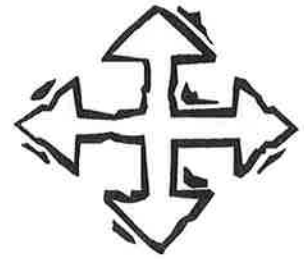


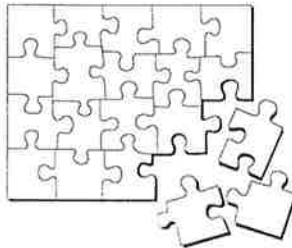
BEAL MATH TRAIL

Welcome to the new Beal. As part of this fall conference, WOMA 1999, New Math for a New Millennium, we created a small math trail to lead you around our new school for the new millennium!



This is not a detailed Math Trail. It was developed to give you an example of a Math Trail as well as act as a vehicle to explore a little of this new building.

As you travel around the school answering the questions of the Math Trail you will be collecting pieces puzzles. At the end of the back to the Atrium to check



to two other puzzles - logic Trail you will make your way your answers.

To travel along this Math Trail I introduce you to a group of new students to the school, the Wee-beals. They are a hardy group. There are 350 of them here out of a possible population of 2000 this year. They are new to the school, arriving from more than 62 feeder schools.

1.

The first thing the Wee-beals wish to do when they arrive is to find the cafeteria and buy a pop. They drink gallons and then wonder why they cannot sit still in class for 75 minutes! Right down the hall from the cafeteria is a unique element to this high school: a pool.

Looking into the pool area from the entrance doors you can see the pool itself. If we had access we would be able to measure the length and width and find them to be 10m by 5m, and we'd find the depth to be 2m at one end gradually decreasing to a depth of 9.5m at the other end.

How many pop cans of cola would be needed to fill this pool?

That's a lot of pop! That's a lot of trips to the washroom! This would be about as much exercise as if the Wee-beals were playing basketball for a class period. Last year the senior boys' basketball team played in the city finals! After an exciting game where they played their hearts out, they won second place. We know how good they were, and so do the fans!

When the school first opened in September of 1998, there was a finished gym, with beautiful wooden floors, new colour schemes, bleachers and scoreboard. The London Free Press came to write an article about this new gym.

2.

BUT . . . they couldn't get in. There were no stairs completed in the construction yet! But for the Wee-Beals this year we have a Stairway to Heaven. It is large, bright with natural light, and un-airconditioned! There is no air circulation, so work fast . . . with all this glass block it makes you wonder how safe it really is! Glass breaks doesn't it? By the way, what is the diagonal size of one of those glass blocks?



Walk down to the basement level, to your right, around the corner past the display case toward the gym. There might be a game on tonight.

3.

A basketball is on display in the display case. If the gym is 28mx45mx18m how many basketballs would the Wee-beals need to fill the gym?

Come back up the hall and go down the few stairs. A number of Wee-beals are permitted to enroll at Beal even though it is outside their family of schools area. This is because the Wee-beal wishes to be a part of the extensive art program offered at Beal.

4.

Our broadcasting, computer art are of the hallway, 10m) do you think B22, and what area?



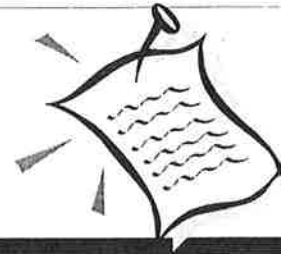
animation, fine art, textiles, 3D art and all in rooms off of this hallway. Given the size how many average size classrooms (9m by there are in this art hallway, from room B07 to could be the size of the floor space for this art

There are two floors above this art level, the technical floor on the first level and the academic floor on the second level. Every Wee-beal now has to complete three math courses to graduate. Go up the stairs to the second level.

Tonight the classrooms on the second floor are being used by the Conference. Room 219 is a teacher work room for the teachers of this wing. During the day, the Wee-beals use the rooms near 218 for Math classes, the rooms in the middle of the hall for ESL and the rooms at the end of the hall for Moderns classes.

5.

There is a bulletin board for the math classrooms outside room 221. Thumbtacks are still a collector's item by the Wee-beals. Thumbtacks always seem to disappear. Without overlapping, how many thumbtacks will be needed to completely cover this bulletin board?



It is necessary to group the Wee-beals together to give them all the same message at the same time. So that they are as comfortable as possible we use the auditorium. New seats, carpet and lighted aisles make this an enjoyable location for assemblies.

6.

The doors to the auditorium are on the second floor and face the former front of the school on Dundas Street. Go to these doors. There is a small set of stairs from the hall to the doors of the auditorium, and there is a larger set of stairs from the hall down to the doors of the school. Which set of stairs would be the easiest to climb because it is not as steep? For example, what is the slope of each set of stairs?

Moving toward the northwest corner of the school you will follow the same path as the Wee-beals to experience state-of-the-art computers on the third floor.

7.

State-of-the-art at Beal requires an average of one every four students. If a Wee-beal theoretically every computer in the school, including those and teachers use, how many computers exist in



computer for has access to administration this school?



Walk down the stairs to the bottom level. This is the cockroach and fish floor. A world class entomologist works here as the Science Head, Mr. B. Nagy. Can you find the cockroaches?

8.

These are Madagascar hissing cockroaches. When you rub their back, they hiss at you. Their habitat is a molting mass of coffee trays. Estimate how many cups of coffee could be held by the trays in the habitat space for the cockroaches you see in the window.

The Wee-beals realize that in their grade 10 science course they will have their own Tarantula to “love and to hold and to cherish.” One of the grade 10 science course objectives is to study the growth of a living organism. This may not be the organism everyone wants to work with. Just like Monty’s knights of the round table who encounter a fuzzy little rabbit at the cave’s entrance, we “run away” up the hallway toward the cafeteria (not toward the front atrium).

9.

The Wee-beals, as you are now doing, are passing a giant fish tank on your left side. Wee-beals wonder . . . if one fish requires 5 litres of water to survive, then how many fish might be able to live in that aquarium?

As you continue up the hall, you are entering a hangout zone. There are usually blasts and crashes of popular music coming from the “jukebox” in the cafeteria.

10.

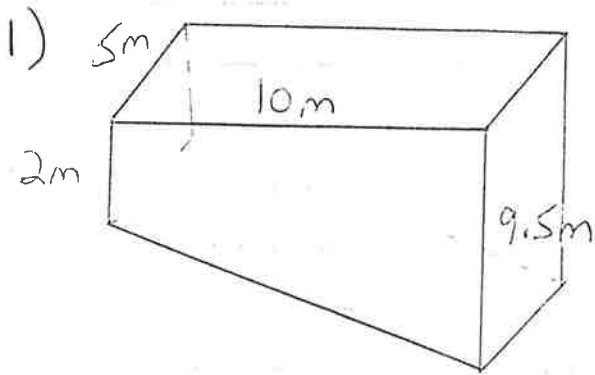
A large number of the Beal student body does not stay in for lunch. In fact the cafeteria was built to hold about 350 people. What percent of the student body can eat in our cafeteria? Is this the same percent as we had in the original Beal where the school could hold 3000 students and the cafeteria could seat 485 people?

Walk down the stairs toward the Main Office again.



Now you are back at the beginning. We hope you have enjoyed the tour with our Wee-beals. They are a good group and we know we will be proud of their achievements. Check your answers back at the table.

ANSWERS TO BEAL MATH TRAIL



Area of the trapezoidal side

$$\begin{aligned} A &= \frac{1}{2}(a+b)h \\ &= \frac{1}{2}(2+9.5)10 \\ &= 57.5 \text{ m}^2 \end{aligned}$$

$$1\text{m} = 100\text{cm}$$

$$1\text{m}^3 = 100 \times 100 \times 100 \text{cm}^3$$

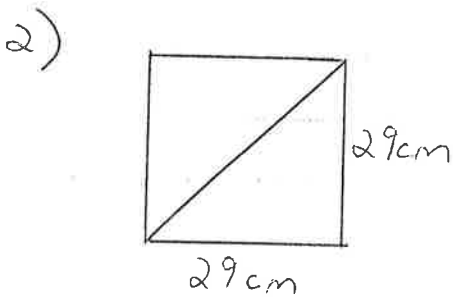
$$1\text{m}^3 = 10^6 \text{cm}^3$$

Area of the pool

$$\begin{aligned} A &= 57.5 \text{ m}^2 \times 5\text{m} \\ &= 287.5 \text{ m}^3 \\ &= 287.5 \times 10^6 \text{cm}^3 \\ &= 2.875 \times 10^8 \text{cm}^3 \end{aligned}$$

Since one can of pop contains $355\text{mL} = 355\text{cm}^3$ of pop,
therefore $\frac{2.875 \times 10^8 \text{cm}^3}{355 \text{cm}^3} = \text{approx. } 800,000 \text{ cans}$

would fill the pool.



Using Pythagorean Theorem,

$$a^2 = b^2 + c^2$$

$$a^2 = 29^2 + 29^2$$

$$a^2 = 841 + 841$$

$$a^2 = 1682$$

$$a = \sqrt{1682}$$

$$a = 41\text{cm}$$

(BUT You could have ~~cheated~~ and measured the diagonal directly).

$$\begin{aligned}
 3) \text{ Volume of Gym} &= 28 \times 45 \times 18 \\
 &= 22680 \text{ m}^3 \\
 &= 22680 \times 10^6 \text{ cm}^3
 \end{aligned}$$

The approximate diameter of the basketball is 18cm.

One way to calculate the number of basketballs is :

$$\begin{aligned}
 V &= \frac{4}{3} \pi r^3 \\
 &= \frac{4}{3} \times 3.14 \times 9^3 \\
 &= 3052 \text{ cm}^3
 \end{aligned}$$

$$\begin{aligned}
 &22680 \times 10^6 \div 3052 \\
 &= 7.4 \text{ million}
 \end{aligned}$$

But this value would be too large, since there would be some wasted space or volume in between the basketballs

Another way to calculate the number is :

$$\begin{aligned}
 V &= 18 \times 18 \times 18 \quad (\text{pretend the basketball is a cube}) \\
 &= 5832 \text{ cm}^3
 \end{aligned}$$

$$22680 \times 10^6 \div 5832 = 3.9 \text{ million}$$

But this value would be too small since the basketballs would fit in between one another.

Therefore, we could average the two values and get 5.7 million.

4) There are actually 26 art rooms and therefore the entire floor space would be:

$$26 \times 9 \times 10 = 2340 \text{ m}^2$$

5) Area of the bulletin board

$$A = 119 \text{ cm} \times 240.5 \text{ cm} \\ = 28619.5 \text{ cm}^2$$

Area of the 10x10 thumbtack display

$$A = 12.5 \text{ cm} \times 12.5 \text{ cm} \\ = 156.25 \text{ cm}^2$$

$$\text{No. of displays} = 28619.5 \div 156.25 \\ = 183$$

$$\text{No. of tacks} = 183 \times 100 = 18300$$

6) The set of stairs that is the easiest to climb would be the smaller set of stairs.

Smaller set

$$\text{slope} = \frac{15 \text{ cm}}{30 \text{ cm}} = \frac{1}{2} = 0.5$$

larger set

$$\text{slope} = \frac{17 \text{ cm}}{27 \text{ cm}} = 0.63$$

↑
average values

7) Since there are 2000 students that attend this school, therefore $\frac{2000}{4} = 500$ computers should be available.

8) There are 27 trays in the container. Each tray has 4 cup holders.
 $\therefore 27 \times 4 = 108$ coffee cups.

9) The aquarium's volume
 $V = 180 \text{ cm} \times 45 \text{ cm} \times 50 \text{ cm}$
 $= 405000 \text{ cm}^3$

$$\therefore \text{No. of fish} = \frac{405000 \text{ cm}^3}{5000 \text{ cm}^3} = 81 \text{ fish}$$

$5\text{L} = 5000 \text{ mL}$
 $= 5000 \text{ cm}^3$

10) Present % $\frac{350}{2000} = 17.5\%$

Past % $\frac{485}{3000} = 16.2\%$

} Close but a little higher % for the present.