Area of Learning: Mathematics	**Workplace Mathematics 10**
Big Ideas	Elaborations

• **Proportional reasoning** is used to make sense of **multiplicative** relationships.	• **Proportional reasoning:**
	  ○ reasoning about comparisons of relative size or scale instead of numerical difference
	• **multiplicative:**
	  ○ the multiplicative relationship between two numbers or measures is a relationship of scale rather than an additive difference (e.g., "12 is three times the size of 4" is a multiplicative relationship; "12 is 8 more than 4" is an additive relationship)
	• *Sample questions to support inquiry with students:*
	  ○ What are the similarities and differences between strategies for solving proportional reasoning problems in different contexts?
	  ○ How does understanding the relationship between multiplication and division help when working with proportions?
	  ○ How are proportions used to describe changes in size?

• 3D objects can be examined mathematically by **measuring** directly and indirectly length, surface area, and volume.	• **measuring:**
	• *Sample questions to support inquiry with students:*
	  ○ What measurement is the most important for examining 3D objects?
	  ○ Why is it important to understand the components of a formula?

• **Flexibility** with number builds meaning, understanding, and confidence.	• **Flexibility:**
	• *Sample questions to support inquiry with students:*
	  ○ How does using a measuring tool increase fluency and flexibility with decimals and fractions?
	  ○ How does solving puzzles and playing games help our understanding of number?
	  ○ Why are fractions important for imperial measurements?
	  ○ How does base 10 make the metric system easier to use?
	  ○ How is the order of operations connected to formula calculations?

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How do we determine which unit is the most appropriate to use?
What level of estimation is considered reasonable when purchasing goods?

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Representing and analyzing data allows us to notice and wonder about relationships.

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Representing and analyzing data:
Sample questions to support inquiry with students:

How do we choose the most appropriate graph to represent a set of data?
How do graphs help summarize and analyze data?
How can simulations help us make inferences?
How can investigating trends help us make predictions?
Why are graphs used to represent data?
Why do we graph data?

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<tr><td colspan="4">Learning Standards</td></tr>
<tr><td>Curricular Competencies</td><td>Elaborations</td><td>Content</td><td>Elaborations</td></tr>
<tr><td>Students are expected to do the following:

Reasoning and modelling

Develop thinking strategies to solve puzzles and play games
Explore, analyze, and apply mathematical ideas using reason, technology, and other tools
Estimate reasonably and demonstrate fluent, flexible, and strategic thinking about number
Model with mathematics in situational contexts
Think creatively and with curiosity and wonder when exploring problems

Understanding and solving

Develop, demonstrate, and apply

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thinking strategies:

using reason to determine winning strategies
generalizing and extending

analyze:

examine the structure of and connections between mathematical ideas (e.g., angle relations, primary trigonometric ratios, measurement calculations)

reason:

inductive and deductive reasoning
predictions, generalizations, conclusions drawn from experiences (e.g., with puzzles, games, coding)

technology:

graphing technology, dynamic geometry, calculators, virtual

</td><td>Students are expected to know the following:

create, interpret, and critique graphs
primary trigonometric ratios
metric and imperial measurement and conversions
surface area and volume
central tendency
experimental probability
financial literacy: gross and net pay

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graphs:

including a variety of formats, such as line, bar, and circle graphs, as well as histograms, pictographs, and infographics

primary trigonometric ratios:

single right-angle triangles; sine, cosine, and tangent

conversions:

with a focus on length as a means to increase computational fluency
using tools and appropriate units to measure with accuracy

surface area and volume:

including prisms and cylinders, formula manipulation
contextualized problems involving 3D

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conceptual understanding of mathematical ideas through play, story, **inquiry**, and problem solving • **Visualize** to explore and illustrate mathematical concepts and relationships • Apply **flexible and strategic approaches** to **solve problems** • Solve problems with **persistence and a positive disposition** • Engage in problem-solving experiences **connected** with place, story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures Communicating and representing • **Explain and justify** mathematical ideas and **decisions** in **many ways** • **Represent** mathematical ideas in concrete, pictorial, and symbolic forms • Use mathematical vocabulary and language to contribute to **discussions** in the classroom • Take risks when offering ideas in classroom **discourse** Connecting and reflecting • **Reflect** on mathematical thinking • **Connect mathematical concepts** with each other, other areas, and personal	manipulatives, concept-based apps ○ can be used for a wide variety of purposes, including: – exploring and demonstrating mathematical relationships – organizing and displaying data – generating and testing inductive conjectures – mathematical modelling • **other tools:** ○ manipulatives such as algebra tiles and other concrete materials • **Estimate reasonably:** ○ be able to defend the reasonableness of an estimated value or a solution to a problem or equation (e.g., measurement calculations, angle-size reasonableness, primary trigonometric ratio calculations) • **fluent, flexible, and strategic thinking:** ○ includes: – using benchmarks and partitioning for graph creation and analysis – choosing from different ways to think of a number or operation (e.g., Which will be the most strategic or efficient?) • **Model:**		shapes • **central tendency:** ○ analysis of measures and discussion of outliers ○ calculation of mean, median, mode, and range • **experimental probability:** ○ simulations through playing and creating games and connecting to theoretical probability where possible • **financial literacy:** ○ types of income; income tax and other deductions

interests • Use **mistakes** as **opportunities to advance learning** • **Incorporate** First Peoples worldviews, perspectives, **knowledge**, and **practices** to make connections with mathematical concepts	○ use mathematical concepts and tools to solve problems and make decisions (e.g., in real-life and/or abstract scenarios) ○ take a complex, essentially non-mathematical scenario and figure out what mathematical concepts and tools are needed to make sense of it • **situational contexts:** ○ including real-life scenarios and open-ended challenges that connect mathematics with everyday life • **Think creatively:** ○ by being open to trying different strategies ○ refers to creative and innovative mathematical thinking rather than to representing math in a creative way, such as through art or music • **curiosity and wonder:** ○ asking questions to further understanding or to open other avenues of investigation • **inquiry:** ○ includes structured, guided, and open inquiry ○ noticing and wondering ○ determining what is needed to make sense of and solve problems • **Visualize:**		

	○ create and use mental images to support understanding ○ Visualization can be supported using dynamic materials (e.g., graphical relationships, simulations), concrete materials, drawings, and diagrams. • **flexible and strategic approaches:** ○ deciding which mathematical tools to use to solve a problem ○ choosing an effective strategy to solve a problem (e.g., guess and check, model, solve a simpler problem, use a chart, use diagrams, role-play) • **solve problems:** ○ interpret a situation to identify a problem ○ apply mathematics to solve the problem ○ analyze and evaluate the solution in terms of the initial context ○ repeat this cycle until a solution makes sense • **persistence and a positive disposition:** ○ not giving up when facing a challenge ○ problem solving with vigour and determination • **connected:** ○ through daily activities, local and traditional practices, popular media and news events, cross-curricular		

	integration ○ by posing and solving problems or asking questions about place, stories, and cultural practices • **Explain and justify:** ○ use mathematical arguments to convince ○ includes anticipating consequences • **decisions:** ○ Have students explore which of two scenarios they would choose and then defend their choice. • **many ways:** ○ including oral, written, visual, use of technology ○ communicating effectively according to what is being communicated and to whom • **Represent:** ○ using models, tables, graphs, words, numbers, symbols ○ connecting meanings among various representations • **discussions:** ○ partner talks, small-group discussions, teacher-student conferences • **discourse:** ○ is valuable for deepening understanding of concepts ○ can help clarify students' thinking,		

	even if they are not sure about an idea or have misconceptions
	• **Reflect:**
	  ○ share the mathematical thinking of self and others, including evaluating strategies and solutions, extending, posing new problems and questions
	• **Connect mathematical concepts:**
	  ○ to develop a sense of how mathematics helps us understand ourselves and the world around us (e.g., daily activities, local and traditional practices, popular media and news events, social justice, cross-curricular integration)
	• **mistakes:**
	  ○ range from calculation errors to misconceptions
	• **opportunities to advance learning:**
	  ○ by:
	  – analyzing errors to discover misunderstandings
	  – making adjustments in further attempts
	  – identifying not only mistakes but also parts of a solution that are correct
	• **Incorporate:**
	  ○ by:		

	– collaborating with Elders and knowledge keepers among local First Peoples – exploring the First Peoples Principles of Learning (http://www.fnesc.ca/wp/wp-content/uploads/2015/09/PUB-LFP-POSTER-Principles-of-Learning-First-Peoples-poster-11x17.pdf; e.g., Learning is holistic, reflexive, reflective, experimental, and relational [focused on connectedness, on reciprocal relationships, and a sense of place]; Learning involves patience and time) – making explicit connections with learning mathematics – exploring cultural practices and knowledge of local First Peoples and identifying mathematical connections • **knowledge:** o local knowledge and cultural practices that are appropriate to share and that are non-appropriated • **practices:** o Bishop's cultural practices: counting, measuring, locating, designing,		

Comment [mw1]: Carpe Diem: Can the link be embedded in "First Peoples Principles of Learning"? Or does it have to appear this way—with the URL as the link?

	playing, explaining (http://www.csus.edu/indiv/o/oreyd/ACP.htm_files/abishop.htm) ○ Aboriginal Education Resources (www.aboriginaleducation.ca) ○ *Teaching Mathematics in a First Nations Context*, FNESC (http://www.fnesc.ca/resources/math-first-peoples/)		