Title of Lesson
A (Practice) Understanding Task

Purpose: Find the volume of large irregular shaped objects

Career Field:

(Name of Company that inspired lesson)

WTCC Associate Program of Study and Contact Person:

NC Math 4 Standards:
NC.M4.AF.2 Apply properties of trigonometry to solve problems.
> *NC.M4.AF.2.1 Translate trigonometric expressions using the reciprocal and Pythagorean identities.*
> *NC.M4. AF.2.2 Implement the Law of Sines and the Law of Cosines to solve problems.*

Unit Alignment:
NC Math 3 - Trigonometry Unit
NC Math 4 - Trigonometry Unit
WTCC Math 110, 121, 171, or 143   ****I'm unsure about this****

Common Core State Standards for Mathematical Practice
Indicate which of the standards are highlighted in this lesson
> 1. Make sense of problems and persevere in solving them.
> 2. Reason abstractly and quantitatively.
> 3. Construct viable arguments and critique the reasoning of others.
> 4. Model with mathematics.
> 5. Use appropriate tools strategically.
> 6. Attend to precision.

Prerequisite Skills
- use sine and cosine and Pythagorean theorem to find missing side lengths in a right triangle (degrees)
- estimate area of a quadrilateral
- find volume of a prism
- find coterminal angles (such that result is in domain of 0 to 360 degrees)
- use excel (or google sheets) to multiply a column by a number, to sum a column (introduce sigma), and to divide a sum by a constant

Time Required
The time required to complete this activity is approximately 90 minutes.

Materials Needed
- computer, pen, paper

The Teaching Cycle:
Launch:

Explore:

Discuss:

Exit Ticket:

Two example assessments for testing:

Student Activity Sheet

Answer Key

1. variety of answers
   Possible answers:
     - fill a measuring cup part full of water, drop in rock, measure displacement of water (go science friends!!)
     - smash it into tiny pieces - pour these into a prism shaped mold - measure dimensions
     - find the length, width, and height and use these and the formula for volume of a prism to estimate
     - break the rock into smaller pieces and use the technique above
     - etc.

2. variety of answers
3. slope distance = how far you've walked,
   horizontal distance = dimension of the base of a prism to find volume
4. variety of answers
5. 253.3886 feet
6. sum is 538.9789 deg
7. 540 deg
8. 1.0211 deg
9.

Point number	Horizontal Angle	Azimuth
101	95.1245	183.2487
102	108.5431	111.7918
103	112.4215	44.2133
104	99.7312	323.9445
105	123.1586	267.1031

10. Latitude: -32.8936 feet (moved left)
    Departure: 251.2445 feet (moved up)

11.

Point Number	Latitude	Departure
101	46.1264	23.3251
102	32.4542	-10.2399
103	-17.2154	-7.2134
104	-60.9726	-5.6026

Σ	0.3932	0.2692

Linear Misclosure: 0.4765 feet

**essentially, your surveyed loop almost closes - on your drawing, your final point is 0.3932 feet right and 0.2692 feet north of where it should actually be to close the loop (the sum of your horizontal and vertical movements should be 0 and 0)

12. 1165.1292 - Of your traverse covered 1165.1292 feet, you would have 1 foot of error.
13. answers will vary

14 and 15: use the excel information:

		Stock Pile Survey		
		Base Pile Elevation (ft)	384	
Method	Resolution	Elevation Data	Volume (ft3)	Difference from Method 3
1	39 Points	25ft GRID Volume	410,625.00	4%
2	48,502 Points	0.7 ft GRID Volume	418646.4	2%
3	1,285,048 Points	SfM Point Cloud	427,142.00	