Kansas City Area Teachers of Mathematics
2014 KCATM Contest

Mathletics

Grade 5

Instructions:

- Do **NOT** turn this page until instructed to do so.
- WRITE YOUR **TEAM NUMBER** AND **SCHOOL NAME** ON THE LINE PROVIDED ON THE FRONT OF EACH SHEET EACH TIME YOU BEGIN A NEW PROBLEM.
- You **may** use calculators on this test (*NO* cell phone calculators).
- Use the π button on your calculator or use 3.14159.
- Blank scratch paper can be used. Do **NOT** write on the team number card.
- You may **not** use rulers, protractors or other measurement devices on this test.

Problems # 1-3

This is a relay problem.

Team Number: _____   School: _____

Students: _____

_____

_____

Problems 1-3 *(3 minutes, 3 points)*

1. Solve the number riddle:

- It is a multiple of 3.
- It is not even.
- It is greater than 20.
- It is less than the answer to 7 x 6.
- The sum of the digits is even.
- The difference between the digits is 6.

Answer: _____

2. The answer from #1: _____ is the **percent** of the circle representing the number of 5th grade students who play soccer. There are 360º in a circle. What is the degree of the angle representing the number of 5th grade students who play soccer? Report your answer to the nearest tenth of a degree.

Answer: _____

Ans. from #1

3. The answer to #2 _____ is the cost of a birthday present. There is a discount of 25%, plus an additional 10% off with the coupon from the newspaper. What does the item cost after both discounts are applied?

Answer: _____
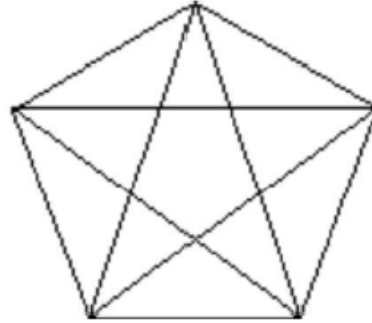
TEAM #: _____   School Name _____

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Problem # 4
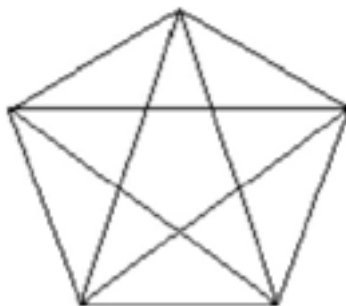
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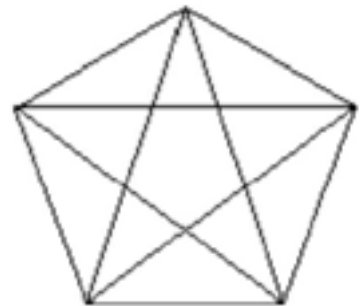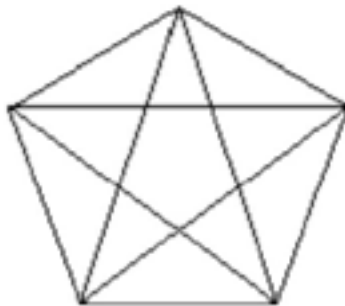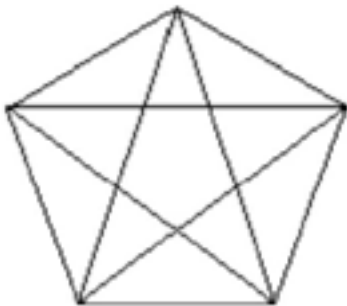
Team Number: _____   School: _____

Problem 4 *(3 points, 3 minutes)*

How many triangles are in a fully connected pentagon?

Hint: Find all the different triangles at one vertex. Use these diagrams to help you.

Answer: _____

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Problem # 5

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 5 *(3 minutes, 3 points)*

By adding four consecutive integers it is possible to make different totals. For example, 16 + 17 + 18 + 19 = 70, which is also divisible by 10.

How many of the numbers under 100 that are divisible by 10 can you make by adding four consecutive integers?

Consecutive numbers are numbers that follow each other. When adding the following 4 consecutive positive numbers: 16 + 17 + 18 + 19, the sum is 70. Seventy is divisible by 10.

List all numbers under 100 that are divisible by 10 when you add four consecutive numbers. Be sure to include the number 70.

Answers: _____

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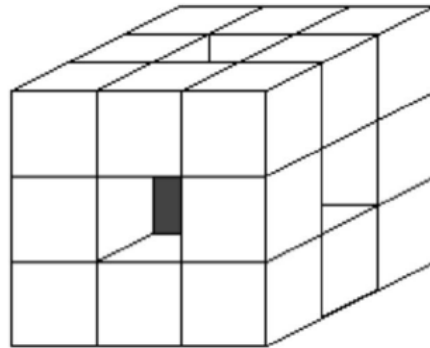
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Problem # 6

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 6 *(2 minutes, 2 points)*

A cube measuring 3 × 3 × 3 is made up of 27 smaller cubes and has a 1 × 1 square hole pushed right through the centre of each face so that you can see straight through the cube from every side.

The number of small cubes remaining is 20.

If a 5 × 5 × 5 cube has 3 × 3 square holes pushed through the centre of each face, how many smaller cubes would remain?

Answer: _____

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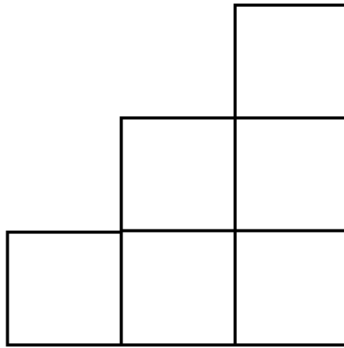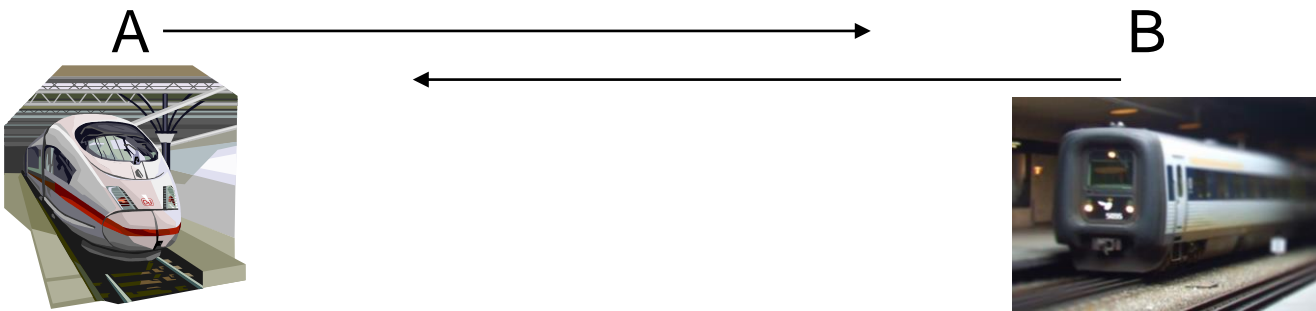**2014 KCATM Contest**

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Problem # 7

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 7 *(2 minutes, 2 points)*

Two numerical sequences occur in mathematics: **<u>arithmetic</u>** and **<u>geometric</u>**. An arithmetic sequence has a common difference between terms, whereas a geometric sequence has a common ratio between terms. Use this information to find the **<u>SUM</u> of the 10th terms** in each of the two sequences below.

Arithmetic: -8, -5, -2, _____, _____, _____, _____, _____, _____, _____

Geometric: 2, 6, 18, _____, _____, _____, _____, _____, _____, _____

Answer: _____

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Problem # 8

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 8 *(1 point, 1 minute)*

An exclamation point (!) in mathematics is defined as the product of whole numbers from the given number down to one.

Example: 4! = 4 x 3 x 2 x 1

Find the value of: $\dfrac{10!}{(3!)(10-3)!}$

Answer: _____

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Problem # 9

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 9 *(3 points, 3 minutes)*

The staircase below has three steps made of blocks. Use the pattern adding blocks for each additional row to **find how many steps you would have when you use 105 blocks to build your stairs.**

Answer: _____

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Problem # 10

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 10 *(2 points, 2 minutes)*

One train runs from A to B at 105 miles per hour, the other runs from B to A at 85 miles per hour. How far apart were the two trains 30 minutes prior to their crossing?

Use d = rt   (distance = rate x time; time is in hours)

A ———————————————————→ B

←———————————————————

Answer: _____ miles

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Problem # 11

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 11 *(1 point, 1 minute)*

TRUE STATEMENTS:

A. The number of false statements here is one.

B. The number of false statements here is two.

C. The number of false statements here is three.

D. The number of false statements here is four.

Which one of these statements must be true?

Answer: _____

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Problem # 12

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 12 *(2 points, 2 minutes)*

Complete the table logically.

♦	♦	♣	♦	♣	■
♦	♣	■	♣	♦	♣
■	♣	♥	♦	♣	■
♣	♥	♠	♦	♣	■
♣	♥	♠	♥	♦	♣
■		♥	♠	♥	♠

Circle the correct answer:

♦   ♣   ♣   ♥   ♥   ■   ♠   ♠

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Problem # 13

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 13 *(2 points, 2 minutes)*

Favorite Sports Logic Puzzle

	Baseball	Tennis	Basketball	Soccer
Alex				
Jessica				
Ryan				
Sophie				

Four friends each have different favorite sports. Use the clues to figure out who likes which sport.

1. Jessica likes neither soccer nor basketball.
2. Ryan used to like basketball and baseball best, but he has changed his mind.
3. Neither of the boys likes soccer best.
4. Jessica plays a team sport.

Alex likes _____

Jessica likes _____

Ryan likes _____

Sophie likes _____

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Problem # 14

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 14 *(3 points, 3 minutes)*

Find the **perimeter** and **area** of the shaded composite figure below.

67cm

23.06 cm

23.06 cm

30 cm

4 cm

4 cm

35 cm

Answers:

Perimeter = _____ cm

Area = _____cm²

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Problem # 15

Do NOT turn the page until you are told to do so.

Team Number: _____   **School: _____**

Problem 15 (3 points, 3 minutes)

Use order of operations to add **+, - , x , ÷** *and/or* **( )** to make the equations work:

a) 1   2   3   4   5   6   7 = 51

b) 3   4   5   6   7   1   2 = 51

Answers:

a)   1   2   3   4   5   6   7 = 51

b)   3   4   5   6   7   1   2 = 51

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Problem # 16

Do NOT turn the page until you are told to do so.

Team Number: _____   **School:** _____

Problem 16 *(2 points, 2 minutes)*

Inspect the following patterns:

a) How many squares will there be in the **5th group**?

b) How many squares will there be in the **8th group**?

c) Write an **expression for the "nth" group**.

1   2   3
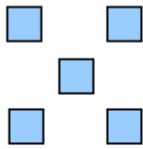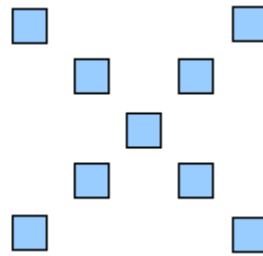
Answers:

A. _____

B. _____

C._____

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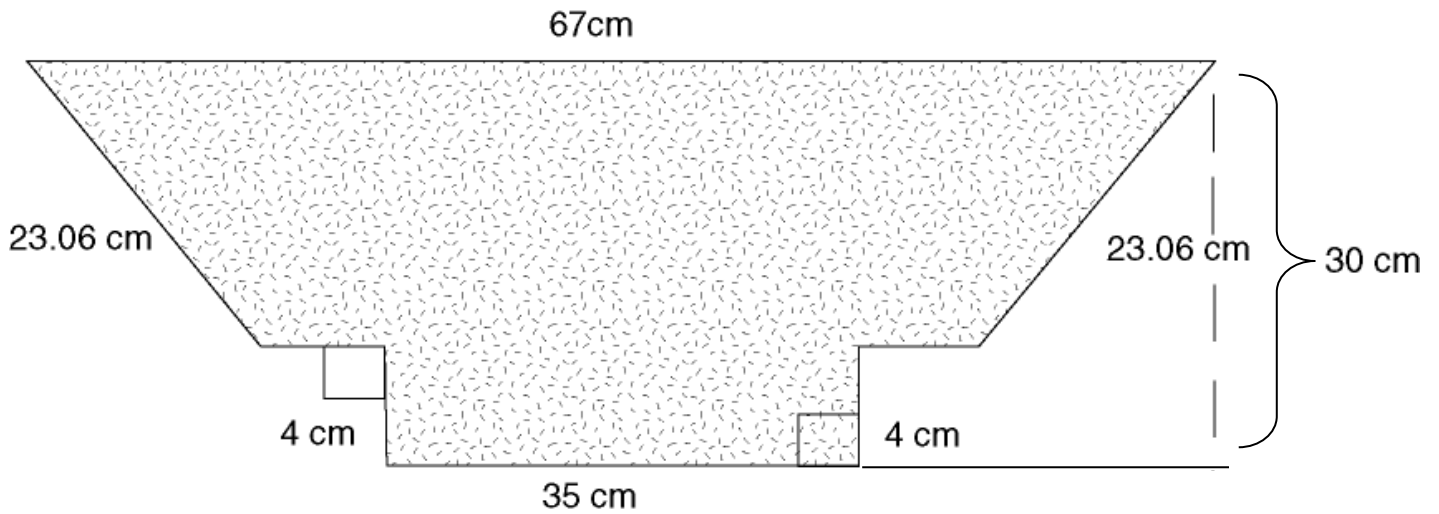**2014 KCATM Contest**

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Problem # 17

Do NOT turn the page until you are told to do so.

Team Number: _____   School: _____

Problem 17 *(3 points, 3 minutes)*

Calculate the area of the region **between the triangle and the circle** (lighter shaded region.) The diameter of the circle is 5 units.

Use 3.14 for π. Round the answer to the nearest thousandths.
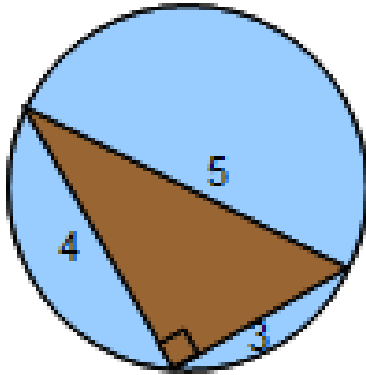
Answer: _____ sq. units

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Answer Key

PT	#	Solutions
1	1	39
1	2	140.4º
1	3	$94.77
3	4	35 By rotational symmetry, all triangles below exist in exactly five other positions. Making a total of 7 × 5 = 35 triangles in the diagram.

3	5	**10, 30, 50, 70, 90** Taking four consecutive integers, starting from n, $$n + (n + 1) + (n + 2) + (n + 3) = 4n + 6$$ Clearly for the total ($4n + 6$) to be divisible by 10, $4n$ must end in a 4. So the units digit of n must be 1 or 6, $1 + 2 + 3 + 4 = 10$ $6 + 7 + 8 + 9 = 30$ $11 + 12 + 13 + 14 = 50$ $16 + 17 + 18 + 19 = 70$ $21 + 22 + 23 + 24 = 90$ Giving 5 numbers under 100 that are divisible by 10 and can be made from the sum of four consecutive integers.
2	6	**44** A solid cube measuring $5 \times 5 \times 5$ consists of 125 cubes. A cube measuring $3 \times 3 \times 3 = 27$ cubes is removed from the centre and six faces of $3 \times 3 = 9$ cubes are removed. That is, $125 - (27 + 6 \times 9) = 125 - (27 + 54) = 125 - 81 = 44$ cubes remaining.
2	7	**39,385** $= 19 + 39366$
1	8	**120**
3	9	**14** **http://www.insidemathematics.org/problems-of-the-month/pom-growingstaircases.pdf**
2	10	**95 miles** **TRAINS:** They were 95 miles apart 30 minutes before the two trains crossed each other. Since one train is traveling at 105 MPH, and the other at 85 MPH, the relative speed is 190 MPH (105 + 85). One hour (or 60 minutes) before they crossed, they would have been 190 miles apart. Since the question asked how far away they were 30 minutes before they crossed, then it would be half that distance, or 95 miles. http://www.expandyourmind.com/logicproblems/logic_problems.shtml
1	11	**C** **TRUE STATEMENTS:** Option "C" is the answer: three statements are false. Since each statement concludes that there is a different number of false statements, that proves that only one statement can be correct (hence the object is to decide which statement is true). Given that one statement is true, by definition, the other **three** *must* be false! http://www.expandyourmind.com/logicproblems/logic_problems.shtml
2	12	1. **MISSING SYMBOL:** Each symbol is associated with another's position; this upside-down spade is always to the left of a right-side-up heart.

2	**13**	**Alex likes <u>baseball</u>.** **Jessica likes <u>basketball</u>.** **Ryan likes <u>tennis</u>.** **Sophie likes <u>soccer</u>.**
3	**14**	**Perimeter = 164.12 cm** **Area = 1430 cm^2**
3	**15**	**a)** **(**$1 + 2 + 3 + 4$**) x** 5 **-** 6 **+** 7 **= 51** **b)** 3 **x** 4 **+ (**5 **x** 6 **+** 7**) x** 1 **+** 2 **= 51** http://mathtop10.com/5th_grade_math_challenge_free/5th_grade_math_P4.htm
2	**16**	A. 17 B. 29 C. 4n - 3
3	**17**	**13.625** Solution: The area of the blue region is the area of the circle minus the area of the brown triangle. 3.14 * 2.5 * 2.5 - 1/2 * 3 * 4 = 13.625