Backwards by Design Unit Plan Template

Subject	Foundations & Pre-Calc Math	**Grade Level**	Grade 10
Theme/Topic for Time-frame/Unit	Trigonometry	**Dates/Number of Classes**	September 27 – October 15 (omit Oct 11 for stat) 14 lessons including work time
Developed By	Miss Allysia Doratti (Mrs. Coburn)		

Stage 1 - Identify Desired Results

Learning Outcomes

Should be identified by designation (e.g., 5.1- Health-related Fitness; 5.2 Muscle Fitness; 5.4 …, 5.5 …, 5.6., 5.7, 5.10) and then written in student-friendly language – words that you can share with the students, so they know what it is they are trying to achieve. These outcomes identify the 'Big Ideas' of this plan for learning. Remember that you need to include at least one other subject plus Treaty learnings (see planning guide).

FP10.4

A) Students can develop, explain, and apply relationships and how side and angle sizes compare in similar right triangles
B) Students can show how to find the hypothenuse (longest side) of a right triangle and the legs (adj and opp sides) in a right triangle
C) Students can solve problems using one or more right triangles by applying ratios or the Pythagorean theorem
D) Students can create and solve problems that involve primary trigonometric ratios, Pythagorean theorem, and other measurements

TR10

- Students will investigate, through math problems, the economic impact that First Nations have on the provincial and territorial economies and the resulting benefits for all people
- Students will evaluate the impact that First Nations have on local economies through mathematical problem solving.

Key Understandings What understandings about the big ideas are desired? (what you want students to understand & be able to use several years from now)	**Questions for Deep Understanding** What provocative questions will foster inquiry into the content? (open-ended questions that stimulate thought and inquiry linked to the content of the enduring understanding)
Students will understand that... - Right triangles, and all their angles and sides, can be solved using trigonometric ratios or Pythagorean Theorem - The sum of all angles in a triangle will equal 180 degrees - Using the skills like developing, generalizing, explaining, and applying are ways they can communicate information - Two triangles can be similar if they have all three of the same angles - First nations people have a large impact on our economy that benefits all people.	*Content specific….* *Make sure you consider TELs, multicultural, cross-curricular… when finalizing your questions.* What kinds of jobs exist that work with triangles daily? What types of skills does math provide you and how will it set you up for your ideal career? What math skills can be used in your other high school classes? How could you build a Tipi or Pit house using triangles? How would knowing the angle between a harpoon and a fish help First Nations catch fish or other animals?

Knowledge: What knowledge will student acquire because of this unit? This content knowledge may come from the indicators or might also address pre-requisite knowledge that students will need for this unit.	**Skills** What skills will students acquire because of this unit? List the skills and/or behaviors that students will be able to exhibit as a result of their work in this unit. These will come from the indicators.

Students will know...
- What the hypothenuse and legs of a right triangle are
- That the three angles of a triangle add to 180 degrees
- That SOHCAHTOA stands for:
  - Sin = opposite/hypotenuse (a/c)
  - Cos = adjacent/hypotenuse (b/c)
  - Tan = opposite/adjacent (a/b)
	Students will be able to…
	- understand Pythagorean Theorem is followed by the equation: $a^2 + b^2 = c^2$ where *a* and *b* are the legs of the triangle and *c* is the hypotenuse.
	- Use SOHCAHTOA to solve triangle problems
	- Create and solve problems involving right triangles by using ratios or Pythagorean theorem
	- Develop, explain, and apply relationships and how side and angle sizes compare in similar right triangles
	- Define the following terms and how they relate to right triangles: angle of inclination, tangent ratio, indirect measurement, sine ratio, cosine ratio, angle of elevation, and angle of depression

Stage 2 – Assessment Evidence

Assessment Evidence

Through what evidence (work samples, conversations, observations, performances, quizzes, tests, journals, presentations or other means) will students demonstrate achievement of the outcomes? Identify both formative and summative assessments you will use throughout the unit and indicate which outcome(s) each assessment will be evidence for (note that one assessment can provide evidence on more than one outcome). Consider including authentic performance task(s) where students will demonstrate the desired knowledge, understandings, and skills? (Typically, a performance task describes a scenario or situation that requires students to apply knowledge and skills to demonstrate their understanding in a real-life situation).

NOTE: You must also include one pair-created Assessment tool for one of your identified Summative Assessments which clearly presents the outcome-driven criteria for assessment.

Students will have identified, to me, what they consider to be success. I will use this information to allow for a variety of assessments that adhere to all levels of achievement (UDL). Some options would be podcasting, blog posts, exit tickets, group work, creating problems in pairs, quizzes, vlogging (tiktoks), teaching mini lessons, etc. There may be more ideas added to the list based on students' achievement and ideals for proving knowledge. Some of the previous examples of assessment would be authentic performance task related.

Student Self-Assessment

How will students reflect upon or self-assess their learning? Provide at least three examples of how you can engage students in self-assessments.

This will be an open conversation. I will use student-teacher feedback to question students on their own work and how they could change their work to fulfill the problem solving. Also, if they have shown proficiency, I will further this knowledge by challenging them to think deeper about their answers. There will also be opportunities for peer assessment, specifically in the partner daily problems. Another would be having self-assessment via a rubric for one of the options for assessment.

Stage 3 – Learning Plan

What teaching and learning experiences will you use to:

- **achieve the desired results identified in Stage 1?**
- **equip students to complete the assessment tasks identified in Stage 2?**

Where are your students headed? Where have they been? How will you make sure the students know where they are going?
What experiences do the learners bring to the unit? How have the interests of the learners been ascertained? Have the learners been part of the pre-planning in any way? What individual needs do you anticipate will need to be addressed?
Learning environment: Where can this learning best occur? How can the physical environment be arranged to enhance learning?

Where have they been? They should have a great understanding of solving linear problems including inequalities and polynomials. I will check their understanding of past topics before moving on (fill in gaps where necessary). They should have at least some background knowledge on First Nations peoples.
What experiences do they bring? I will use Kahoot to "test" them on grade 9 outcomes so that I can fill gaps where necessary. I will use questioning methods to figure out what they know about first nations.
Where are they going? They will move towards understanding how to solve for right triangles by showing this in a multitude of ways (universal design) that best suit their needs. The students will have shared how they define and reach success. They will need to fully understand the following concepts: all 3 angles in a triangle add to 180, a right triangle is 90 degrees, define SOHCAHTOA and how to apply it, create and solve problems with right triangles, what Pythagorean Theorem is and how to apply it, comparing right triangles, and how to explain their ways of knowing (deeper thinking).
How will they know where they are going? Once each student has identified their ways of achieving success, we will create a checklist for each student. This will also be written in their student learning contracts. Once we have finished a section of that learning contract or checklist, we will work together to ensure that those things have been checked off. This success will measure individually and will be an open conversation.
Have the learners been part of the pre-planning? When we have figured out each student's measure of success, we can have conversations about how they will be assessed to maximize success. Once this has been decided, I will have many options available to prove learning. If students have any other ideas for proving success, they may present those through conversation.
How have the interests of the learners been included? This will be an open conversation, but students will have many options for assessment and teaching/learning. I will have learnt the students interests by this unit plan so I will have a better idea how this will be incorporated.
What needs do you anticipate will need to be addressed?

- As far as different types of learners, using a universal design will allow success to be achieved for all.
- Things to be aware of: access to tech at home, school, and community; contracts and adjustments in assessment per student; ed tech to be used in assessment and teaching
- Differentiation: dependent on the learner. Will work with Educational Assistant with this if necessary. With universal design, any type of learner should be able to answer problems in the way that they can based on their level of understanding.

LEARNING ENVIRONMENT:
Where can this learning best occur? Using universal design, there will be many platforms where learning will occur. There may be times, if weather permits, we could be outside for some classes. Most will be a combination of group work, pair work, online, in person (traditional), and hands-on activities.
How can the physical environment be arranged to enhance learning? By having a multitude of ways to learn material, this will change based on the students learning. I can assume that at least one of these methods will adhere to everyone's learning style. Stepping outdoors will always enhance learning because they can connect math to life problems.

How will you engage students at the beginning of the time frame/unit? (Motivational set for the unit)

Set will include the following TikToks:
https://www.tiktok.com/@ath3na_77/video/6939946232408329478?lang=en&is_copy_url=0&is_from_webapp=v1&sender_device=pc&sender_web_id=7001513777561273862
https://www.tiktok.com/@tremaynevargas/video/6974725801639955713
These videos will be engaging because it is on a platform most widely used by teens and the content is fun and silly enough but still holds value.

What events will help students experience and explore the deep understandings and questions in the unit plan? How will you equip them with needed skills and knowledge? Note: For this assignment you must include full summary details across all columns for 6 days only. For the other days, you need to complete the Outcome(s) and Indicator's column along with a brief description of the learning tasks/experiences in the second column below. There must be at least 12 days in this sequence of learning.

#	Outcome(s) and Indicators	Assessment	Instructional Strategies/Process Learning Tasks/Experiences	Resources/Materials
1-2	FP10.4 – Develop the tangent ratio and relate to the angle of inclination of a line segment. (2.1)	1.Exit slip – solving a single question on own – teacher assessment + post conference 2.Group work on white board/chalkboard	- Traditional lecture (very short) - Pair or individual work to construct a triangle - Examples on board with student involvement - Group discussion - Google Classroom exit slip	TikTok for unit "set" Textbook White board Group work: graph paper, rulers, protractors
3-4	FP10.4 – apply the tangent ratio to calculate lengths of legs (2.2) TR10 – problem(s) including First Nations economic impact	1.Exit slip – solving a single question on own – teacher assessment + post conference 2.Group work on white board/chalkboard 3.Daily problem presentation– pairs (2 groups) – self, peer, and teacher assessment 4. Student-created example and solution	- Guided examples - Group discussion - Google Classroom exit slip - Pairs – daily problem (2 groups) - Student-created example via some sort of media (different per student) – homework - Individual work activity	Textbook Google Classroom (on board) White board Computers/Devices for online work
5-6	FP10.4 – determine a height that cannot be measured directly – application to real-world measurements (2.3) TR10 – problem(s) including First Nations economic impact	1.Exit slip – solving a single question on own – teacher assessment + post conference 2.Daily problem presentation – pairs (2 groups) – self, peer, and teacher assessment 3. Outdoor-based problem	- Group work activity - Group discussion - Google Classroom exit slip - Outdoors activity – student-created examples based on outdoors (real-life application) - Guided examples - Pairs – daily problem (2 groups)	Group work: enlarged copies of protractor, scissors, meter sticks, straws, cardboard, glue, tape, need and thread, washers, graph paper Textbook Google Classroom (on board)
7-8	FP10.4 – develop and apply the sine and cosine ratios to determine angle measures (2.4) TR10 – problem(s) including First Nations economic impact	1.Exit slip – solving a single question on own– teacher assessment + post conference 2.Group work activity 3.Daily problem presentation– pairs (2 groups) 4. Student-created example and solution	- Group work activity - Group discussion - Google Classroom exit slip - Guided examples - Pairs – daily problem (2 groups) - Student-created example via some sort of media (different per student) – homework	Group work: graph apper, rulers, protractors Google Classroom White board Textbook Computers/Devices for online work
9-10	FP10.4 – use the sine and cosine ratios to determine length indirectly (2.5)	1.Exit slip – solving a single question on own– teacher assessment + post conference 2.Group work activity 3.Daily problem presentation – pairs (2 groups) – self, peer, and teacher assessment 4. Student-created example and solution	- Group work activity - Group discussion - Google Classroom exit slip - Guided examples - Pairs – daily problem (2 groups) - Student-created example via some sort of media (different per student) – homework	Google Classroom White Board Textbook

11-12	FP10.4 – use a primary trigonometric ratio to solve a problem modelled by a right triangle (2.6) TR10 – problem(s) including First Nations economic impact	1.Exit slip – solving a single question on own– teacher assessment + post conference 2.Group work activity 3.Daily problem presentation– pairs (2 groups) – self, peer, and teacher assessment 4. Student-created example and solution	- Group work activity - Group discussion - Google Classroom exit slip - Guided examples - Pairs – daily problem (2 groups) - Student-created example via some sort of media (different per student) – homework	Google Classroom White Board Textbook Computers/Devices for online work
13-14	FP10.4 – use trigonometry to solve problems modelled by more than one right triangle (2.7)	1.Exit slip – solving a single question on own – teacher assessment + post conference 2.Group work activity 3.Daily problem – pairs (2 groups) – self, peer, and teacher assessment 4.Unit final assessment (pre-chosen to student preference of proof of learning) – self and teacher assessment **INQUIRY**	- Group work activity - Group discussion - Google Classroom exit slip - Guided examples - Pairs – daily problem (2 groups)	Kahoot Google Classroom Whiteboard Group work: graph paper, ruler

** these seven lessons may not coordinate with seven days of class, it could be more like 14 classes (1 lesson lasting 2 days)
** these also may or may not run into each other (meaning lessons may overlap based on time needed to complete the daily work)
** this unit may be extended based on the possibility of re-teaching

Self-Assess and Reflection (Stage 4)

Considerations	Comments
Learning Alignment: Is there alignment between questions for deep understanding, the outcomes/indicators, learning assessments, and learning tasks/experiences?	All of the following deep-thinking questions align with indicator a) - How do the ratios compare? - What do you think the value of each ratio depends on? - Why does the value of the tangent ratio of a given angle not depend on the right triangle you use to calculate it? - How can you use the tangent ratio to determine the measures of the acute angles of a right triangle when you know the lengths of its legs? - How can you use the tangent ratio to determine the length of a leg in a right triangle? Indicator b) - Suppose you know or can calculate the lengths of the legs in a right triangle. Why can you always calculate its hypotenuse? Indicator c) - When you have to solve a problem that involves two right triangles, how do you decide where to begin? Indicator d) - Students will have an opportunity to create their own problems and solutions to that problem more than once during this lesson All indicators - Why is it important to draw a sketch before you start to solve a problem? - Why are the values of the sine of an acute angle and the cosine of an acute angle less than 1? - When can you use the sine ratio to determine the measure of an acute angle in a right triangle? When can you use the cosine ratio? - What are the advantages of using a trigonometric ratio instead of an accurate drawing to solve a measurement problem?

	- When would you use the sine ratio to determine the length of a side of a right triangle? When would you use the cosine ratio? - When we solve a right triangle, sometimes we determine the measure of an unknown angle before we determine the length of an unknown side and sometimes, we reverse these calculations. How would you decide which measure to calculate first? - Can we solve a right triangle if we are given only the measures of two acute angles? Explain. - What do you have to think about when you draw a diagram with triangles in three dimensions?
Adaptive Dimension/Differentiation: Have you made purposeful adjustments to the learning content (not outcomes), instructional practices, and/or the learning environment to support meeting the learning needs and diversities of all your students? What might variations in learning tasks look like to meet the needs and learning styles of diversity of learners?	<u>For struggling students:</u> Provide two different examples of what this might look like. - Having many options for completing the daily problem assignment. The question will be given, they must present the solution. - In the student-created problem assignment, students can complete this using WordPress (blog), TikTok (short vlog), videoing the teaching of solution, podcasting, etc. The students can show their understanding with this. No matter the level of understanding, I can note down any re-teaching that may need to occur. <u>For students who are exceeding and need a challenge:</u> - Have on-the-go additions to assignments available to those who are mastering the current grade level content. For example, if a question were to ask to find one of the legs, I would have them find all of the legs and angles in the problem. Also, I would have deeper thinking and/or problem-solving questions that are much more difficult. For example, maybe the question would hint at some of the measurements versus having them available.
Instructional Strategies/Models/ Approaches: Did you use a variety of teacher directed and student-centered instructional approaches? Do the selected modes/approaches align with the learning focus? *For three different instructional strategies, name and explain where, why and how you used it.*	**Cooperative learning/Hands-on:** this strategy will be used daily because students will always have something to learn from their group members while they learn the content. This is a strategy I use during the cooperative group activity. Groups will have 3 people per group (1 writing on the board, 1 giving instructions to the writer, and one using pen and paper to solve it.) and they will have to work together to solve. I will prompt them to switch, and they can use this method to fix others mistakes until they come to a solution. This aligns with indicator c) of FP10.4 **Direct instruction/Guided examples:** this strategy will be used daily but limited to 10 minutes so that students remain engaged. This is important to keep some tradition so that students can learn the necessary material to engage in cooperative and individual work. This will still be guided note taking. This will minimize the amount of writing needed to share problems and allow the students to worry about the guided examples. **Experiential Learning:** this will also be used plentifully through the unit. This is a strategy used in the student-created examples and the daily problem presentations. These are both opportunities for them to be really engaged to promote deep thinking by using platforms that are relatable to their real lives. It takes the classroom learning outside of the classroom and promotes assessment for and as learning. This directly relates to indicator c) because they are creating problems.
TELs Content/Gender Equity/Multicultural Education: Have you nurtured and promoted diversity while honoring each child's identity? How have you interconnected your learnings to support holistic learning? *Comment on where and how you see this being addressed within your plan.*	Teacher-created content will have a multitude of diversity within it including: TELs, gender equity and multicultural problems. Based on the cultures of my students, I will ensure to incorporate their culture in all of the work that I create. I will do my best to incorporate others' ways of knowing and learning. Students will also be reminded that they can incorporate any part of themselves in their problem creation assignments.

From: Wiggins, Grant and J. McTighe. (1998). *Understanding by Design*, Association for Supervision and Curriculum Development, ISBN # 0-87120-313-8 (pbk)