Trigonometry Assignment

Activity Summary

In this activity, students will:

- Measure items in the school and record answers using trigonometry
- Explore careers that focus on Numeracy skills

Prior Knowledge

- ***Essential Skills*** including all subcategories
- Basic Trigonometric Ratios
- Pythagorean Theorem
- Angle of inclination, angle of depression
- Solving problems involving one triangle to find a height, distance or angle
- Solving problems involving two triangles
- Measuring angles using a clinometer and transit (or transit-like device)

Teaching Planning Notes

- Review the assignment including prior learning required, assessment and evaluation tools
- Provide students with measuring tapes at least 10 m long and clinometers, transits or other devices that allow for measuring angles
- Set up 4 stations with required measurement tools and worksheets
- Provide a step ladder (preferably longer than 6 ft.) in the classroom
- Provide an extension ladder in the classroom, leaning it against the wall, marking the location on the floor where the feet should sit
- Label step ladder and extension ladder for students to avoid confusion
- To link this to the workplace effectively, the teacher should arrange for a surveyor to come to the class to describe the requirements of his/her job, show the tools used on the job and to discuss how the surveyor would solve the problems presented. If possible, the surveyor could demonstrate the calculation of one of the activities and the students could compare their results with the professional.

Note 1: *Teachers may wish to link this activity more closely with other technical sectors that use surveying equipment (i.e. Horticulture and Landscape Design, Construction, etc.). Problems may easily be changed to reflect applications in these areas.*

Assessment of Student Achievement

Task	Tool / Type
Stations 1-4 Worksheets	Off on a Tangent Activity Checklist (Formative)
Record Solutions to Measurement Problems	Off on a Tangent Do You Measure Up Rubric Stations 1-4 (Summative)
Guest Speaker	Off on a Tangent We Have a Visitor Activity Sheet (Formative)

Activity and Assessment Materials

- Activity Assignment Sheet
- Worksheets for Stations 1 through 4
- We Have a Visitor Activity Sheet
- Assignment Checklist
- Do You Measure Up? Rubric

FOCUS ON LEARNING

Essential Skills:

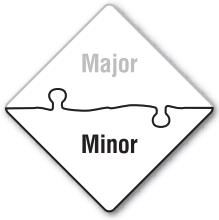
Reading Text
All Activities

Writing
Guest Speaker Follow-up

Numeracy
All Activities

Thinking Skills
Solving Problems

Working with Others
Solving Problems



Curriculum Linkages For Ontario Educators

Essential Skills truly are everywhere and as teachers we are always teaching students the ***Essential Skills!*** As subject teachers and specialists, we know that many of the curriculum expectations we are accountable to teach and assess, also address the ***Essential Skills*** and while the linkages are not always readily apparent, the linkages exist nonetheless.

While this activity connects to a variety of courses, it is most closely aligned to the following courses:

- Foundations of Mathematics, Grade 10, Applied - MFM 2P

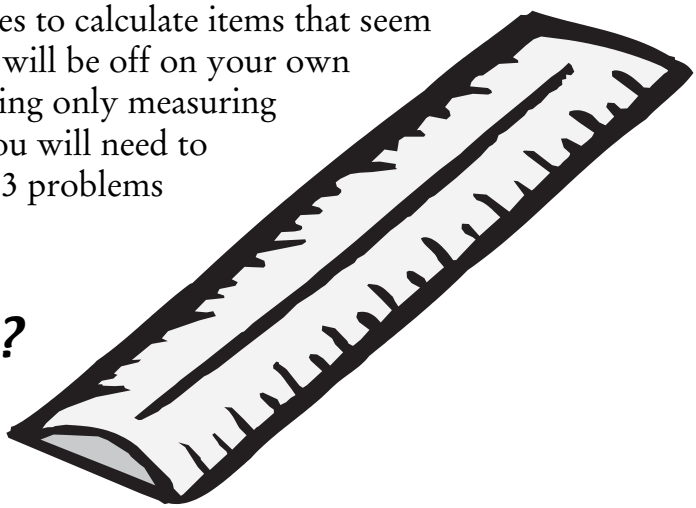
To assist you, the teacher, in making more transparent linkages, we have identified the following curriculum linkages for this activity.

Foundations of Mathematics, Grade 10, Applied - MFM 2P

Coded Overall Expectations	Coded Specific Expectations
MTV.02 - solve problems involving right triangles, using the primary trigonometric ratios and the Pythagorean theorem;	MT2.02 - determine the measures of the sides and angles in right triangles, using the primary trigonometric ratios; MT2.02 - determine the measures of the sides and angles in right triangles, using the primary trigonometric ratios and the Pythagorean theorem;
	MT2.03 - Solve problems involving the measures of sides and angles in right triangles in real-life applications (e.g., in surveying, in navigation, in determining the height of an inaccessible object around the school), using the primary trigonometric rations and the Pythagorean theorem.
	MT2.04 - describe, through participation in an activity, the application of trigonometry in an occupation (e.g. research and report on how trigonometry is applied in astronomy; attend a career fair that includes a surveyor, and describe how a surveyor applies trigonometry to calculate distances; job shadow a carpenter for a few hours, and describe how a carpenter uses trigonometry)
	MT3.01 - use the imperial system when solving measurement problems (e.g., problems involving dimensions of lumber, areas of carpets and volumes of soil or concrete)
	MT3.02 - perform everyday conversions between the imperial system and the metric system, and within these systems, as necessary to solve problems involving measurement

Off on a Tangent

Trigonometry has been used throughout the ages to calculate items that seem immeasurable. Today, in groups of 2 or 3, you will be off on your own quest to measure various items in the school using only measuring tapes, meter sticks, clinometers and transits. You will need to complete four activities. Each activity has 2 or 3 problems that require the same tools to solve.



Task 1: Do You Measure Up?

Station 1: Finding Heights
Station 2: Finding Angles
Station 3: Finding Distances
Station 4: Finding It All

Step 1: Starting at one of the stations, select one problem sheet from the envelope and take the indicated measurement tools located at that station. For these activities, your group will have to determine how best to solve the problem using the measurement tools you have. After formulating a plan, take all necessary measurements, and draw a rough sketch of the situation recording the measurements that you made to solve the problem. Return to class, replace all measurement tools in the proper station and hand in the worksheet (with your names on it). Continue until you have completed the sheets from each station. When all stations are complete, collect all your worksheets from your teacher.

Step 2: Using your rough sketches, proceed to write out full solutions to all the problems in a neat, well-organized fashion, including labelled diagrams. Submit your solutions to the teacher. (Every student must complete this step.)

Task 2: Who Uses this Stuff Anyway?

Many professionals and skilled trades workers use the ***Essential Skill*** of Numeracy daily in their role. The ***Essential Skill*** of Numeracy includes the skills of measurement and calculation math, data analysis math, money math, scheduling or budgeting and accounting math and numerical estimation. Listen carefully to the guest speaker in order to record information as well as identify some keys to being successful in his/her job. Record all the information on the "We Have a Visitor" Activity Sheet.

Off on a Tangent
Station #1: Finding Heights

Materials Required
- 1 clinometer
- 1 measuring tape
- 1 meter stick
- Station 1 Worksheet
- Pencil or pen
- Hard surface to write on (e.g. clipboard or binder)

☑ Completed
- ❒ returned to station
- ❒ returned to station
- ❒ returned to station
- ❒ returned to teacher

Problem 1A: Determine the height (in meters) of the school.

Problem 1B: Determine the height (in meters) of the Gym ceiling.

Problem 1C: Determine the maximum height (in feet and inches) reached by the step-ladder in the classroom without climbing up the ladder.

Off on a Tangent
Station #2: Finding Angles

Materials Required
- 1 measuring tape
- Station 2 Worksheet
- Pencil or pen
- Hard surface to write on (e.g. clipboard or binder)

☑ Completed
- ❒ returned to station
- ❒ returned to teacher

Problem 2A: Determine the angle of inclination of any wheelchair ramp in the school. Indicate the location of the ramp.

Problem 2B: A ladder is leaning against the wall in the classroom, a certain distance from the wall. What angle is the ladder making with the wall?

Problem 2C: Determine the angle of depression from the second floor to the landing between the first and second floors.

Off on a Tangent
Station #3: Finding Distances

Materials Required

- 1 transit
- 1 measuring tape
- 2 meter sticks
- Station 3 Worksheet
- Pencil or pen
- Hard surface to write on (e.g. clipboard or binder)

☑ Completed

- ❒ returned to station
- ❒ returned to station
- ❒ returned to station
- ❒ returned to teacher

Problem 3A: Determine the distance across the football field. (in feet and inches)

Problem 3B: Determine the distance (in meters) from the portable nearest the school to the closest set of doors.

Problem 3C: Determine the distance (in meters) across the parking lot of the school. Include a sketch of the parking lot, indicating which distance you are measuring.

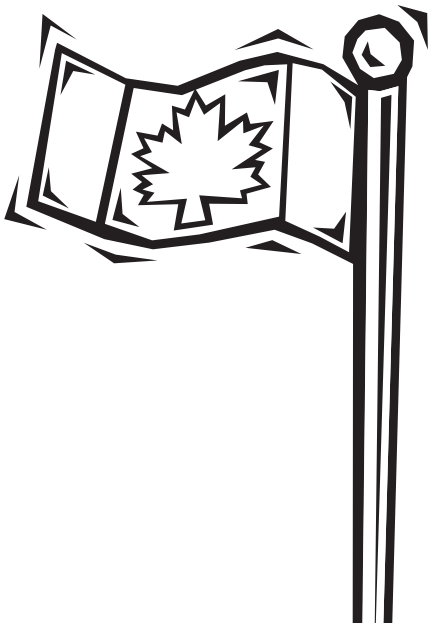
Off on a Tangent
Station #4: Finding it All

Materials Required

- 1 transit
- 1 clinometer
- 1 measuring tape
- 2 meter sticks
- Station 4 Worksheet
- Pencil or pen
- Hard surface to write on (e.g. clipboard or binder)

☑ Completed

- ❒ returned to station
- ❒ returned to station
- ❒ returned to station
- ❒ returned to station
- ❒ returned to teacher



Problem 4A: Determine the height (in meters) of the school's flagpole.

Problem 4B: Determine the height (in feet and inches) of the goal posts on the football field without stepping onto the field.

Problem 4C: Find a place in the school where you can stand and see both the top and bottom of an object above your head.

What is the object? _____

Where is the object? _____

Determine the height of the object you've selected.

Off on a Tangent
Assignment Checklist

	Worksheets Returned after each Station? ☑	Problem Solutions Completed? ☑
Station 1: Finding Heights	❑	❑
Station 2: Finding Angles	❑	❑
Station 3: Finding Distances	❑	❑
Station 4: Finding It All	❑	❑

Off on a Tangent
Do You Measure Up? Rubric
(Stations 1-4 Worksheets and Problem Solutions)

Categories/ Criteria	Level 1 (50-59%)	Level 2 (60-69%)	Level 3 (70-79%)	Level 4 (80-100%)
Knowledge and Understanding				
Completed measurements with accuracy using the primary trigonometric ratios and the Pythagorean Theorem	Limited	Some	Considerable	Thorough
Solved problems with mathematical accuracy in real life applications	Limited	Some	Considerable	Thorough
Understood the conversion of measurements between the imperial and metric systems	Limited	Some	Considerable	Thorough
Thinking				
Interpreted the problems correctly and created a graphical model of the situation	Limited Effectiveness	Some Effectiveness	Considerable Effectiveness	High Degree of Effectiveness
Communication				
Used correct mathematical symbols, labels, units and conventions	Limited Effectiveness	Some Effectiveness	Considerable Effectiveness	High Degree of Effectiveness
Application				
Selected the appropriate method to solve the problems	Limited Effectiveness	Some Effectiveness	Considerable Effectiveness	High Degree of Effectiveness

Note: A student whose achievement is below Level 1 (50%) has not met the expectations for this assignment.

Off on a Tangent
We Have a Visitor

Visitor's Name: _____

Company: _____

Occupation: _____

Length of time in the job: _____

Education required to do the job: _____

Does our guest use Numeracy in their job? _____

Complete the following chart.

Numeracy Sub-Category	Used This In Their Job (Y/N)	Example
Measurement and Calculation Math		
Data Analysis Math		
Money Math		
Scheduling or Budgeting and Accounting Math		
Numerical Estimation		

Off on a Tangent
We Have a Visitor

List 3 additional ***Essential Skills*** required for success in this job. Explain how each is used.

1._____

_____

_____

2._____

_____

_____

3._____

_____

_____

List any Technical skills that are required for this job.

_____

_____

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_____

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