. As students become more involved in the assessment process, they are more engaged and motivated in their learning.

Summative Assessment

Summative evaluation is used to inform the overall achievement for a reporting period for a course of study. Rubrics are recommended to assist in this process. Sample rubrics templates are referenced in this document, acknowledging teachers may have alternative measures they will apply to evaluate student progress.

For further reading in assessment and evaluation, visit the Department of Education and Early Childhood Development's Assessment and Evaluation site here.

Cross Curricular Literacy

Literacy occurs across learning contexts and within all subject areas. Opportunities to speak and listen, read and view, and write and represent are present every day - in and out of school.

Assessment and scheduling NBCC Skilled Trades and Work-Ready Math 120

It is recommended that assessment in NBCC Skilled Trades and Work-Ready Math 120 reflect in-context applications throughout the course. Opportunities for assessment naturally arise in most project-based activities (ex: the computation, organization, and planning while creating a project plan, materials list, and cut-list). Some project ideas are listed in **Appendix 4**.

Students should complete summative assessment on all the NBCC competencies (listed on page 12) while in high school, which are integral to the course. Successful students looking to acquire a post-secondary credit at a NBCC campus can complete a Recognition of Prior Learning form at NBCC and may be awarded Math Foundations 1208 upon beginning their program of study (**see Appendix 6**).

The following NBCC programs require the successful completion of Math Foundations 1208:

- Agricultural Equipment Repair
- Auto Body and Collision Technician
- Automotive Service Technician
- Automotive Technology
- Bricklaying
- Carpentry
- CNC Machining
- Cook
- Industrial Mechanics
- Electrical: Construction
- Electrical: Industrial
- Fuels Technician
- Heavy Equipment Service Technician
- HVAC: Sheet Metal Fabrication
- Machinist
- Motorcycle Repair
- Marine Diesel Mechanics
- Mechanical Technician (CO-OP)
- Plumbing
- Steamfitting/Pipefitting
- Steel Fabrication
- Truck and Transport Service Technician
- Welding
- Welding and Metal Fabrication

The amount of time to complete this curriculum will be dependent on the class and clientele, some versions of this course will finish in advance of the end of the academic school year. If this is the case, suggestions for new topics to explore include: personal finances and financial literacy concepts; creating business plans and running a business; filling out and applying for grants; individualized personal interest projects; capstone projects; site visitations to NBCC/industry/community/etc.

Scheduling of NBCC Skilled Trades and Work-Ready Math 120 will depend on the school context and can adjust based on location. It is recommended that it take place in the winter semester as a grade 12 elective course. The primary targeted cohort are students who intend to take a NBCC trades program with a mathematics requirement (Math Foundations 1208).

3. Subject Specific Guidelines

3.1 Rationale

There is continuing concern from NBCC (New Brunswick Community College), and New Brunswick industry, that students entering New Brunswick trades programs or workplaces do not possess the ability to effectively apply math concepts in-context(s). Mathematics concepts are often understood in isolation and students then struggle to apply learnings in different post-secondary education or job-site settings. In response, NBCC created the first year Math Foundations 1208 course which is intended to refresh math skills in areas deemed essential.

EECD and NBCC have collaborated to establish the offering of a dual-credit math pilot at two New Brunswick high schools – Woodstock and St. Stephen High Schools. This opportunity allows students to accumulate a grade 12 elective credit, simultaneously earning a NBCC course credit for Math Foundations 1208 (upon successful completion of the NBCC Math Foundations 1208 assessment). NBCC Skilled Trades and Work-Ready Math 120 allows high schools flexibility in scheduling a larger variety of math courses and allowing for student personalization, it is expected this will motivate students to continue learning mathematics through high school graduation. Emphasis of these math concepts in-context, in high school, can strengthen skills and instill confidence before entering a trades program or workplace, and improve chances of success in NBCC's Math Foundations 1208 course and chosen NBCC post-secondary program.

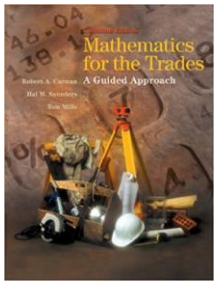
It is now the hope to expand NBCC Skilled Trades and Work-Ready Math 120 into more New Brunswick high schools. This support document will serve as a guide and starting point in offering the course and tailoring it to fit each school and community.

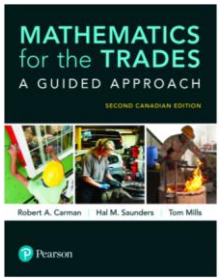
3.2 Course Description

NBCC Skilled Trades and Work-Ready Math 120 gives students the opportunity to practice skills individually, to solve problems with others and to work on projects that incorporate mathematics. Ideally, students will apply math concepts using a hands-on fashion in an authentic workplace or trades facility. However, safety restrictions and limitations of facilities in some schools require the flexibility to design activities that can also be completed in a community or classroom environment. Teachers should use a variety of learning situations that will address various learning styles of students and complement the resources available in the school and community.

Every concept and skill should be authentically contextualized. The intent of this course is that students become proficient with concepts in-context, so they can easily apply skills in workplace situations. Teachers are encouraged to be innovative in their methods of presentation of the material. Students should become familiar and proficient with the terms 'accuracy' and 'precision,' and be able to determine what measuring tool is appropriate in various situations and will provide the required level of accuracy/precision. Lessons should feature the opportunity to work with measurement tools such as a tape measure, metal ruler, micrometer, calipers, protractors, etc., in context. Imperial and S.I. units should both be explored with a focus given to those most commonly found in the context of a post-secondary program or jobsite (ex: fractional inch).

The NBCC Course Profile for Math Foundations 1208 is the current curriculum document. Teachers are expected to draw from relevant career experiences, available skilled trades/math resources and/or texts in the education system, NBCC materials, authentic workplace resources, and community when planning. There is no mandated core resource, however *Mathematics for the Trades: A Guided Approach* is recommended and used by NBCC campuses. Most skilled trades texts provide conceptual overlap and would be suitable resources.





3.3 Curriculum Organizers and Outcomes

The NBCC Skilled Trades and Work-Ready Math 120 curriculum support document is arranged in the same format as the NBCC Math Foundations 1208 competencies and associated content/concepts. Each competency includes example "I Can …" Statements that concretely situate the learning within a high school classroom project or situate the aspirational learning within a post-secondary program or workplace context, or future career. **It is *not* expected that students explicitly fulfill each (or any specific) included example "I Can …" Statement** but demonstrate a range of competency within each content area. The NBCC Math Foundations 1208 competencies are listed below:

Students will:

- Add, subtract, multiply or divide whole numbers.
- Add, subtract, multiply or divide integers.
- Add, subtract, multiply or divide by a fraction; add, subtract, multiply or divide fractions.
- Add or subtract decimals; multiple or divide by a decimal; multiply or divide decimals.
- Calculate the percent one number is of another; calculate a percent of a number.
- Convert between fractions, decimals, and/or percentages.
- Use formulae by inserting quantities for variables and solving.
- Use a rate showing comparison between two quantities with different units.
- Use a ratio showing comparison between two quantities with the same units.
- Use a proportion showing comparison between two ratios or rates in order to solve problems.
- Perform measurement conversions in Imperial and S.I. measurements.
- Calculate averages.
- Calculate rates other than percentages.
- Calculate proportions or ratios.
- Use calculators.
- Use powers and roots.
- Calculate areas.
- Calculate Perimeters.
- Calculate Volumes.

The following concepts complement and are associated with the above competencies, some are found within more than one competency:

Whole Numbers
- Place Value
- Addition, Subtraction, Multiplication, Division
- Order of Operations
- Arithmetic Mean and Median
- Problem Solving

Fractions
- Factors, Prime Factors, Composite Numbers
- Improper Fractions, Mixed Numbers
- Equivalent Fractions
- Reducing Fractions
- Addition, Subtraction, Multiplication, and Division of Fractions
- Comparing Fractions
- Complex Fractions
- Problem Solving

Decimals
- Place Value
- Reading and Writing Decimals
- Comparing Decimals
- Rounding Off
- Addition, Subtraction, Multiplication, and Division of Decimals
- Fractions ↔ Decimals
- Order of Operations with Decimals
- Estimation
- Problem Solving

Percent
- Fractions, Decimals, Percents
- The Arithmetic of Percent
- Introduction to Word Problems
- Increase and Decrease Problems
- Markup and Markdown Problems
- Miscellaneous Percent Problems
- Simple Interest
- Percent Problem Review

Ratio and Proportion
- Ratio, Rate and Proportion
- Types of Proportions
- Solving Direct and Inverse Proportions
- Summary of Problem Solving with Proportions

Signed Numbers (Integers)
- Positive and Negative Numbers
- Addition, Subtraction, Multiplication, and Division of Signed Numbers
- Order of Operations
- Signed Fractions
- Distributive Law and Factoring

Scientific Notation
- Powers
- Laws of Exponents
- Scientific Notation
- Square Roots

Metric System
- The Metric System
- Length (metre), Mass (gram), Volume – Capacity (litre), Area (metre squared), Volume (metre cubed)
- Time
- Temperature

Measurement
- Area Principles
- Perimeter Principles
- Volume Principles

Students will: Add, subtract, multiply or divide whole numbers.

Concepts and Content

- Place Value
- Addition, Subtraction, Multiplication, Division
- Order of Operations
- Arithmetic Mean and Median
- Problem Solving

Example "I Can …" Statements

- Count the quantity of tools or parts available for a task.
- Add materials requests.
- Subtract materials used from a stock of resources.
- Multiply the physical dimensions of objects.
- Estimate the number of machine passes required to machine products within tolerances.
- Calculate a subsidy using an online calculator tool.
- Count or measure dosages of medications (ex: pills).
- Measure quantities of tints and bases in a paint mixture using a ratio or measuring stick.
- Calculate the tables/chairs needed for catering a function.
- Estimate cut length and seam allowances when exact measurements are not required.
- Use divisibility rules for whole numbers such as 2, 5 and 10.
- Take inventory of a school storeroom or facility.
- Total the number of hours worked on a jobsite.
- Measure and cut bolts of fabric to specified lengths.
- Distribute/share assets or resources to multiple jobsites as a manager.

Students will: Add, subtract, multiply or divide integers.

Concepts and Content

- Positive and Negative Numbers
- Addition, Subtraction, Multiplication, and Division of Signed Numbers
- Signed Fractions
- Distributive Law and Factoring
- Order of Operations

Example "I Can …" Statements

- Calculate a net total when managing bank deposits and withdraws.
- Execute a receipt refund on a purchase return.
- Calculate acceptable ranges for measurement parameters. (ex: adding/subtracting tolerances from ideal dimensions or values)
- Calculate subsidies. (i.e. using income and expenses)
- Balance tills.
- Read temperature measurements.
- Survey using the appropriate tools. (ex: tripod, prism, grade rods, range poles, GPS, etc.)
- Measure air pressure.
- Set up computer numerical control programs. (ex. machining tools)
- Calculate personal and commercial debt. (i.e. personal finances; business operations)
- Calculate and compare elevations using sea level measurements.
- Create a travel itinerary accounting for differences in time zones.
- Track and predict outdoor temperatures for outdoor jobsite safety.
- Calculate the voltage difference of a circuit.

Students will: Add, subtract, multiply or divide by a fraction; add, subtract, multiply or divide fractions.	
Concepts and Content	
• Factors, Prime Factors, Composite Numbers • Improper Fractions, Mixed Numbers • Equivalent Fractions • Reducing Fractions	• Addition, Subtraction, Multiplication, and Division of Fractions • Comparing Fractions • Complex Fractions • Problem Solving
Example "I Can …" Statements	
• Add fractions of an inch to find the total length of a measurement. • Subtract a fraction of an inch from a measurement to account for overlay in construction design. • Divide the total length of a measurement into smaller equal measurements. (ex: fractions of an inch) • Calculate ingredient requirements when doubling, tripling, etc. a recipe. • Measure ingredients using an exact measurement. (ex: measuring cup) • Prepare a schedule using blocks of time. (ex: ½ day blocks) • Measure and confirm the length of screws or nails when restricted by depth. • Use 'rise' and 'run' measurements to determine slope or steepness. (i.e. inclination as a fraction) • Account for and calculate kerf (saw blade width) when cutting wood.	

Students will: Add or subtract decimals; multiple or divide by a decimal; multiply or divide decimals.

Concepts and Content

- Place Value
- Reading and Writing Decimals
- Comparing Decimals
- Rounding Off
- Addition, Subtraction, Multiplication, and Division of Decimals
- Fractions ↔ Decimals
- Order of Operations with Decimals
- Estimation
- Problem Solving

Example "I Can …" Statements

- Calculate the number of specified steel bolts that can be made from steel rods.
- Deduct weight from a crane's gross capacity to determine lift capacity.
- Complete a travel claim using 'per-kilometre' rates.
- Compare refrigerator temperature readings to food safety specifications. (i.e. calculate the difference in temperature)
- Count and return change from a cash purchase.
- Compare readings to specification. (ex: horsepower, torque, emissions, voltage, amperage, resistance, tachometers, etc.)
- Calculate piping system pressure changes over time.
- Calibrate pressure gauges to manufacturing standards.
- Measure the exact weight of an object using a scale. (ex: package to be sent by courier)
- Track the temperature of prepared foods to serve.
- Measure and compare distances at accident and crime scenes.
- Calculate object clearance.
- Calculate net pay and compare with gross pay. (i.e. check for errors)
- Calculate the 'end play' (float, thrust bearing clearance, or axial clearance) of a bearing and compare to the normal tolerance.
- Calculate the labor cost of a job. (i.e. rate of pay x time worked)
- Write a paper receipt or create a digital receipt.
- Count and create an inventory of items. (ex: to be seized and held as evidence, or when a patient arrives for medical treatment)
- Compare running costs and spec differences between products. (ex: Incandescent vs. LED light bulbs)
- Determine or estimate the gauge of resources. (ex: gauge of sheet metal)
- Subtract the thickness of material to find interior diameter. (i.e. the interior diameter of a pipe)

Students will: Calculate the percent one number is of another; calculate a percent of a number.

Concepts and Content

- Fractions, Decimals, Percents
- The Arithmetic of Percent
- Introduction to Word Problems
- Increase and Decrease Problems
- Markup and Markdown Problems
- Miscellaneous Percent Problems
- Simple Interest
- Percent Problem Review

Example "I Can …" Statements

- Calculate the amount I am saving on a "___% off" sale.
- Calculate an appropriate gratuity.
- Calculate the dollar amount of an interest rate.
- Calculate tax.
- Read and write tolerances.
- Adjust machine loads.
- Estimate the percentage that a project is complete.
- Determine the percent of a number and adjust readings or calibration accordingly.
  (ex: barometer adjustments due to temperature, elevation, barometric pressure)
- Calculate and compare the lifespan of tools or products. (ex: LED lightbulbs last approx. 800% longer than incandescent bulbs)
- Calculate percentage when comparing volumes or flow rates. (ex: typical and Ultra Low Flush water tank efficiency)
- Calculate the increase in performance of a tool or machine when modified. (ex: percentage increase of horsepower of a vehicle)
- Remove a purchase from a receipt (finding the amount still owed). (i.e. calculating a percent of a number to find your answer).

Students will: Convert between fractions and decimals, or fractions and percentages.

Concepts and Content	Example "I Can…" Statements
• Equivalent Fractions • Reducing Fractions • Comparing Fractions • Place Value	• Comparing Decimals • Fractions ↔ Decimals • Fractions, Decimals, Percents

Example "I Can …" Statements

- Compare measurements (like rotor thickness) to specifications to assess usability and wear.
  (ex: converting a fractional inch measurement to a decimal unit; determining what percentage of the rotor has been used/consumed)
- Calculate the percentage of coverage of a surface using area.
- Calculate slope of incline as a decimal using rise/run measurements.
- Calculate stud spacing, or the number of studs required, in constructing a wall.
- Convert precision units in machining. (ex: one rotation of a dial is a thousandth of an inch in precision)
- Convert the fall of a drain pipe, as 'rise' over 'run,' to a decimal value.
- Convert measurements to find the thickness of materials. (ex:11-gauge stainless steel sheet metal is approx. 1/8" or 0.125 inches thick)

Students will: Convert between decimals and percentages.	
Concepts and Content	
• Place Value • Comparing Decimals	• Fractions, Decimals, Percents
Example "I Can … Statements"	
• Calculate and compile data to determine sales trends and the effects of sales promotions. • Calculate differences in performance when making automobile modifications. • Scale an object in a design or 3-D printing program, or scale a physical prototype. • Calculate tax on goods or services. • Convert net profits and losses to calculate percent earnings of a business.	

Students will: Use formulae by inserting quantities for variables and solving.

Concepts and Content

- Problem Solving
- Place Value
- Order of Operations With Decimals
- Order of Operations
- Introduction to Word Problems
- Increase and Decrease Problems
- Markup and Markdown Problems
- Simple Interest
- Solving Direct and Inverse Proportions
- Summary of Problem Solving with Proportions
- Distributive Law
- Area Principles
- Perimeter Principles
- Volume Principles

Example "I Can …" Statements

- Calculate total falls within drain lines.
- Calculate electrical requirements. (i.e. flows, resistances, and voltages)
- Calculate the heating time of a metal.
- Calculate angles within a task using trigonometry.
- Calculate length using the Pythagorean Theorem.
- Manipulate variables when calculating stud spacing in wall construction. (ex: optimize number of studs, optimize costs)
- Use the formula for the volume of a cylinder to calculate the volume of pipes.
- Calculate the surface area of a sphere to cover the object. (ex: cover a Styrofoam ball with fabric in art design)
- Find the volume of uncommon 3-D Shapes.
  (ex: find the volume of concrete needed for the frustrum of a cone, a common shape structure at skateboard parks)

Students will: Use a rate showing comparison between two quantities with different units.	
Concepts and Content	
• Ratio, Rate and Proportion	• Types of Proportions
Example "I Can …" Statements	
• Compare amounts of money in different currencies • Calculate particles-per-million of a substance. • Compare rotations-per-minute readings. • Convert between physical measurements and measurements on a scale map. • Measure the viscosity of primers and paints by drip rates. (i.e. using Zahn cups) • Compare assets to projected value, and then collect money from debtors in lieu of seizing property. • Project sales figures. (ex: clients served per month) • Calculate the rate at which false alarms were received.	

Students will: Use a ratio showing comparison between two quantities with the same units.	
Concepts and Content	
• Ratio, Rate and Proportion	• Types of Proportions
Example "I Can …" Statements	
• Compare the same type of product manufactured by different producers using ratios. (ex: spiral nails by different distributors) • Reconcile cash and credit receipts with register total records. (i.e. do the purchase receipts match the records?) • Compare financial and social indicators to standards. (ex: net incomes to benchmark amounts) • Compare counts, measurements, and instrument readings to legal limits to determine if a law has been broken. • Compare measurements of vital signs against normal range. (ex: temperature, heart rate, blood pressure, etc.) • Analyze fabrication process data. (ex: feed rate, speed rate on boring machines, drills, lathes, etc.) • Compare the differences of dry and wet weight, and volumes, of ingredients. • Create an exact measurement in a scale drawing.	

Students will: Use a proportion showing comparison between two ratios or rates in order to solve problems.	
Concepts and Content	
• Ratio, Rate and Proportion • Types of Proportions	• Solving Direct and Inverse Proportions • Summary of Problem Solving with Proportions
Example "I Can …" Statements	
• Compare the respective cost and shelf life of fresh and frozen ingredients. • Compare specific engine tachometer readings to engine idle speeds. • Analyze quality control tests by taking multiple readings. • Compare measured fuel consumption rates with standard fuel consumption rate to assess the operating condition of a machine. • Review different suppliers and compare costs and aspects of customer service. • Compare the slope of two inclines to determine which is steeper. • Compare single units of measurement by using comparisons of other measurements. (ex: The weight of a bag of soil is expressed on the bag in pounds and kilograms, how many pounds is one kilogram equal to?) • Compare ground and air speed to determine travel times. • Compare efficiencies of heating sources given different units of rate. (ex: BTU compared to kilowatt hours)	

Students will: Perform measurement conversions in Imperial and S.I. measurements.

Concepts and Content

- The Metric System
- Length (metre), Mass (gram), Volume – Capacity (litre), Area (metre squared), Volume (metre cubed)
- Time
- Temperature

Example "I Can … Statements"

- Convert a measurement in centimetres to fractional inches. (i.e. round to the nearest appropriate fractional inch)
- Convert a measurement in pounds to kilograms.
- Choose the best measuring tool in context.
- Identify and use units in both Imperial and S.I. systems.
- Convert between Celsius and Fahrenheit temperature measurements.
- Convert between different electrical units.
- Convert between volume specifications and pipe capacities. (ex: cubic meters per hour; cubic feet per hour)
- Compare the weight of boarded individuals to the weight restriction of an elevator. (i.e. total pounds of passengers compared to weight restriction in kilograms)
- Convert units to select appropriate wrench sizes.
- Convert volume measurements to space measurements. (ex: a bag of soil is measured in liters, determine the amount of cubic feet it could fill)

Students will: Calculate averages.

Concepts and Content

- Addition, Subtraction, Multiplication, Division
- Arithmetic Mean and Median
- Problem Solving
- Rounding Off
- Estimation
- Miscellaneous Percent Problems
- Ratio, Rate, and Proportion
- Types of Proportions
- Time
- Temperature

Example "I Can … Statements"

- Calculate the average hours worked each day for a given week.
- Predict the time to complete a job based on the average time it has taken in the past.
- Predict the time to complete a speciality job based on the average time it takes for the special technique. (ex: pin striping)
- Plan to purchase enough materials to complete a task based on the average amount of materials used previously.
- Calculate defects per unit of parts for a supplier.
- Calculate average sales per hour.
- Calculate blood pressure averages from multiple readings. (i.e. systolic and diastolic)
- Calculate the average number of products completed in an assembly line.
- Calculate averages from sets of readings to ensure levels are within manufacturing recommendations. (ex: humidity, temperature, water pressure)
- Calculate average cylinder pressures by using several readings.
- Calculate the average power demand for a commercial building or industrial equipment. (ex: Kilowatt usage and/or billing history).
- Compare the average cure times for various types of concrete when choosing the best material for the job.
- Estimate how many individuals can safely ride an elevator at the same time (based on a known weight restriction) using average human weight.
- Predict tool or machine lifespans.

Students will: Calculate rates other than percentages.

Concepts and Content

- Ratio, Rate, and Proportion
- Types of Proportions
- Summary of Problem Solving with Proportions
- The Metric System
- Time
- Temperature

Example "I Can …" Statements

- Find the exchange rate between two different currencies.
- Estimate distance travelled or response time using a known speed measurement. (ex: law enforcement)
- Calculate the pitch of a roof.
- Calculate the rise for a run of drain pipe.
- Calculate the unit price of a product. (ex: the price of one item bought in bulk)
- Compare the cost of different types of ingredients. (ex: price per one kilogram)
- Calculate distance travelled using nautical measurements. (ex: longitude and latitude, nautical speed [knots])

Students will: Calculate proportions or ratios.

Concepts and Content

- Ratio, Rate and Proportion
- Types of Proportions
- Solving Direct and Inverse Proportions
- Summary of Problem Solving with Proportions

Example "I Can …" Statements

- Use a ratio when preparing a plastic compound solution. (i.e. dilution percentage/ratio)
- Calculate the amount of water needed to mix specific amounts of mortar.
- Calculate the substance amounts in oil and gas mixtures.
- Calculate the amount of glycol needed to prevent engines from freezing.
- Calculate the amount of chlorine needed for a pool. (i.e. parts per million)
- Practice counting gear ratios. (ex: automobile transmission)

Students will: Use calculators.

Concepts and Content

- Place Value
- Addition, Subtraction, Multiplication, Division
- Order of Operation
- Arithmetic Mean and Median
- Problem Solving
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- Perimeter Principles
- Volume Principles

Example "I Can …" Statements

- Tally time cards
- Calculate gross earnings. (ex: hourly rate, commission, piecework, overtime, etc.)
- Calculate wastage.
- Describe social programs by developing statistics. (ex: populations served)
- Calculate fuel consumption.
- Calculate the amount of material needed by using measurements in a scale drawing. (ex: length of pipe)
- Calculate safety margins. (ex: increasing the capacity of rigging by a factor of 10)
- Calculate data using specialized equipment. (ex: using a speedometer; using a breathalyser)
- Calculate the combustion efficiency of a furnace.
- Practice using an online tool that helps convert between units of measurement.

Students will: Use powers and roots.

Concepts and Content

- Powers
- Laws of Exponents
- Scientific Notation
- Square Roots

Example "I Can …" Statements

- Calculate the length of rafter required for a pitch of roof using square root and squares.
- Calculate dimensions for a staircase using square roots.
- Calculate power and current in three-phase motors.
- Determine where to place holes.
- Calculate the correct angles for rigging loads.
- Use Ohm's law to check motor voltage.

Students will: Calculate areas.

Concepts and Content

- Addition, Subtraction, Multiplication, Division
- Problem Solving
- Reading and Writing Decimals
- Addition, Subtraction, Multiplication and Division of Decimals
- Powers
- Square Roots
- The Metric System
- Length (metre), Area (metre squared)
- Area principles

Example "I Can … Statements"

- Calculate floor coverage in square feet.
- Calculate an area of wall and purchase enough paint for coverage.
- Calculate the heat loss of a home using area concepts. (ex: windows)
- Measure text for laying out signage and for printing.
- Find the centre of a room or space to install fixtures.
- Calculate the area of space to be seeded and how many bags of seeds would be required.
- Estimate the surface area required to cover a cylinder. (ex: cladding a silo with sheet metal)

Students will: Calculate Perimeters.

Concepts and Content

- Addition, Subtraction, Multiplication, Division
- Problem Solving
- Reading and Writing Decimals
- Addition, Subtraction, Multiplication and Division of Decimals
- The Metric System
- Length (metre)
- Perimeter principles

Example "I Can …" Statements

- Calculate the perimeter of a space to build an enclosure.
- 'Pace out' a distance to estimate the perimeter.
- Measure the perimeter of a space by using a trundle wheel.
- Calculate the length of drain tile required given a foundation layout.
- Estimate the length of rope required to wrap around a flywheel the specified amount of times. (ex: lawn mower pull cord)

Students will: Calculate Volumes.

Concepts and Content

- Addition, Subtraction, Multiplication, Division
- Problem Solving
- Reading and Writing Decimals
- Addition, Subtraction, Multiplication and Division of Decimals
- Powers
- Square Roots
- The Metric System
- Length (metre), Area (metre squared), Volume (meter cubed)
- Volume principles

Example "I Can …" Statements

- Calculate and work with volumes of earth when creating inclines/declines and paving roads.
- Calculate the amount of combustion air or exhaust gas travelling through pipes.
- Measure air pressure and air velocity using a manometer.
- Estimate air pipe and home total volume to install a furnace.
- Calculate volume by using measurements taken with a caliper.
- Calculate the amount of storage space needed for items or standard box sizes.
- Calculate the volume of standard shipping containers.
- Estimate the number of loads needed to fill a specified volume or excavate. (ex: truck loads of dirt of backfill when excavating a foundation)
- Compare space-to-be-filled and capacity to determine the size of a job. (ex: for large concrete jobs: is a ready-mix truck is required?)
- Estimate the volume of concrete required to pour a section of sidewalk.

4. Project Ideas

- Create an accurate measuring tool. (ex: create a metre stick with Imperial and Metric measurements)
- Build a scale miniature version of a house or building.
- Create a small-scale agriculture project and track data. (i.e. greenhouse)
- Design and plan a building project by creating a scaled layout drawing (blueprint). (i.e. engineering paper)
- Small scale construction project. (ex: shed, ramp)
- Design basic wiring scheme for home renovation projects.
- Design a small-scale plumbing network. (i.e. pump, pressure tank, water source, calculate outflow, etc.)
- Assemble/disassemble/repair a small-scale motor.
- Simulate book keeping operations of a small business. (i.e. salaries, vacation, taxes, expenses etc.)
- Revisit and extend common school building projects. (ex: propellent rockets, mouse trap cars, structural design, etc.)
- Attempt to improve an existing design, utility or product using an iterative process and prototyping. (ex: small construction, safety procedures)
- Design tools, parts, or objects using 3-D design software.

5. Appendices

5.1 New Brunswick Global Competencies

5.2 Universal Design for Learning (UDL)

UDL helps meet the challenge of diversity by suggesting flexible instructional materials, techniques, and strategies that empower educators to meet these varied needs. UDL research demonstrates that the challenge of diversity can and must be met by making curriculum flexible and responsive to learner differences. UDL provides guidelines to minimize barriers and maximize learning for all.

Is there a form of **assistive technology** that could be used to enhance/facilitate this lesson?	Example in your subject area
Are there **materials which can appropriately challenge** readers to enhance this learning?	Authentic NBCC course materials, workplace materials/receipts/forms/paperwork
Are there other **choices** that can be provided in this learning opportunity?	Different roles assigned within the project depending on strengths and abilities. Flexibility to allow for planning-oriented or project-oriented assignments.
Is there another/a **variety of media** available? Only paper-based? Can it be listening? Can I add a visual component?	Learning can encompass paper-based assignments, project-based learning involving hands-on components, and digital simulations/virtual reality.
Can **movement** be involved?	In context learning can bring students to classrooms, trades facilities, locations within the school, locations within the community, and post-secondary visitations.
Grouping and regrouping?	Opportunities to group and regroup for different collaborative projects. A project assignment can be framed within a competition or team game.

Teacher versus non- teacher centered? **Instructional design strategies** –…	Opportunities include student led interest projects, and other project-based learning within schools (i.e. skilled trades projects in other classes)
Contracts?	Contracts with project deliverables may make learning expectations clear, and are authentic to workplace contract agreements.
Opportunities for students to **propose variations** to the assignments/projects?	Opportunities to customize and alter construction or project designs.
Are there any **experts** that I could bring into the classroom electronically or as a guest speaker?	Skilled trades educators within the school, community members, industry, NBCC instructors.
Have I linked the goal to as current event or a cultural event in the student's lives? Can I make the learning more **relevant**?	Relevance may be increased if students are provided opportunity to align course expectations with NBCC profile requirements and program areas.

6. Resources

Design and 3-D Printing

Autodesk Fusion 360 (Education License)

Onshape

SketchUp

SOLIDWORKS

Thingiverse

Tinkercad

Ultimaker Cura

General Career Resources

Nova Scotia Sector Council

General Numeracy Resources

Kuta Software

Math Worksheets 4 Kids

The University of Waterloo - CEMC Courseware and Web Resources

Government of Canada

Canadian Financial Literacy Database

Numeracy Indicator: A Guide for Employers

Numeracy Self-Assessment

Trades Math Workbook

NBCC

Full-time Programs

Program Areas

Recognition of Prior Learning

Skills Canada

Essential Skills

Numeracy Workbook