



**Grade 7 & 8 Math Circles**  
**November 23, 2011**  
**Jeopardy**

**Round 1**

Arithmetic

1.  $(-10) + (-4) + \left(\frac{6}{2}\right) \times 3$
2. What is  $\sqrt{16}$  equal to (all solutions)?
3. Simplify  $\frac{(5^4)^3 \times 5^2}{5^7}$
4. If  $R$  is negative, what can be said that is true for any value of  $R$  about the expression  $R^4 - R^2$  ?
5. Using a choice of the basic mathematical operations  $+$ ,  $-$ ,  $\div$ ,  $\times$ ,  $(, )$ , and the numbers 2, 4, 7 and 7, determine how you can attain the result of 14 (*Note:* Each number can only be used once).

Prime Numbers

1. What method was used in class to find prime numbers from 1-100?
2. How is 1 categorized-prime, composite, or neither?
3. You decide to have a barbeque. After going to the grocery store, you notice that the hotdogs come in packages of 8 and the buns come in packages of 12. How many packages of both hotdogs and buns must you buy to ensure that there is an equal amount of hotdogs as buns?



- Find the prime factorization of 53,000.
- Using the prime factorization of the following numbers, determine what  $\frac{6320}{395}$  is.

### Patterns/Sequences

- Name the next two terms of the sequence 3, 5, 4, 7, 6, 10, 9, ...
- How can we determine if a number is divisible by 8?
- Using the formula

$$F_n = \frac{\left(\frac{1+\sqrt{5}}{2}\right)^n - \left(\frac{1-\sqrt{5}}{2}\right)^n}{\sqrt{5}}$$

What is the 40<sup>th</sup> Fibonacci number?

- Calculate the difference between the 29<sup>th</sup> and the 30<sup>th</sup> triangular numbers.
- What is the explicit formula for hexagonal numbers?

### Modular Arithmetic

- $5 \equiv 5 \pmod{8}$ . Determine two other congruent numbers to this.
- Decode the following using a shift number of 5 : RFYM HNWHQJX
- Today is Wednesday, what day will it be in 125 days?
- Encode the following using a shift number of 23: JEOPARDY.

5.



Susan's birthday is today, Wednesday November 23 2011. If she turned 15 today, what day of the week was she born on (don't forget about leap years)?

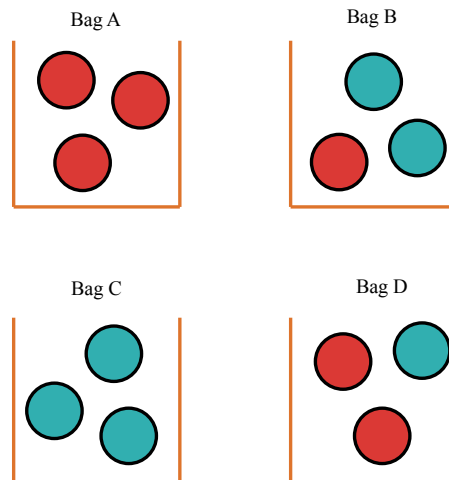
### Probability

- In the Math Circles Math class of 50, there are 50 students under the age of 10. If one of the students were chosen randomly, what is the probability that the student is under the age of 11?

2. What is the probability of rolling two 6's in a row using a standard fair die?
3. Two fair dice are rolled. What is the probability of rolling a sum of 7?



4. 1,000 people went to the fair. 60% of the people were males. 40% of the males were under the age of 15. 75% of the males under the age of 15 had brown hair. If one person were to be chosen at random, what is the probability that the person is a boy is under 15 with brown hair?
5. You have four bags each with three marbles. Bag A has three red marbles, Bag B has two blue marbles and one red marble, Bag C has three blue marbles, and Bag D has two red marbles and one blue marble.



You pick a random bag and pick and take out one marble that is blue. What is the probability that the next marble out of the same bag is blue as well?

## Round 2

### Logic

1. We have 4 dogs. the first is named Abby, the second Babby, the third is Cabby, what is the name of our 4<sup>th</sup> dog?
2. At Thanksgiving dinner, there was 1 grandmother, 1 grandfather, 2 wives, 2 husbands, 3 children, 2 daughters, 2 sons, 2 brothers, 1 sister, 1 mother-in-law, 1 father-in-law, 2 fathers, and 2 mothers. How many people were actually at the dinner?
3. Yesterday, Joe turned 12. Next year he will be 14. When is Joe's birthday?
4. A thief was caught and brought to the King. The King told the thief,  
*You must give me a statement. If it is true, you will be thrown into jail. If it is false, you will be thrown into the fire.*

The thief, being very clever made a statement that stumped the King. The King finally decided to let the thief go.

What was the statement the thief said?

5. You are given an  $8 \times 8$  chessboard with the two opposite black corners cut out. Is it possible to cover this board with dominoes if each dominoe takes up 2 squares on the chessboard?

### Word Problems

1. Joseph got 87%, 69%, 97%, 80%, and 79% on the first 5 math tests. If he wants an average testing mark over 85%, what must be the minimum mark he receives on the final 6<sup>th</sup> test (*Assume: All tests are worth the same amount*)?
2. Audrey is 2 years older than her brother. Next year, she will be twice the age of her brother. How old is both Audrey and her brother?

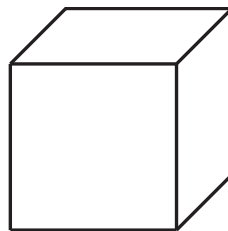
3. I have a pile of quarters, dimes and nickels in my pocket. I have two more dimes than nickels, a total of 10 coins all together and in total I have \$1.85 in my pocket. How many quarters, dimes and nickels do I have?



4. Nine people at a party shook hands with each other (each person with each other person). A tenth person came to the party late and shook hands with some people. A total of 40 handshakes were made. How many people did the tenth person shake hands with?
5. You are running through a narrow tunnel at a speed of 10 km/hr. You are  $\frac{3}{8}$  of the way through the tunnel when all of the sudden you notice that a train is coming. If you run back to the beginning of the tunnel, you will jump out of the tunnel just in time before the train enters the tunnel. If you keep running to the end of the tunnel, you will reach the end of the tunnel as soon as the train does. What is the speed of the train?

### Gauss Math Competition

1. What number when tripled and decreased by 12 equals 21?
2. In the diagram, the cube has a volume of  $27 \text{ m}^3$ . What is the length of each edge?



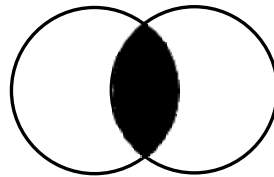
3. Each time a bar of soap is used, its volume decreases by 10%. What is the minimum amount of times that a new bar would need to be used so that less than one half of the bar remains?

4. In the multiplication shown, P and Q each represent a digit:

$$\begin{array}{r} 39P \\ \times Q3 \\ \hline 32951 \end{array}$$

What is the value of  $Q + P$  ?

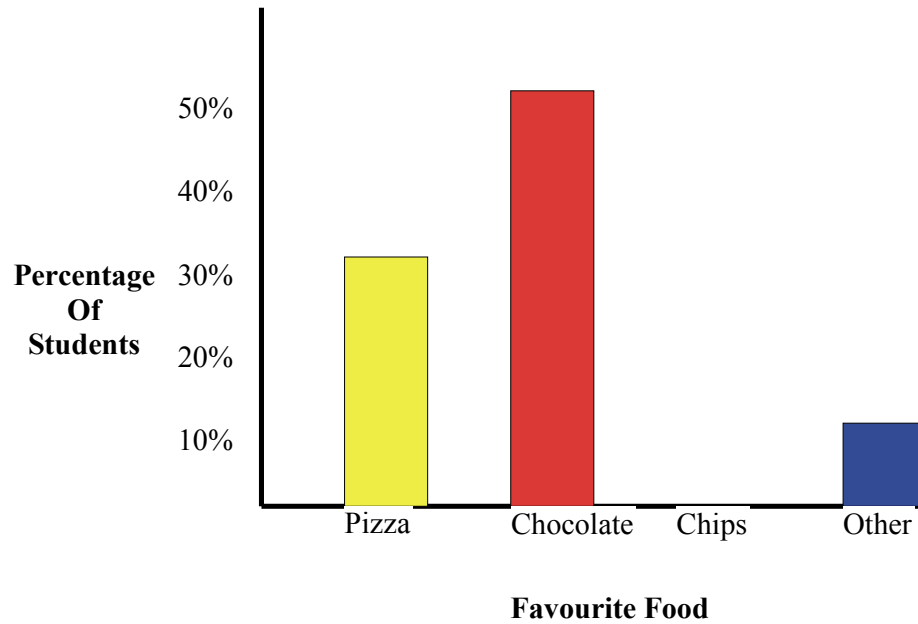
5. Two circles each have radius 10 cm. They overlap so that each contains exactly 25% of the other's circumference as shown. What is the area of the shaded region to 2 decimal places?



### Data Analysis

- The following results were attained to the question how many people live in your household:  
3, 5, 6, 3, 3, 4, 6, 2, 9  
Find the mean.
- What is the definition of *range*?
- Name two reasons a set of data may be considered *biased data*.

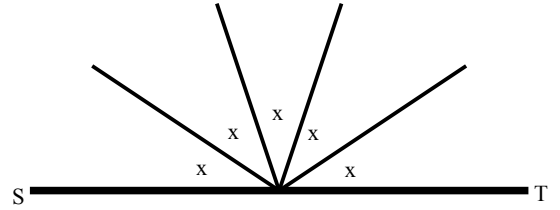
4. For the following graph, each person was asked their favourite food. Unfortunately, the number of people who liked chips the best was not graphed. How many people like chips if a total of 50 people were polled?



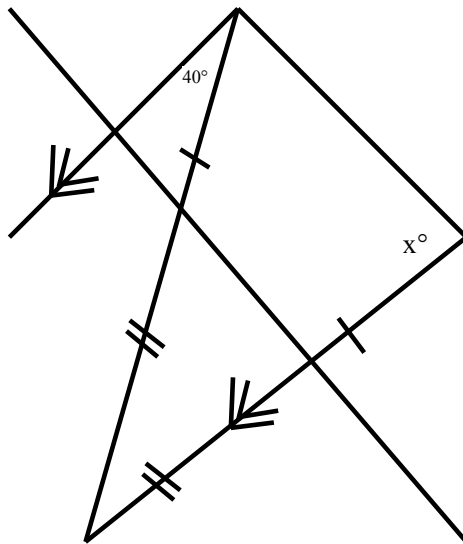
5. People start work at many times during the day. Find the average starting time for the following set of data:  
10:00 am, 6:45 am, 7:20 am, 9:00 am, 8:30 am, 6:00 am, 8:10 am

Area/Angles

1. If ST is a straight line, what is the value of  $x$ ?

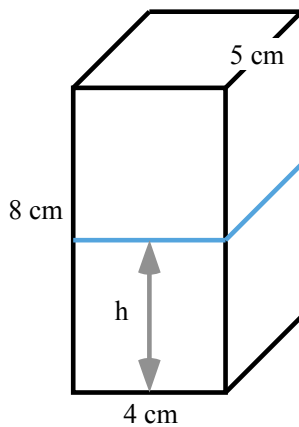


- 2.



Determine angle  $x$ .

3. The sum of the squares of lengths of the edges of a right angled triangle is 128. What is the length of the longest side of the triangle?
4. I had a rectangular prism full of water. Afterwards, I poured some of the water into a cylinder so that the height of the water left in the rectangular prism and the water in the cylinder were the same. Find the height of the water in both containers (*Note:* Use the dimensions of the rectangular prism and cylinder below).



5. A square is placed inside a circle. Find the area of the shaded region.

