

Good Morning and Welcome to the 2010 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 Mrs. Hoedeman 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. Hamel, or Mrs. Husak.

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

QuickTime™ and a
decompressor
are needed to see this picture.

Mission - to create a stronger population of new engineering-, science- and mathematics-educated individuals that will ultimately increase and improve the pool of engineers and scientists seeking to tackle the tough and ever more complicated technical problems facing our nation and the world.

Warm-Up Answers

- 9;** $(8 \times 10) + (5 \times 11)$ or $80 + 55 = 135$ and $135 / 15 = 9$
- 25 envelopes;** $\frac{4}{200} = \frac{1}{x}$ 1 person can seal 50 in 20 min., so $1/2(50)$ or 25 in 10 minutes
- 90;** $108 / 12 = 9$ Arthurs's System Decimal System
 90 = 108
- 24 girls;** $2x + x = 36; x = 12; \text{ so } 2x = 24$
- 7 quarters;** 2 notebooks = \$1 and 6 pencils = 75¢; $\$1.75 / 0.25 = 7$
- Aug 15, 1974;** $1248 / 24 = 52$ days; 6 days in June, 31 days in July, 15 days in August
- 7 stars;** $7 \times 7 = 49$ and $7 - 7 = 0$
- 15 small squares;** $x^2 = 225$, so $x = 15$
- 3600 feet;** $2700 + 900 = 3600$
- 5 minutes 52 seconds;** 1 mile = 5280 feet; $5280 / 15 = 352$ sec.
 $352 / 60 = 5$ min. 52 sec.

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

- **Ms. Fleckenstein**
 - **Mrs. Heins**
 - **Mrs. Husak**
 - **Mrs. Hoglund**

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 dark wood desk with a blue pen and a glass. The pen is in the bottom left corner, and the glass is in the top right corner. The text is centered on the desk.

Group Question

Set timer for 7:00

Boyce Ambassadors

Please pass out the 1st group question face down and the 1st group answer sheet.

Question 1 - Group

Jerry got a phone call from a telephone solicitor who said he was taking a survey. First he asked how old Jerry was. Jerry gave the following clues:

“My age is between 30 and 69 inclusive.”

The salesman asked if he was in his thirties.

“If I am not in my thirties, then my age is a multiple of four.”

The salesman asked if he was in his forties.

“If I am not in my forties, then my age is a multiple of seven.”

The salesman asked if he was in his fifties.

“If I am not in my fifties, then my age is not a multiple of five.”

The salesman finally asked if he was in his sixties.

“If I am not in my sixties, then my age is not a multiple of eight.”

How old is Jerry?

Question 1 Answer

Jerry got a phone call from a telephone solicitor who said he was taking a survey. First he asked how old Jerry was. Jerry gave the following clues:

How old is Jerry?

30s, 40, 44, 48, 52, 56, 60, 64, 68	- 30s and mult. of 4
35, 40, 44, 48, 56	- 40s and mult. of 7
44, 48, 56	- minus mult. of 5

44 years old

Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Boyce Ambassadors

Please pass out Problem 2
(Individual Question #1) face down.

Question 2

At 5 o'clock in the evening a soldier standing six-and-a-half feet tall salutes a flag sitting atop a flagpole. The soldier casts a shadow 9 feet long and the flag pole casts a shadow 42 feet long. How tall is the flag pole?

Question 2 Clue

At 5 o'clock in the evening a soldier standing six-and-a-half feet tall salutes a flag sitting atop a flagpole. The soldier casts a shadow 9 feet long and the flag pole casts a shadow 42 feet long. How tall is the flag pole?

Clue:

The pole is shorter than its shadow.

Question 2 Answer

At 5 o'clock in the evening a soldier standing six-and-a-half feet tall salutes a flag sitting atop a flagpole. The soldier casts a shadow 9 feet long and the flag pole casts a shadow 42 feet long. How tall is the flag pole?

Solution: Set up a proportion.

- *(the soldier's height)* $\frac{6.5}{x} = \frac{9}{42}$ *(the soldier's shadow)*
- *(the pole's height)* $\frac{6.5}{x} = \frac{9}{42}$ *(the pole's shadow)*
- $8x = 162$ Solving for x gives us...

30.33 ft or 30 ft. 4 in.

Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Boyce Ambassadors

**Please pass out Problem 3
(Individual Question #2) face down.**

Question 3

Four hungry brothers went to bed, thinking about the batch of cookies that their mother had just baked. In the middle of the night, each of them got up and ate some of the cookies. Alan got up first. He separated the cookies into three piles and found there was one left over. He gave the leftover cookie to the dog, then ate one-third of the remaining cookies and went back to bed. Burt was the next to get up, and he ate one-fourth of the remaining cookies. (The dog didn't get any from him because he thought the dog looked stuffed.) Chris then got up and gave two to the dog. Then he ate one-fifth of the remaining cookies. Daniel was the last to get up, and he ate just four cookies and then gave one to the dog, who was beginning to look really sick. When their mother went into the kitchen the next morning, she found a lot of crumbs, ants, a pale-looking dog, and only 15 cookies. How many cookies had she baked originally?

Question 3 Clue

Four hungry brothers went to bed, thinking about the batch of cookies that their mother had just baked. In the middle of the night, each of them got up and ate some of the cookies. Alan got up first. He separated the cookies into three piles and found there was one left over. He gave the leftover cookie to the dog, then ate one-third of the remaining cookies and went back to bed. Burt was the next to get up, and he ate one-fourth of the remaining cookies. (The dog didn't get any from him because he thought the dog looked stuffed.) Chris then got up and gave two to the dog. Then he ate one-fifth of the remaining cookies. Daniel was the last to get up, and he ate just four cookies and then gave one to the dog, who was beginning to look really sick. When their mother went into the kitchen the next morning, she found a lot of crumbs, ants, a pale-looking dog, and only 15 cookies. How many cookies had she baked originally?

Clue: Try working backwards!

Question 3 Answer

How many cookies had she
baked originally?

Solution:

15 cookies + 5 + 5 + 2 + 9 + 18 + 1

55 Cookies

Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Boyce Ambassadors

Please pass out Problem 4
(Individual Question #3) face down.

Question 4

Determine the next value in the following pattern of numbers:

$\frac{124}{186}$	$\frac{231}{396}$	0.5	$\frac{460}{1104}$	$33 \frac{1}{3}\%$	0.25	$\frac{1}{6}$	_____
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Question 4 Clue

Determine the next value in the following pattern of numbers:

<u>124</u>	<u>231</u>	0.5	<u>460</u>	33 1/3%	0.25	<u>1</u>
186	396		1104			6

CLUE: I once got 19/20 on a test,
and I found out that is a 95%!

Question 4 Answer

Determine the next value in the following pattern of numbers:

$$\frac{124}{186} \quad \frac{231}{396} \quad 0.5 \quad \frac{460}{1104} \quad 33 \frac{1}{3}\% \quad 0.25 \quad \frac{1}{6}$$

Solution: Solution: $1/12$ First, convert the percent to a fraction. Second, convert all decimals to fractions in simplest form. Third, simplify all other fractions. Using a common denominator of 12 and finding equivalent fractions for all values produces the following:

$$8/12 \quad 7/12 \quad 6/12 \quad 5/12 \quad 4/12 \quad 3/12 \quad 2/12$$

So the next number is... $1/12$

Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Boyce Ambassadors

Please pass out Problem 5
(Individual Question #4) face down.

Question 5

A home builder put in a large planter box in the backyard. The planter box is 20 feet long, 3 feet back, and 2 feet high. The builder wants to fill the box with dirt. He is able to buy dirt in 3-pound bags. Dirt weighs 2 pounds per cubic foot. He has a wheelbarrow that will carry three bags of dirt at a time from his garage (where his truck with the dirt is) to the backyard. How many trips does he have to make with the wheelbarrow in order to fill up the planter box?

Question 5 Clue

A home builder put in a large planter box in the backyard. The planter box is 20 feet long, 3 feet back, and 2 feet high. The builder wants to fill the box with dirt. He is able to buy dirt in 3-pound bags. Dirt weighs 2 pounds per cubic foot. He has a wheelbarrow that will carry three bags of dirt at a time from his garage (where his truck with the dirt is) to the backyard. How many trips does he have to make with the wheelbarrow in order to fill up the planter box?

Clue:

He really just wants to make mud pies.

Question 5 Answer

How many trips does he have to make with the wheelbarrow in order to fill up the planter box?

Solution:

$$20 \times 3 \times 2 = 120 \text{ cubic feet}$$

$$120 \text{ cubic feet} \times 2 \text{ pounds} = 240 \text{ pounds of dirt}$$

$$240 \text{ pounds of dirt} / 3 \text{ lb bags} = 80 \text{ bags}$$

$$80 \text{ bags} / 3 \text{ bags per trip} =$$

$26 \frac{2}{3}$ so he will need **27** trips

A dark wood desk with a blue pen and a glass. The text is centered on the desk.

Group Question

Set timer for 7:00

Boyce Ambassadors

Please pass out Problem 6
(Group Question #2) face down.

Question 6 - Group

At the Maple Grove Swimming Pool there are two drain pipes. The first one by itself can drain the full pool in 2 hours. The second can drain the full pool by itself in 3 hours. There is also a water inlet pipe that can completely fill the empty pool in 6 hours. The maintenance staff opens the two drain pipes to empty out the swimming pool at the end of the season, but they accidentally turn on the water inlet pipe, too. How long will it take them to drain the pool if it is initially full?

Question 6 Answer

The first one by itself can drain the full pool in 2 hours. The second can drain the full pool by itself in 3 hours. There is also a water inlet pipe that can completely fill the empty pool in 6 hours. How long will it take them to drain the pool if it is initially full?

Solution: By looking at what each pipe can do in one hour $-1/2 + -1/3 + 1/6 = -2/3$ At $2/3$ of the pool per hour drain rate the pool will be empty in...

1.5 hours

Snack Time

We will dismiss by tables.

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

Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Boyce Ambassadors

**Please pass out Problem 7
(Individual Question #5) face down.**

Question 7

Mayra is a human computer. She has appeared on talk shows with her amazing ability with numbers. One of the problems that Mayra is very adept at is the following: A person from the audience will give Mayra a number and Mayra will immediately be able to tell how many one-digit factors that number has. For example, if you were in the audience and you said 50, Mayra would say three, because 50 has three one-digit factors (namely 1, 2, and 5).

One day, Mayra was on a well-known talk show, and some wise guy in the audience asked Mayra to tell him how many one-digit factors the numbers from 1 to 100 had. The answer is not nine, since Mayra had to count every factor as it appeared for a particular number, and sum that with the number of factors for each of the other numbers from 1 to 100. So for instance, even though the factor 5 appears in 50, it also appears in 45, and so must be counted each time. Mayra quickly “programmed” her brain to give her answer, and she had it in a few moments.

What was her answer?

Question 7 Clue

Some wise guy in the audience asked Mayra to tell him how many one-digit factors the numbers from 1 to 100 had. The answer is not nine, since Mayra had to count every factor as it appeared for a particular number, and sum that with the number of factors for each of the other numbers from 1 to 100. So for instance, even though the factor 5 appears in 50, it also appears in 45, and so must be counted each time. Mayra quickly “programmed” her brain to give her answer, and she had it in a few moments. What was her answer?

- **Clue: There must be an easy way to do this...**

Question 7 Answer

Some wise guy in the audience asked Mayra to tell him how many one-digit factors the numbers from 1 to 100 have. What was her answer?

Solution: Simply see how many times each factor goes into 100 and that is how many times each factor should be counted.

1 - 100, 2 - 50, 3 - 33, 4 - 25, 5 - 20, 6 - 16,
7 - 14, 8 - 12, 9 - 11

Add them all together and the answer is...

281 factors

Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Boyce Ambassadors

**Please pass out Problem 8
(Individual Question #6) face down.**

Question 8

Your favorite flashlight batteries are sold in two-packs and four-packs. You watch as a store clerk hangs six packages of batteries on each of 12 hooks. Later, he notes that he hung 200 batteries in all. How many two-packs are in stock?

Question 8 Clue

- Your favorite flashlight batteries are sold in two-packs and four-packs. You watch as a store clerk hangs six packages of batteries on each of 12 hooks. Later, he notes that he hung 200 batteries in all. How many two-packs are in stock?

Clue:

All of the batteries are double A's.

Question 8 Answer

Your favorite flashlight batteries are sold in two-packs and four-packs. You watch as a store clerk hangs six packages of batteries on each of 12 hooks. Later, he notes that he hung 200 batteries in all. How many two-packs are in stock?

Solution: $x + y = 72$

$$2x + 4y = 200$$

Solving the system gives us...

44 two-packs

Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Boyce Ambassadors

**Please pass out Problem 9
(Individual Question #7) face down.**

Question 9

There is a new pizza restaurant in town and they are offering a number of different specials. All of their pizzas are round and sized according to diameters. You can either buy two 8-inch pizzas for \$24 or one 16-inch pizza for \$22. What is the price per square inch of the pizza that is the better deal? (round your answer to the nearest whole cent)

Question 9 Clue

There is a new pizza restaurant in town and they are offering a number of different specials. All of their pizzas are round and sized according to diameters. You can either buy two 8-inch pizzas for \$24 or one 16-inch pizza for \$22. What is the price per square inch of the pizza that is the better deal? (round your answer to the nearest whole cent)

- **Clue: I love pizza pies that are square!**

Question 9 Answer

There is a new pizza restaurant in town and they are offering a number of different specials. All of their pizzas are round and sized according to diameters. You can either buy two 8-inch pizzas for \$24 or one 16-inch pizza for \$22. What is the price per square inch of the pizza that is the better deal? (round your answer to the nearest whole cent)

Solution: Find the areas of the pizzas using $A = \pi r^2$ and then divide the prices by the area to find that the 16 inch pizza is just...

11 cents
per square inch

Individual Question

Set timer for 5:00

Set timer for 2:00 for the clue

Boyce Ambassadors

**Please pass out Problem 10
(Individual Question #8) face down.**

Question 10

The fines for speeding tickets inside Minni-Math Township are computed as follows: the speed you were going is added to how much over the speed limit that speed is. The sum is then squared. The answer is the fine. Carl's fine for going 23 miles per hour over the posted speed limit was \$5041. What was the speed limit?

Question 10 Clue

The fines for speeding tickets inside Minni-Math Township are computed as follows: the speed you were going is added to how much over the speed limit that speed is. The sum is then squared. The answer is the fine. Carl's fine for going 23 miles per hour over the posted speed limit was \$5041. What was the speed limit?

Clue: Carl is not driving a jet.

Question 10 Answer

The speed you were going is added to how much over the speed limit that speed is. The sum is then squared. The answer is the fine. Carl's fine for going 23 miles per hour over the posted speed limit was \$5041. What was the speed limit?

Solution: $(x + 23)^2 = 5041$ so you simply need to take the square root of 5041, and subtract 23 to find that he was going 48 mph. 23 less than that...

25

mph