

Kansas City Area Teachers of Mathematics  
2014 KCATM Math Contest

# MATHLETICS

## GRADE 6

### INSTRUCTIONS

- WRITE YOUR TEAM NUMBER AND SCHOOL NAME ON THE LINE PROVIDED ON EACH SHEET EACH TIME YOU BEGIN A NEW PROBLEM.
- Do **NOT** turn this page until instructed to do so.
- WRITE YOUR TEAM NUMBER AND THE ANSWER ON EACH BACK PAGE. This will be checked and recorded for each problem.
- You may use calculators on this test.
- ***Scratch paper can be used.*** Do **NOT** write on the team number card!
- Use the  $\pi$  key on your calculator or 3.14159 as the approximation for pi.
- You may not use rulers, protractors, or other measurement devices on this test.

Many problems came from or adapted from:  
Problem Solving Strategies for Efficient and Elegant Solutions, Alfred Posamentier & Stephen Krulik,  
Corwin Press, 2008

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

**Team Members:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Problem 1****3 points**  
**3 minutes**

A family left their house in two cars, A and B, at the same time traveling to the same location.

- Car B travels an average of 7 miles an hour faster than Car A.
- Car B arrived at the final destination after 5 ½ hours of driving.
- Together Car A and Car B drove a total of 599.5 miles in the 5 ½ hours.

If Car A continues at the same average calculated speed, how much longer (to the nearest minute) will it take for Car A to arrive at the same destination as Car B?

- A. 40 minutes
- B. 45 minutes
- C. 50 minutes
- D. 55 minutes
- E. None of the above

**Answer:** \_\_\_\_\_

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# **Mathletics**

## **Grade 6**

### **Problem # 2**

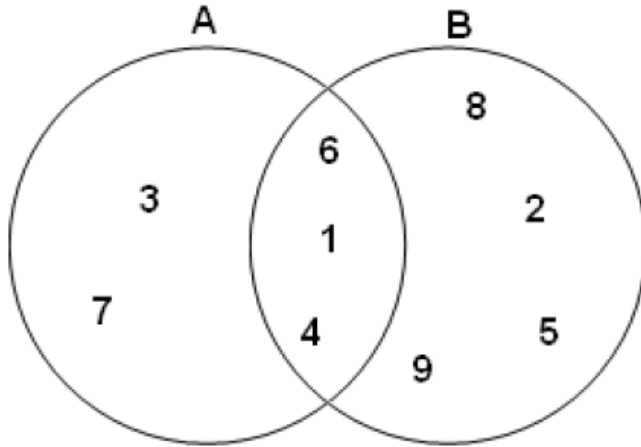
**Do NOT turn the page until you are told to do so.**

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

**Problem 2**

**2 points**  
**2 minutes**

Fill in the blanks using the given Venn diagrams:



**Answer:**

Use set notation { list of numbers } for your answers.

$A \cup B =$ _____
$A \cap B =$ _____
$A - B =$ _____
$B - A =$ _____

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### **Problem # 3**

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

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

**Problem 3****2 points  
2 minutes**

When I was 14 years old, my father was 42 years old, which was three times my age. Now he is twice my age, how old am I?

**Answer:** \_\_\_\_\_**School** \_\_\_\_\_ **TEAM #** \_\_\_\_\_

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### **Problem # 4**

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

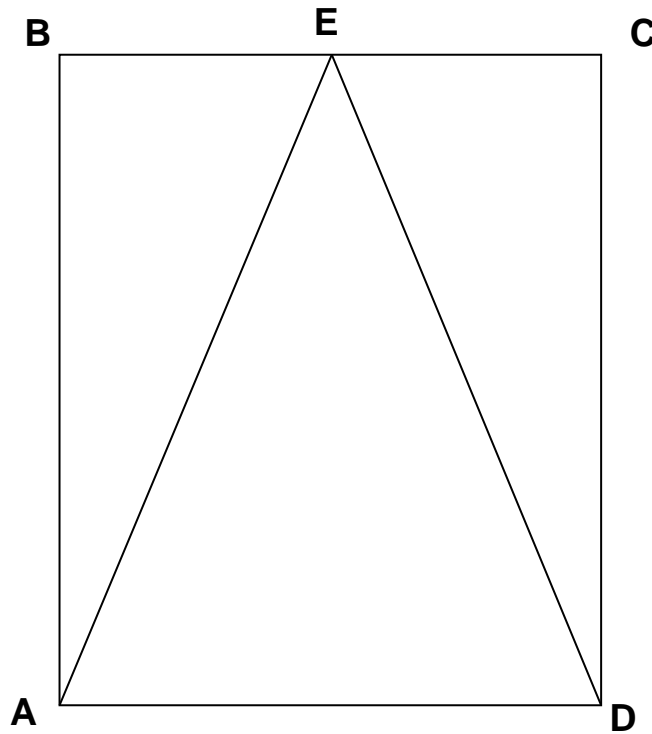
**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

## Problem 4

1 point  
1 minute

Triangle ADE is inside rectangle ABCD. Point E is halfway between points B and C on the rectangle. Side AB is 8 cm and side AD is 7 cm.

- A. What is the area of triangle ADE?  
B. What is the ratio of the area of triangle ABE to area of triangle ADE in reduced fraction form?  
C. What is the ratio of the area of triangle CDE to area of rectangle ABCD in reduced fraction form?



Answers:

Part A: \_\_\_\_\_

Part B: \_\_\_\_\_

Part C: \_\_\_\_\_

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### **Problem # 5**

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

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

**Problem 5 - Computer Upgrade****3 points  
3 minutes**

During an automated daily task a computer spends 20% of the time importing the raw data from thousands of text files, 70% of the time processing it, and 10% of the time exporting the results to spreadsheet files and archiving the data. (*Hint: think of the original unit of time as 100 minutes.*)

To help speed-up the task a new chip is purchased that will double the speed of the processing task and the newly purchased hard drives allow both import and export times to be reduced by 30%.

How much time will be saved overall and what percentage of the time will be spent doing each of importing, processing, and exporting the data?

[http://mathschallenge.net/view/system\\_upgrade](http://mathschallenge.net/view/system_upgrade): Problem ID: 305 (20 Jan 2007) Difficulty: 1 Star

**Answer:** Time saved: \_\_\_\_\_ minutes

Import Time: \_\_\_\_\_ %

Process Time: \_\_\_\_\_ %

Export Time: \_\_\_\_\_ %

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# **Mathletics**

## **Grade 6**

### **Problem # 6**

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

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

Problem 6

1 point  
1 minute

The sides of a triangle are in a ratio of 3:5:6. If the perimeter is 56, what are the side lengths of the triangle?

Answer: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

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### **Problem # 7**

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

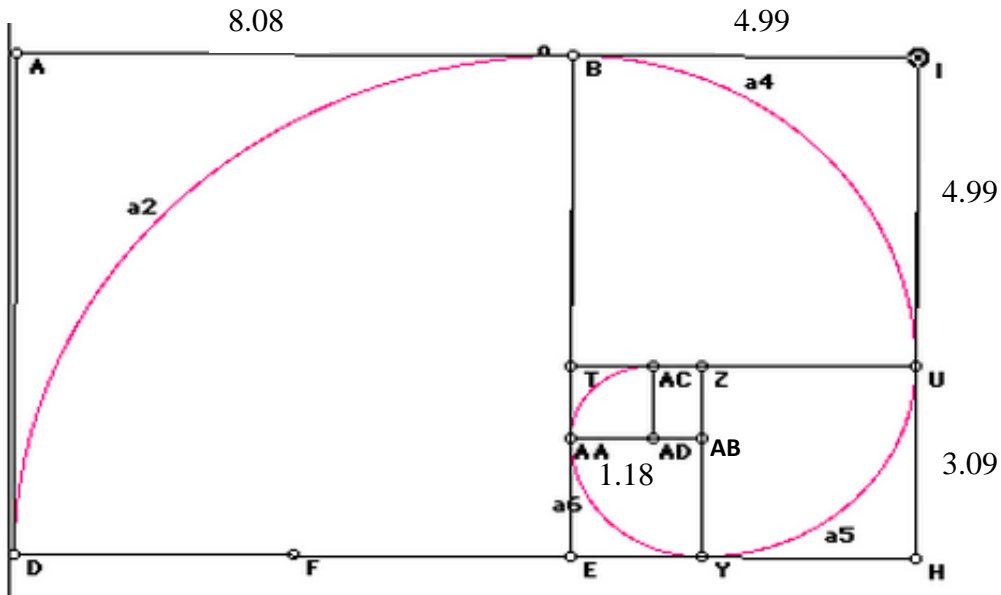
**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

**Problem 7**

**2 points  
2 minutes**

The “Golden Rectangle” is drawn below. A program called Geometer’s Sketchpad can measure lengths of line segments of figures drawn in the program. Given the measures of the line segments below, determine the three ratios. Round to the nearest hundredth. What do you notice?

Given:  $ABAD = 0.73$



**Answers:**

$$\frac{AB}{IB} = \underline{\hspace{2cm}} \quad \frac{UI}{HU} = \underline{\hspace{2cm}} \quad \frac{AAAD}{ABAD} = \underline{\hspace{2cm}}$$

**What did you notice about the ratio values of your answers?** \_\_\_\_\_

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### **Problem # 8**

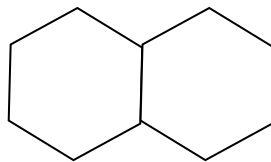
**Do NOT turn the page until you are told to do so.**

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

## Problem 8

1 point  
1 minute

Tables at a party are all regular hexagons. If they were put together end to end as shown, how many tables would you need for 50 people?



Answer: \_\_\_\_\_

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### **Problem # 9**

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

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

## Problem 9

2 points  
2 minutes

Determine the value of the expression:

$$\left(\frac{-2}{3}\right)^0 \left(\frac{8}{27}\right)^{\frac{-2}{3}}$$

Answer: \_\_\_\_\_

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### **Problem # 10**

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

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

## Problem 10

3 points  
3 minutes

Use the 10 digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9  
to fill in the missing values.

$$6 \div \square \times 4 = \square 2$$

$$\square \div \square \times 2 = 6$$

$$\square \div 4 \times \square = 10$$

$$\square \div \square \times 8 = 0$$

$$\square \div 3 \times 2 = \square$$

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### **Problem # 11**

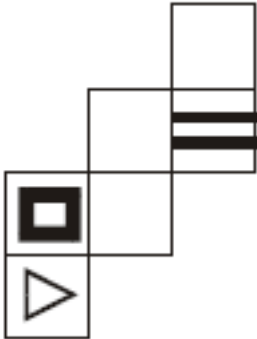
**Do NOT turn the page until you are told to do so.**

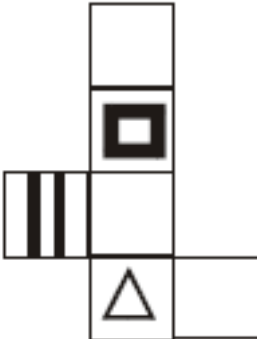
**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

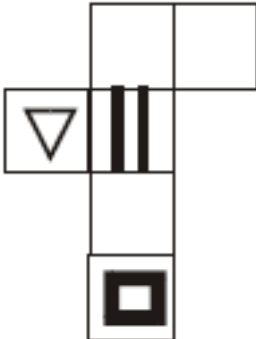
Problem 11

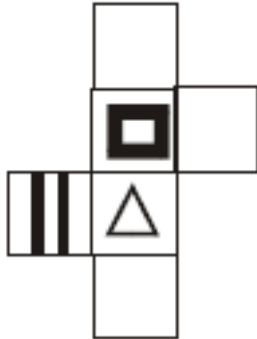
1 point  
1 minute



A. 

B. 

C. 

D. 

Taken from: Pieces of Learning by Barbara Vandecreek, 2002

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 following steps:**

1. Start with 18 and 24.
2. Divide the Least Common Multiple (LCM) by the Greatest Common Factor (GCF).
3. Find 25% of that number.
4. Divide the number by  $\frac{3}{5}$ .
5. Round that number to the nearest hundredth (if needed).
6. Subtract the first prime number.

Answer: \_\_\_\_\_

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## **Grade 6**

### **Problem # 13**

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

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

## Problem 13

3 points  
3 minutes

Your math teacher bought some apples and oranges. The ratio of the number of apples to the number of oranges was 2:5. She gave  $\frac{3}{4}$  of the apples to the first class of the day and 34 oranges to the second class. The ratio of the number of apples to the number of oranges is now 2:3. How many **apples** did your math teacher buy?

Answer: \_\_\_\_\_ apples

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# **Mathletics**

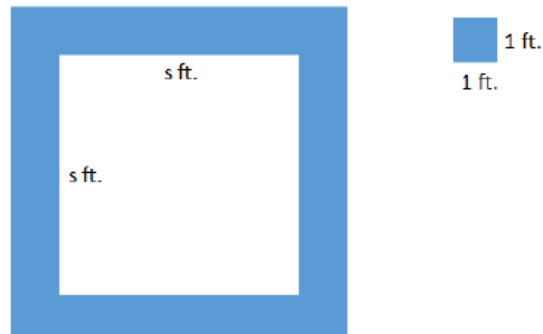
## **Grade 6**

### **Problem # 14**

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

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

## Problem 14

3 points  
3 minutes

A square fountain area with side length “ $s$ ” is bordered by a single row of square tiles as shown.

If  $s = 4$ , how many tiles would you need to border the fountain?

If  $s = 5$ , how many tiles would you need to border the fountain?

If  $s = 6$ , how many tiles would you need to border the fountain?

Generalize this using “ $s$ ” in an expression.

**Answers:**

$s = 4$ : \_\_\_\_\_  $s = 5$ : \_\_\_\_\_  $s = 6$ : \_\_\_\_\_

**Expression Answer:** \_\_\_\_\_

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### **Problem # 15**

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

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

Problem 15

2 points  
2 minutes

Simplify. Leave answers in fraction form.

$$\frac{2}{3} + \frac{1}{3} \left( \frac{1}{4}f - 1\frac{1}{3} \right)$$

Answer: \_\_\_\_\_

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### Problem # 16

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

**Team Number:** \_\_\_\_\_ **School:** \_\_\_\_\_

Problem 16

3 points  
3 minutes

$n!$  is defined as the product of all descending whole numbers from “ $n$ ” to “1”. Example:  $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

In probability, permutations are arranging things when order matters, or “the number of ways you can take “ $n$ ” things “ $r$ ” at a time when order

matters”. The formula is  ${}_n P_r = \frac{n!}{r!(n-r)!}$  Find the number of ways 12 things can be put into groups of 3 when order matters.

(A practical application is when you want to find how many different ways 12 runners can come across the finish line for the gold, silver, and bronze medals.)

(Hint:  $n = 12, r = 3$ )

Answer: \_\_\_\_\_

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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

Terrance has 3 times as many nickels as quarters. He has 8 fewer half dollars than nickels. Altogether, Terrance has 153 coins. How many of each coin does Terrance have?

Answer: \_\_\_\_\_

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# **Mathletics**

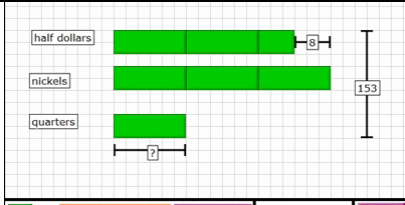
## **Grade 6**

**ANSWER KEY**

**Answers:**

P T	#	Solutions
3	1	<b>45 minutes</b>
2	2	<div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <math display="block">A \cup B = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}</math> <math display="block">A \cap B = \{1, 4, 6\}</math> <math display="block">A - B = \{3, 7\}</math> <math display="block">B - A = \{2, 5, 8, 9\}</math> </div>
2	3	<p>Let <math>f</math> be the father's age and his child's age be <math>c</math>.</p> <p>As the father is <math>42 - 14 = 28</math> years older than the child, <math>f = c + 28</math>.</p> <p>At the moment <math>f = 2c</math>, hence <math>2c = c + 28</math>, and so <math>c = 28</math>. That is, the father's child is now 28 years old.</p> <hr style="width: 50%; margin: 10px auto;"/> <p style="text-align: right; font-size: small;">Problem ID: 78 (May 2002)    Difficulty: 1 Star    [mathschallenge.net]</p> <p style="text-align: center; font-size: large;"><b>28</b></p>
1	4	<p style="text-align: center; font-size: large;"><b>28, <math>\frac{1}{2}</math>, <math>\frac{1}{4}</math></b></p> <p>Part A: 28 sq cm</p> <p>Part B: 14 to 28, 1:2, or other equivalent answer</p> <p>Part C: 14 to 56, 1:4, or other equivalent answer</p>
3	5	<p style="text-align: center; font-size: large;"><b>35 units of time; 25%, 62.5%, 12.5%</b></p> <p>When we are not given actual times it is often convenient to work with an initial value of 100 so that final percentage changes can be compared more easily. On the old system, the computer took 70 units of time to complete the processing part of the task; the new chip doubles the processing speed, so it will now complete in 35 units of time.</p>

		<p>It took 30 units of time to import and export the data. But because the new drives reduce import and export time by 30%, it will complete in 70% of the previous time. And as 10% of 30 is 3, it will now take 21 units of time.</p> <p>Hence the new system will take <math>35 + 21 = 56</math> units of time to complete the task, which represents an overall reduction of 44% in the time taken to complete the task.</p> <p>After the upgrade, the ratio of times to complete each part of the task is,</p> <p style="text-align: center;">import : process : export = <math>14 : 35 : 7 = 2 : 5 : 1</math></p> <p>That is, the computer spends <math>2 + 5 + 1 = 8</math> units of time to complete the task of which it spends <math>2/8 = 25\%</math> of the time importing data, <math>5/8 = 62.5\%</math> of the time processing data, and <math>1/8 = 12.5\%</math> of the time exporting data.</p>
1	6	<b>12, 20 , and 26</b>
2	7	<b>1.62, 1.62, 1.62 They are the same value!</b>
1	8	<b>12 tables</b>
2	9	<b>9/4</b>
3	10	<p style="text-align: center;"> <math>6 \div 2 \times 4 = 12</math>  <math>9 \div 3 \times 2 = 6</math>  <math>8 \div 4 \times 5 = 10</math>  <math>0 \div 7 \times 8 = 0</math>  <math>6 \div 3 \times 2 = 4</math> </p> <p style="text-align: right;">Don Balka, Developing Algebraic Thinking with my Kids</p>
1	11	<b>D</b>
2	12	<b>3</b>
3	13	<p><b>16 apples, 40 oranges</b></p> <p><a href="http://www.youtube.com/watch?v=LY5rQvbdouE">http://www.youtube.com/watch?v=LY5rQvbdouE</a></p>
3	14	<p><b><math>4(s + 1)</math> or <math>4s + 4</math></b></p> <p><a href="http://www.engageny.org/sites/default/files/resource/attachments/math-g7-m3-teacher-materials.pdf">http://www.engageny.org/sites/default/files/resource/attachments/math-g7-m3-teacher-materials.pdf</a> pg. 57</p>

<p>2</p>	<p>1 5</p>	$\frac{2}{3} + \frac{1}{3} \left( \frac{1}{4}f - 1\frac{1}{3} \right)$ $\frac{2}{3} + \frac{1}{3} \left( \frac{1}{4}f \right) + \frac{1}{3} \left( -\frac{4}{3} \right)$ $\frac{2}{3} + \frac{1}{12}f - \frac{4}{9}$ $\frac{1}{12}f + \frac{2}{9}$ <p><a href="http://www.engageny.org/sites/default/files/resource/attachments/math-g7-m3-teacher-materials.pdf">http://www.engageny.org/sites/default/files/resource/attachments/math-g7-m3-teacher-materials.pdf</a></p>
<p>3</p>	<p>1 6</p>	<p style="text-align: center;"><b>220</b></p>
<p>3</p>	<p>1 7</p>	<div style="text-align: center;">  </div> <p><a href="http://www.youtube.com/watch?v=IDKRggTMr_8">http://www.youtube.com/watch?v=IDKRggTMr_8</a></p> <p style="text-align: center;"><b>Quarters: 23, Nickels: 69, Half Dollars: 61</b></p>