GIC: Volume Math Packet **Name_____ per_____**

How does math get used in road construction? Consider the roads we all use. What is involved in building a road? A road can't be built on just the "regular" untouched ground for many reasons but primarily because the natural ground is most likely too soft and won't support the traffic over time. Eventually, the road could fail causing a dangerous situation. Thus, contractors will use different types of soils and techniques to condition the soils for optimum performance.

This activity will replicate what road contractors deal with on a large scale with every project. It is crucial to determine the type of ground you are working with and if the ground can handle the type of traffic required, from small roads in remote areas of Alaska to large airports that must be able to support large jet airplanes.

Dirt Diggers is a Heavy Civil contractor in the state of Alaska and has an opportunity to build a project in remote Alaska. The job requires the contractor to excavate material from a mine site using the overburden to build a perimeter berm and the gravel to build a road. The mine permit allows the contractor to excavate to a total depth of 70' below the surface. The permit also requires that the remaining overburden be place back in the mine for reclamation and a 50' gap in the perimeter berm for vehicle access in the future. The Soils Engineer determined that the overburden material characteristics would swell at a rate of about 25% and shrink at a rate of about 20%, the gravel material would swell at a rate of about 10% and shrink at a rate of about 5%. Thus, it has been determined that the gravel material is suitable for road construction, but the overburden is not. Dirt Diggers is very excited to take on this project but must determine the volumes of materials to assess whether they have the resources needed to do the work.

*Note: use the information above and the attached "Mine Site Area" and "Figure 2" sheets to find critical dimensions needed to solve the problem.

Dilemma: How much material do I need to build a perimeter berm around the mine site and how much material do I have to build a good road?

Step 1: Solve for the following overburden quantities:

a. Calculate the total surface area of overburden available for excavation: _____ (square feet)
b. Calculate the total volume of overburden available for excavation: _____ (cubic feet)
c. Convert the cubic feet of overburden into cubic yards: _____ (cubic yards)

Step 2: Solve for the following gravel quantities:

a. Calculate the total surface area of gravel (lift 2) available for excavation: _____ (square feet)
b. Calculate the total volume of gravel (lift 2) available for excavation: _____ (cubic feet)
c. Convert the cubic feet of gravel (lift 2) into cubic yards: _____ (cubic yards to the nearest whole number)
d. Calculate the total surface area of gravel (lift 3) available for excavation: _____ (square feet)
e. Calculate the total volume of gravel (lift 3) available for excavation: _____ (cubic feet)
f. Convert the cubic feet of gravel (lift 3) into cubic yards: _____ (cubic yards)
g. Calculate the total amount of gravel available for excavation: _____ (cubic yards)

Step 3: Solve for the following quantities of overburden needed to construct a perimeter berm at the mine site and quantity of overburden to be put back in the mine site for reclamation.

a. Calculate the total length of the perimeter berm: _____ (linear feet)

b. Calculate the total amount of overburden needed to construct the berm: _____ (cubic feet)
c. Convert the amount of overburden needed to construct the berm to cubic yards: _____ (cubic yards to the nearest whole number)
d. Calculate the remaining amount of overburden to be placed back in the mine site for reclamation: _____ (cubic yards)

Step 4 "BONUS": Dirt Diggers is trying to calculate how many truck loads would be needed to transport the overburden material to a stockpile area using very large heavy haul trucks. *Think about the shop activity with the flour material*.

a. Calculate how many "loose" cubic yards of overburden are needed to be hauled out of the mine site to a stockpile area: _____ (cubic yards)
b. If a heavy haul truck can hold 36 cubic yards ("loose or truck"), how many truck loads are needed to transport the overburden: _____ (truck loads)
c. Based on this situation, was Dirt Diggers faced with a "shrink" or "swell" factor when excavating the overburden from its natural state (bank cubic yard) to its truck cubic yard: _____