

# Good Morning and Welcome to the 2008 Calcu-Solve Competition!

**We hope you have a challenging and successful day!  
While we are waiting for all the teams to arrive, please:**

1. Put your coats and lunches in the designated areas where your team sponsors can keep an eye on them. The only things you need to take to your team's table are your sharpened pencils, calculators, and scrap paper (if you brought any.)
2. **Make sure your team sponsor has completed the yellow registration/scoring card that is in the folder he/she received when you arrived. This card should be filled out completely and given to the teacher at the Registration Desk.**
3. Make a nametag for everyone in your group. Include your first and last names, school district, school name, and team number on the tag. Please wear the nametag during the entire competition.
4. Read over the information in the folder with your team sponsor. The rules and scoring procedures are explained. We will review these briefly just before the competition begins.
5. **Each person on your team should take one stapled packet of individual answer sheets from the team folder and complete all the information on EVERY sheet. Print neatly and accurately! Your team number is displayed on the sign at your table and on your team folder.**
6. Begin to practice for the competition by working on the Warm-Up Questions that are in your folder. We will go over the answers to these questions just before we begin the actual competition questions.
7. If you need help or further direction, please find a Boyce Ambassador or see Mrs. Hoedeman, Mr. O'Roark, Mrs. Obrosky, or Mrs. Cayuela.

**Relax, Have Fun, and Good Luck!**

# Dr. Robert L. Furman

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

Executive Faculty  
Program Director  
Educational  
Administration and  
Supervision

# Mrs. Karen Brown

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

Principal at Boyce  
Middle School

## Warm-Up Answers

1.  $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 18$  minutes; so  $6+6+6 = 18$  minutes; so it will take her 6 more minutes to walk the rest of the way home.

2. Ursula-3m-Alma-3m-Cathy-2m-Lani-2m-Isabel-2m-Betty

3.  $\div 2, \div 3, \div 4, \div 5$ , so 30

4. 11 bicycles ( $2 \times 11 = 22$ ); and 4 tricycles ( $4 \times 3 = 12$ ); and  $22 + 12 = 34$  wheels

5. to the game: cars                    3                    3                    3                    3                    3 train    7  
from the game:        cars            4                    4                    4                    4                    4 train    2

so, there were 22 friends and 5 cars.

6. 3: 3, 6, 9, 12, 15 ... 30...45...60

5: 5, 10, 15, ... 30...45...60

$15 \div 7 \neq R4$ ;  $30 \div 7 \neq R4$ ;  $45 \div 7 \neq R4$ ;  $60 \div 7 = R4$

7. Friend:            1    2            3    4            5    6            7    8

Trades:            7 + 6 + 5 + 4 +        3 + 2 + 1 + 0 = 28 trades altogether.

8.  $\$700 = 70,000$  cents;  $25\text{¢} + 50\text{¢} + 100\text{¢} = 175\text{¢}$ ;

$70,000 \div 175 =$  400 of each coin.

9. 30 minutes = 12 minutes + 12 minutes + 6 minutes;  $1 + 1 + 0.5 = 2.5$  times as far;

so, Sue can walk  $2.5 \times 1.56$  miles = 3.9 miles

10.  $\frac{7}{12} = \frac{14}{24}$  and  $\frac{5}{8} = \frac{15}{24}$ , so  $\frac{15}{24} - \frac{14}{24} =$   $\frac{1}{24}$

**Thank You from  
Mrs. Hoedeman and Mr. O'Roark**

- Mrs. Obrosky
- Mr. Navoney
- Mrs. Heins
- Mrs. Cayuela
- Mrs. Husak

## **SCHEDULE and EXPLANATION OF SCORING**

**There will be eight Individual Questions - #s 2, 3, 4, 5 and 7, 8, 9, 10. You will be given 5 minutes to earn 5 points for a correct answer on each Individual Question, or you may wait for a clue, work an extra 2 minutes and earn 3 points for a correct answer on each Individual Question.**

**There will be two Group Questions - #s 1 and 6. Your team of students will be given 7 minutes to earn 10 points for a correct answer on each Group Question.**

**We will complete Group Question # 1, Individual Questions # 2, 3, 4, and 5 and Group Question #6. Then we will take a short break and announce half-time scores.**

**After the break, we will complete Individual Questions # 7, 8, 9, and 10.**

**Following Individual Question # 10, we will break for lunch.**

**If necessary, “tie-breakers” will follow lunch.**

**Final scores will be announced and awards will be presented after ties are broken.**

**Estimated concluding time is 1:30 p.m.**

## Guidelines for Tie-Breaking Situations

### **Individual Tie-Breakers\***

1. In the event of a tied individual score, a sudden death question will be given to those participants who are tied. If an answer is turned in and it is incorrect, the person may return to his/her seat and continue to work on the problem. The first person with a correct answer within a 5-minute time limit will be declared the winner. If at the end of 5 minutes, no one has submitted a correct answer ...
2. ...another sudden death question will be given and step # 1 will be repeated. This procedure will be followed until a winner is determined.

\*These rules will be used to determine first, second, third, and tenth place individual winners.

### **Group Tie-Breakers\*\***

Group tie-breakers will be handled in the same fashion as individual except that the entire group will participate.

\* \*These rules will be used to determine first, second, and third place teams only.

## Sample Problem

**Given the following pattern:  
1, 1, 2, 3, 5, 8... what is the  
first perfect square greater  
than one to occur in the  
sequence?**



### Sample Problem - Clue

**Given the following pattern: 1, 1, 2, 3, 5, 8  
what is the first perfect square greater  
than one to occur in the sequence?**

**Clue: There is a famous pattern  
known as the Fibonacci  
Sequence where each number  
after the first two numbers is the  
sum of the preceding two  
numbers.**

# Official Competition

A top-down view of a wooden desk with a white sheet of paper. The paper has the text "Official Competition" centered on it. In the bottom-left corner, a black fountain pen with a gold nib is visible. In the top-right corner, a portion of a brass desk lamp is visible, casting a warm glow on the paper.



# Group Question

Set timer for 7:00

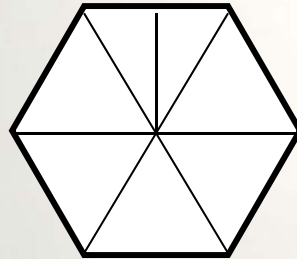
Question 1 - Group

- **Find the exact area of a regular hexagon that has a perimeter of twelve inches.**

### Question 1 Answer

- Find the exact area of a regular hexagon that has a perimeter of twelve inches.

- Solution:



- A regular hexagon can be divided into six equilateral triangles (we know they are equilateral because the central angle measure =  $1/6$  of  $360 = 60^\circ$ ). Each side of the triangle measures 2 in. Using the Pythagorean Theorem ( $a^2 + 1^2 = 2^2$ ) the height of each triangle is the square root of 3. So a regular hexagon with a perimeter of 12 inches has an area six times that number, or  $6\sqrt{3}$  in.<sup>2</sup>



# Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

## Question 2

**Sally and Tom were partners in a business. To begin the business, Sally invested \$4,000 and Tom invested \$11,000. Their profit for the first year was \$6,000. Expressed in dollars, what is Sally's share of the profit?**

### Question 2 Clue

**Sally and Tom were partners in a business. To begin the business, Sally invested \$4,000 and Tom invested \$11,000. Their profit for the first year was \$6,000. Expressed in dollars, what is Sally's share of the profit?**

**Clue:**

**Sally's profit is less than Tom's profit.**



## Question 2 Answer

Sally and Tom were partners in a business. To begin the business, Sally invested \$4,000 and Tom invested \$11,000. Their profit for the first year was \$6,000. Expressed in dollars, what is Sally's share of the profit?

### Solution:

Set up a proportion.  $\frac{4,000 \text{ (part)}}{11,000 + 4,000 \text{ (whole)}} = \frac{x}{6,000}$

$$\frac{4000}{15000} = \frac{x}{6000}$$

$$\frac{15000x}{15000} = \frac{24000000}{15000}$$

$$x = 1600 \quad \text{Sally's share of the profit is } \underline{\$1,600}.$$



# Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

**Question 3**

**I have six coins in my pocket totaling \$1.15, but I cannot make change for a dollar, half dollar, quarter, dime, or nickel. What coins do I have in my pocket?**

### Question 3 Clue

**I have six coins in my pocket totaling \$1.15, but I cannot make change for a dollar, half dollar, quarter, dime, or nickel. What coins do I have in my pocket?**

**Clue:**

**You can't have two dimes and a nickel because that equals a quarter.**

### Question 3 Answer

I have six coins in my pocket totaling \$1.15, but I cannot make change for a dollar, half dollar, quarter, dime, or nickel. What coins do I have in my pocket?

### Solution:

- You have one half-dollar, one quarter, and four dimes in your pocket. Any other set of coins will allow you to make change.



# Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Question 4

**A bullet train a mile and a half long takes a minute and a half to go through a tunnel two and a half miles long. How fast is the train going in mph?**

#### Question 4 Clue

**A bullet train a mile and a half long takes a minute and a half to go through a tunnel two and a half miles long. How fast is the train going in mph?**

**Clue:**

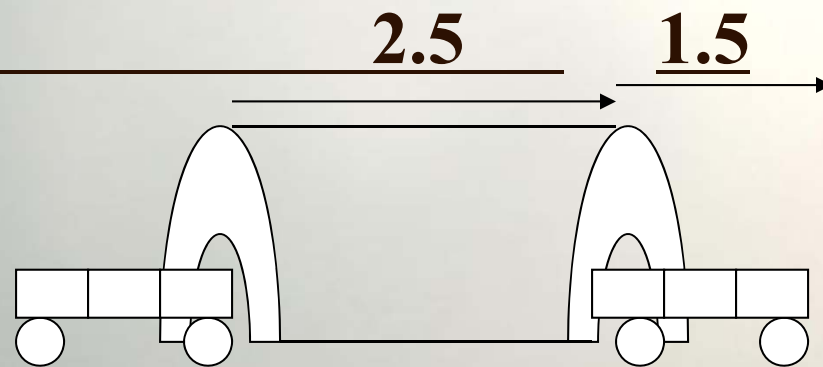
**60 minutes = 1 hour**



### Question 4 Answer

A bullet train a mile and a half long takes a minute and a half to go through a tunnel two and a half miles long. How fast is the train going in mph?

Solution:



Using  $D=RT$  yields  $4 = 1.5t$ . Solve for  $t$  and multiply by 60 to convert to miles per hour to find that the train is traveling 160 mph.



# Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Question 5

**A giant cookie jar is already  $\frac{3}{4}$  full. When 257 cookies are removed and 158 are added, there are now 348 cookies in the jar. How many cookies does the cookie jar hold when it is full?**

**Question 5 Clue**

**A giant cookie jar is already  $\frac{3}{4}$  full. When 257 cookies are removed and 158 are added, there are now 348 cookies in the jar. How many cookies does the cookie jar hold when it is full?**

**Clue:**

**The cookies are chocolate chips!**

### Question 5 Answer

A giant cookie jar is already  $\frac{3}{4}$  full. When 257 cookies are removed and 158 are added, there are now 348 cookies in the jar. How many cookies does the cookie jar hold when it is full?

**Solution:**

$$348 \text{ now} - 158 = 190 \text{ cookies}$$

$$190 \text{ cookies} + \text{original } 257 \text{ cookies} = \frac{3}{4}x$$

$$\frac{4}{3}(447) = \frac{4}{3}(\frac{3}{4}x)$$

$$596 = x$$

$$\text{(or: } \frac{3}{4}x - 257 + 158 = 348)$$

The cookie jar can hold 596 cookies when it is full.



# Group Question

Set timer for 7:00

**Question 6 - Group**

**Using each of the digits 3, 4, 5, 7, 8, and 9 exactly once create a six-digit number. What is the probability that the number will be a multiple of four? Express your answer as a common fraction in lowest terms.**

### Question 6 Answer

Using each of the digits 3, 4, 5, 7, 8, and 9 exactly once create a six-digit number. What is the probability that the number will be a multiple of four? Express your answer as a common fraction in lowest terms.

#### Solution:

There are a total of 720 (654321) possible numbers that can be created by using each of the digits 3, 4, 5, 7, 8, and 9 exactly once. For the number to be a multiple of 4, the last two digits must be "48" or "84". That means there are four digits (3, 5, 7, and 9) that can be in the first four places, so there are 24 numbers (4321) in which the last two digits can be "24" and 24 numbers (4321) in which the last two digits can be "84".  $(24 + 24)/720 = 48/720$

The probability that the number will be a multiple of four is  $1/15$ .



# Snack Time

We will dismiss by tables.

Please wait until you are dismissed and then take 1 cookie and 1 drink.

A dark wood desk with a blue pen and a glass. The pen is blue with gold accents, lying diagonally in the bottom left. A glass is partially visible in the top right corner. The text is centered on the desk surface.

# Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Question 7

**The average of eight different whole numbers is 8. What is the largest possible value of any of these numbers?**

**Question 7 Clue**

**The average of eight different whole numbers is 8. What is the largest possible value of any of these numbers?**

**Clue:**

**“0” is a whole number.**

### Question 7 Answer

The average of eight different whole numbers is 8. What is the largest possible value of any of these numbers?

Solution:

$$(0+1+2+3+4+5+6+x)/8 = 8$$

$$(21 + x)/8 = 8$$

$$21 + x = 64$$

$$x = 43$$

The largest possible value of any of the numbers is 43.



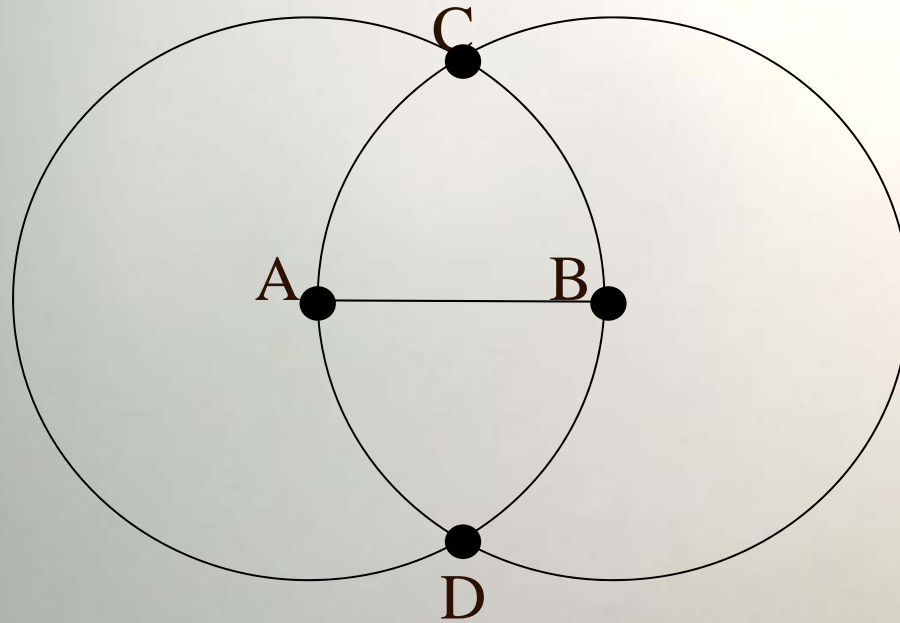
# Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

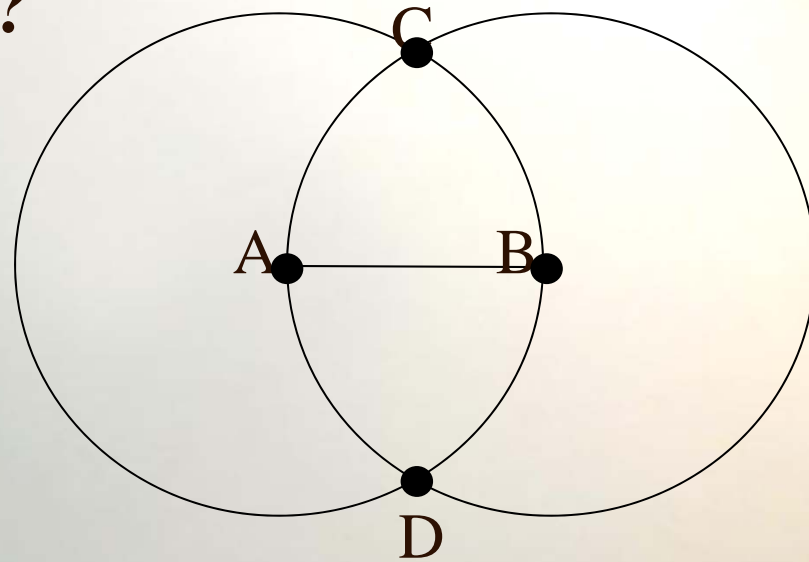
**Question 8**

**Line Segment AB is the radius of Circle A and Circle B. What is the measure, in degrees, of central angle CBD?**



Question 8 Clue

Line Segment AB is the radius of Circle A and Circle B. What is the measure, in degrees, of central angle CBD?



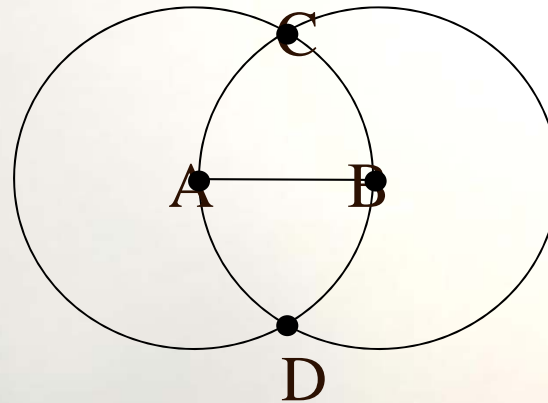
Clue:

Connect-the-dots!



### Question 8 Answer

Line Segment AB is the radius of Circle A and Circle B. What is the measure, in degrees, of central angle CBD?



AB, AC, AD, BC, and BD are all radii of the circles and they are all equal. This means that triangles ABC and ABD are equilateral; therefore, angles CBA and ABD =  $60^\circ$ . So angle CBD =  $120^\circ$



# Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

**Question 9**

**The outside faces of a large cube made from unit cubes are painted. There are exactly 125 unit cubes that have no paint. How many unit cubes were used to create the large cube?**

**Question 9 Clue**

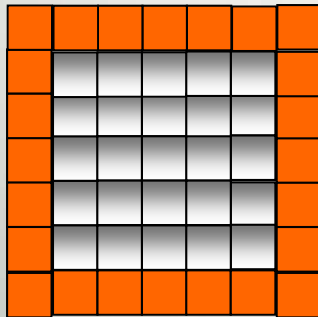
**The outside faces of a large cube made from unit cubes are painted. There are exactly 125 unit cubes that have no paint. How many unit cubes were used to create the large cube?**

**Clue:**

**Draw a picture.**

### Question 9 Answer

The outside faces of a large cube made from unit cubes are painted. There are exactly 125 unit cubes that have no paint. How many unit cubes were used to create the large cube?



To surround a  $5 \times 5 \times 5$  cube, you will need a  $7 \times 7 \times 7$  cube, which would be created with 343 unit cubes.

A dark wood desk with a blue pen and a glass. The pen is blue with gold accents, lying diagonally in the bottom left. A glass is partially visible in the top right corner. The text is centered on the desk surface.

# Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Question 10

**I started with a prime number greater than 30 and then raised that number to the 2008<sup>th</sup> power. What is the digit in the ones' place of my final number?**

**Question 10 Clue**

**I started with a prime number greater than 30 and then raised that number to the 2008<sup>th</sup> power. What is the digit in the ones' place of my final number?**

**Clue:**

**Find a pattern!**



### Question 10 Answer

I started with a prime number greater than 30 and then raised that number to the 2008<sup>th</sup> power. What is the digit in the ones' place of my final number?

#### Solution:

Every prime number greater than 30 has a 1, 3, 7, or 9 in the ones' place. By the time you raise any of those numbers to the 4<sup>th</sup> power, you will have a number that has a "1" in the units digit. Any number that has a "1" in the ones' place will continue to have a "1" in the ones' place. For example:  $3737 = 1369$ ;  $136911369 = 1874161$ ;  $1,874,161$  will have a 1 in the ones' place from now on.