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Window Cleaning Business – How Much Would You Pay Your Employees to Receive a Certain Percentage Profit?

► EQUIPMENT

Stopwatch or wristwatch with a second hand

Rag or paper towels

Bucket

Window cleaner

Squeegee

Metric tape measure

► PROBLEM

Your company has been given a contract to clean all of the windows inside your school building. The school agrees to pay your company \$ _____ per “average” size window. You need to determine: how many windows need to be cleaned; how much money your company will receive from cleaning the windows; how long it takes to clean an “average” size window; how long it should take to complete the entire job; and how much profit your company will earn from the contract.

► PROCEDURE

1. Estimate the number of “average” size windows in your school. Record the number and explain how you came up with this number.
2. Based on the total number of windows, calculate how much money (revenue) your company will receive from cleaning the windows. Show your work.
3. Clean at least five “average” size windows and write down the total number of seconds needed to clean each. Remember your company will only be cleaning the inside of the windows in the school.

Window 1 = _____

Window 2 = _____

Window 3 = _____

Window 4 = _____

Window 5 = _____

Amount of Earth's Surface Visible from Various Heights Above the Earth

► EQUIPMENT

Tape measure (customary)

► PROBLEM

You will use the tape measure to measure your height to the nearest inch. You will then convert your height to the nearest hundredth of a mile and put that into a formula to find the number of square miles that can be seen from that height above the earth. Next you will find the difference between the surface area of the earth you can see from the bottom and top rows of your school's athletic stadium or bleachers. Finally, you will find at what height in the stadium you would need to sit to have a view of 100 square miles.

► PROCEDURE

1. Measure your height to the nearest inch.

height = _____ inches

2. Convert your height to the nearest hundredth of a mile (1 mile = 5,280 feet). Show your work.

height = _____ miles

3. Using the following formula, find the earth's surface area you should be able to see at your height. Round your answer to the nearest square mile.

$$S = \frac{(9.848 \times 10^7)h}{(3.960 \times 10^3) + h}$$

S = Surface Area (In Square Miles) of Earth Seen At a Particular Height

h = The Height In Miles of the Object Above the Earth's Surface

S = _____ square miles

4. Measure the height above the ground of the lowest row of seats in your athletic stadium or bleachers to the nearest inch, then convert to the nearest hundredth of a mile.

height = _____ miles

5. Find the approximate earth's surface area (in square miles) that a fan should be able to view from this row of seats. Use the formula in Step 3.

S = _____ square miles

Comparing Reaction Times

► EQUIPMENT

Meter stick

Graph paper (optional)

► PROBLEM

You will calculate the reaction time to catch a falling meter stick. You will then graph your data and determine if the graph represents a function.

► PROCEDURE

1. Have one member of your group hold the 100 cm end of the meter stick directly above the open hand of another group member who will be the catcher. The uppermost part of the catcher's hand should be even with the meter stick's 0 cm end. Have the first member drop the stick and the second member, looking only at the bottom of the stick, catch the stick as soon as he or she can. After the meter stick is caught and while the catcher is still holding it, record the number of mm the highest part of the catcher's hand is up the meter stick.

Have each member of the group be both a "dropper" of the meter stick and a "catcher" of the meter stick. Each student should catch the meter stick **three** times. Perform this activity for at least ten students. Record the results in the space provided below. When you are finished, find the average of the 3 catches.

Student's Name	Catch #1 in mm	Catch #2 in mm	Catch #3 in mm	Average distance (d)	Reaction Time (t)
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

2. Using the formula, $d = 490t^2$ find the reaction time (t) for each of the average distances (d) in Step 1 and fill in the last column of the chart above.

Similar Triangles: Metric

► EQUIPMENT

Mirror

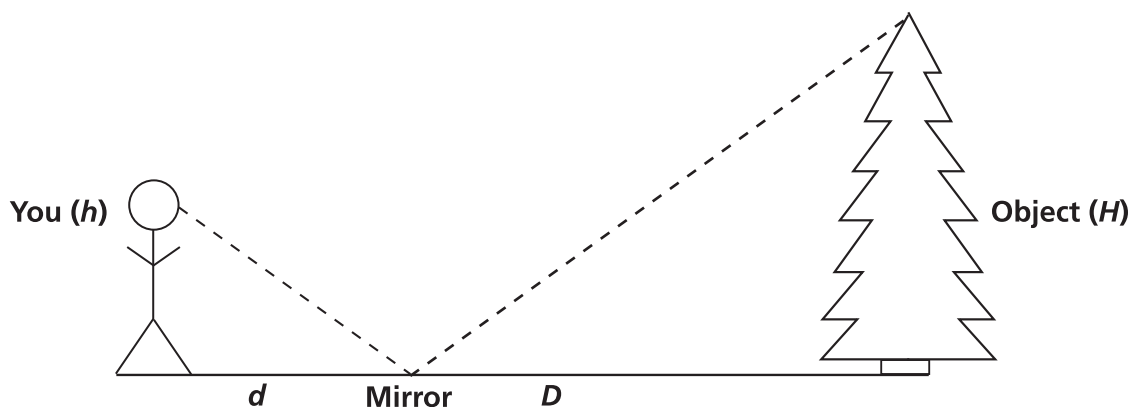
Metric tape measure or meter stick

► PROBLEM

You will use the proportionality of sides of similar triangles to find the height of several objects outside your school building.

► PROCEDURE

Position yourself on a line perpendicular to the object to be measured. Place the mirror between you and the object to be measured. Make sure the mirror is laid on a flat surface with the reflective side up. Stand erect and do not lean over to view the mirror, but position yourself so that when you look into the mirror, you view the top of the object in the center of the mirror.



The drawing above depicts your height (h), the distance (d) from you to the mirror, the height of the object (H), and the distance (D) from the mirror to the object whose height is being measured. The two triangles are similar triangles, their corresponding angles have the same measures.

After positioning yourself as described above, have a member of your group measure:

1. Your height (h)
2. The distance (d) from you to the center of the mirror
3. The distance (D) from the center of the mirror to the object

Fill in the chart below and repeat this procedure using additional objects.