2003 MCTM Elementary Mathematics Contest – Sample Test

Grades 4-6

Sponsored by the
Missouri Council of Teachers of Mathematics

2003 Sample Test Questions and Solutions

Concepts Test: This test will attempt to assess knowledge of and about mathematics. Recall of facts and understanding of relationships will be essential. Items involving Number and Number Sense, Geometry (including visualization, transformations and Logo), Measurement, Data Analysis, and Probability and Statistics will be included in this section of the test.

Problem Solving Test: This test will assess higher order thinking skills. These items should require an application of mathematics utilizing both concepts and/or computation. A wide variety of problems can be expected, all of which can be solved utilizing problem solving strategies found in current literature. Expect to spend more time on some items of this test than on items on the Concepts Test.

Labels on Solutions: Solutions will require labels when they involve money ($ or ¢), time (a.m. or p.m.), or measurement (cm, in, cm^2, ft & in, hours & minutes, weeks & days…).

Student Tools: Each student needs to bring sharpened pencils, an in/cm ruler, and a calculator (optional). Fifth grade students should also bring a protractor; and sixth grade students should also bring a protractor and a compass.

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2003 MCTM Elementary Mathematics Contest – Sample Test

4th Grade Concepts

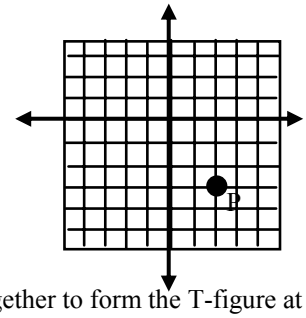
1. A stamp collector bought a rare stamp for $30, sold it for $42, bought it back for $50, and finally sold it for $48. How many dollars did the collector make or lose?

2.

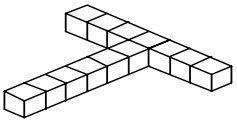
Input	Output
1	0
2	3
3	8
4	15
5	24
6	?

3. The average of 9 numbers is 7, and the average of 7 other numbers is 9. What is the average of all 16 numbers?

4. What ordered pair of coordinates names the location of point P?



5. Thirteen one-inch cubes are put together to form the T-figure at the right. The complete outside of the T-figure (including the bottom) is painted red and then separated into its individual cubes. How many of the cubes have exactly 5 red faces?



6. Which of these number/s is/are **less than** 0.075?

1.438	0.75	0.07
0.567	0.055	1.63
1.003	1.501	0.078
0.3	0.47	1.295

7. ABBCCCABBCCCABBCC… Imagine this pattern continues. If this pattern repeats 7 times, how many letters are there in all?

8. Reduce $\frac{161}{253}$ to lowest terms.

9. Suppose the average American spends 40% of his or her income paying taxes. If this were to be shown with a pie chart, how many degrees would the central angle be for this portion of the chart?

10. If a class of 24 students has a boy to girl ratio of 3:1, what would the ratio be if two boys left the room?

2003 MCTM Elementary Mathematics Contest – Sample Test

KEY

Name **4th Grade Concepts**

1. **10**
2. **35**
3. **7.875 or 7 7/8 or 63/8**
4. **2 and -3**
5. **3**
6. **0.055, 0.07**
7. **42**
8. **7/11**
9. **144**
10. **8:3 or 8/3 or 8 to 3 or 16:6 or 16 to 6**

2003 MCTM Elementary Mathematics Contest – Sample Test

4th Grade Problem Solving

1. There are 11 people at a meeting. If each person shakes hands with each of the others only once, then how many handshakes are there?

2. A man has to be at work by 9:00 A.M. It takes him 15 minutes to dress, 20 minutes to eat, and 35 minutes to get to work. What time should he get up?

3. 0 → 11 The same rule is applied to every number.
   1 → 8
   5 → -4
   3 → 2 6 → ?

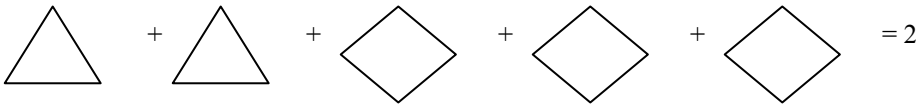
4. The length of a rectangle is 4 times as long as its width. The area of the rectangle is $100m^2$. What are the dimensions of the rectangle?

5. How many addition signs should be put between the digits of the number 987654321, and where should they be put such that when the resulting numbers are added together you get a total of 99?

6. There were 90 campers at a tennis camp. There were 17 instructors. The campers were divided as equally as possible among the instructors. Most groups had 5 campers. How many groups had 6 campers?

7. Three students were absent when the remaining 21 students took a test on which the average score was 77. When the three students took the test their scores were 69, 62, and 91. Taking these three grades into account, what was the new average(to the nearest tenth) of all the test scores?

8. Fractions whose numerators are 1 are called *unit* fractions.
   1/2, 1/3, 1/4, 1/6, and 1/10 are examples of unit fractions. Fill in the shapes below with unit fractions so as to make the equation true. Each shape that is the same must hold the same unit fraction.



9. Joan's mother had twenty "8 x 10" photos of her European tour lined up in a rectangle with only the 10" sides touching. How many inches is the perimeter of this display?

10. The cost of two books about roller skating is $11.50. One costs $2.50 more than the other. What is the cost of each book?

2003 MCTM Elementary Mathematics Contest – Sample Test

KEY

Name **4th Grade Problem Solving**

1. **55**
2. **7:50 a.m.**
3. **-7**
4. **5m by 20m**
5. **6, 9+8+7+6+5+43+21**
6. **5**
7. **76.6**
8. **½, ½, 1/3, 1/3, 1/3 or ¼, ¼, ½, ½, ½**
9. **340**
10. **$7 and $4.50**

2003 MCTM Elementary Mathematics Contest – Sample Test

5th Grade Concepts

1. A model airplane has a scale of ¼ inch equals 28 inches. If the model has a length of 2 3/4 inches, how many inches long is the real airplane?

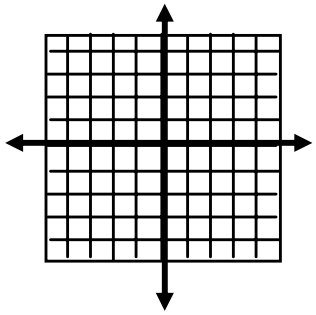
2. A number is doubled and –9 is added to it. The result is –1. What was the number?

3. Of three numbers, two are 1/2 and 1/3. What fraction should the third number be so that the **average** of all three is 1?

4. Calculate 3 1/2 – 1 5/6 + 8 3/4 x 3/5. Express your answer as a reduced fraction.

5. Which of the fractions is the largest 7/13 or 8/15?

6. The vertices of rectangle RSUT are R(-4, 3), S(-1, 3), U(-1,1), and T(-4,1). If RSUT is translated 3 units to the right and 4 units down, find the coordinates of the new rectangle's vertices.



7. Given that:
   2 T 4 = 3
   3 T 7 = 5
   5 T 4 = 4.5
   0 T 6 = 3 Then 6 T 10 = ?

8. If 1/a and 1/ b are two fractions, and *a* and *b* have no common factors, what would their least common denominator be?

9. State the number of faces, edges, and vertices for a pentagonal pyramid.

10.

Input	Output
1	0
2	3
3	8
4	15
5	24
6	?

2003 MCTM Elementary Mathematics Contest – Sample Test

KEY

Name **5th Grade Concepts**

1. **308**

2. **4**

3. **2 1/6 or 13/6**

4. **6 11/12 or 83/12**

5. **7/13**

6. **R'(-1,-1), S'(2,-1)**
U'(2,-3), T'(-1,-3)

7. **8**

8. **ab or a times b**

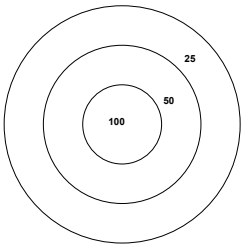
9. **6 faces, 10 edges, 6 vertices**

10. **35**

2003 MCTM Elementary Mathematics Contest – Sample Test

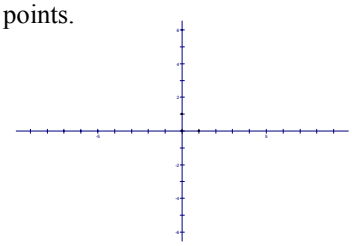
5th Grade Problem Solving

1. In the target shown at the right, the circles have radii = 1, 2, and 3 units, respectively. If you throw one dart and it hits the target, what is the probability that you score more than 25 points?



2. What is the smallest, positive, whole number possible when you rearrange these symbols, using each exactly once? x, -, 9, 2, 4

3. Given the coordinates (4, -2) and (0, 2), find <u>two</u> of the six different points needed to complete a right, isosceles triangle. Name the coordinates (as ordered pairs) for your 2 points.



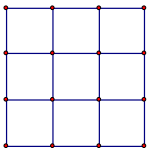
4. . Karen is shopping at the bakery for her mom. She was told to buy 10 onion rolls, 16 hamburger buns, and 8 loaves of rye bread for the picnic. How much did she spend before sales tax?

BAKERY SHOPPE

White Bread	2 for $1.39
Rye Bread	2 for $1.59
Onion Rolls	5 for $2.96
Hamburger Buns	8 for $1.79
Hot Dog Buns	8 for $1.69

5. In a double-dip ice cream cone you can choose from 31 flavors. How many double-dip ice cream cones can you make? Using the same flavor twice is <u>not</u> allowed and chocolate/vanilla is considered different than vanilla/chocolate.

6. In a 3 x 3 grid, make a magic square, arranging the numbers 1 through 9 in the grid so that the sum in each row, column, and the two diagonals is the same.



7. On June 1, 1999, the average age of the 33 employees of Ajax Shoes was 47 years. On June 1, 2000, three of the staff aged 65, 58, and 62 retired and were replaced by four employees aged 24, 31, 26, and 28. What was the average age(to the nearest tenth) of the employees at Ajax Shoes on June 1, 2000?

8. Jenny is 60 inches tall. That is 10 inches taller than Maria. The difference between Joe's height and Jenny's height is 2 inches more than between Joe's and Maria's height. How tall are Maria and Joe?

9. If a deck of 52 playing cards has a thickness of 1.3 cm, and the four kings are removed, how thick is the deck then?

10. A **regular** hexagon and a **regular** octagon have equal perimeters. What is the ratio of the measure of one side of the octagon to the measure of one side of the hexagon? Express your answer as a fraction in lowest terms.

KEY

Name: 5th Grade Problem Solving

1. **4/9 or .44444… or 44.4%**

2. **1**

3. **Any 2 of …**

   (4,2), (0,-2), (4,6), (-4,-2), (8,2), or (0,-6)

4. **$15.86**

5. **930**

6. **Each row and column and row must add to 15. Rows and columns could be interchanged.**

7. **44.4 years**

8. **Maria is 50 in. tall**

   Joe is 54 in. tall

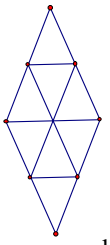
9. **1.2 cm**

10. **3/4**

2003 MCTM Elementary Mathematics Contest – Sample Test

6th Grade Concepts

1. How many triangles are in the following figure?



2. Apples cost more per pound than oranges. Grapefruit cost more per pound than oranges but less per pound than apples. Limes cost less than oranges. Pears cost more than grapefruit but less than apples. Which cost more – oranges or pears?

3. A couple would like to have three children. How many different possible orders of boys and/or girls could be born to this couple?

4. $\frac{1}{2}+\frac{1}{2^2}=\frac{3}{4}$

$\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}=\frac{7}{8}$

$\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+\frac{1}{2^4}=\frac{15}{16}$

What is the fractional answer for:

$\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+\frac{1}{2^4}+\frac{1}{2^5}+\frac{1}{2^6}+\frac{1}{2^7}+\frac{1}{2^8}$

5. How many square cm. (to the nearest tenth cm^2) are in the surface area of a cylindrical can 15 cm. tall with a radius of 6 cm.? (**Include the surface area of both the top and bottom. Use 3.14159 for pi**)

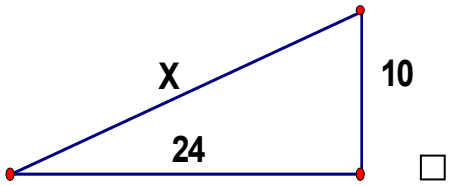
6. If $1/a^3$ and $1/b^2$ are two fractions, and *a* and *b* have no common factors, what would the least common denominator be?

7. What are the next two numbers in the following pattern? -2, 6, 4, 10, 14, 24, __, __.

8. A motorist drives through three sets of traffic lights every day. The probability that the motorist has to stop at the first set of lights is 0.4, at the second 0.6, and at the third, 0.63. Each set of lights is independent of the others. Calculate the probability that the motorist does **not** have to stop at any of the lights.

9. What time is the turkey done if it started to cook at 2:50 and it must cook $3\frac{1}{4}$ hours?

10. Find the length of the side marked X



KEY

Name **6th Grade Concepts**

1. **10**
2. **pears**
3. **8**
4. **255/256**
5. **791.7**
6. **a^3b^2 or a^3 times b^2**
7. **38, 62**
8. **8.88% or 0.0888**
9. **6:05**
10. **26**

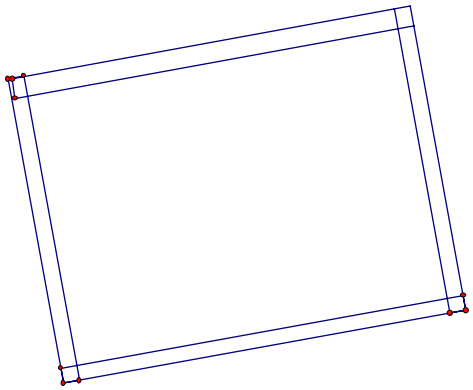
2003 MCTM Elementary Mathematics Contest – Sample Test

6th Grade Problem Solving

1. The minute hand of a clock is 7 cm long. To the nearest tenth of a centimeter, how far does the tip of the minute hand move in 25 minutes(**Use 3.14 for pi)**?

2. Arnold made a cereal display. There are three boxes in the top row. Each succeeding row has 3 more boxes than there are in the row above it. If the display has 8 rows, how many boxes of cereal did Arnold use?

3. Four strips of aluminum, each 50 inches long by 5 inches wide, are arranged in a square as shown in the figure below. How many square inches are in the area of the interior square opening ?



4. Aileen found more and more snails in her garden. On the first day, she found 9 snails. On the second day, she counted 17. On the third day, there were 24, 32 on the fourth day, and 39 on the fifth. On what day did she count more than 90 snails?

5. Led by Kobe Bryant and Shaquille O'Neal, the Los Angeles Lakers beat the Indiana Pacers in the 2000 NBA Finals. Kobe missed Game 3, but he made 31 field goals(2 points each), 2 three-pointers, and 10 free throws(1 point each) in the five games that he did play. How many points did he average per game for the games that he played, to the nearest tenth of a point?

6. Carpeting is on sale at the prices given below. Mrs. Doyle wants to carpet her living room which is 4 m by 5 m, How much will it cost at these prices?

   CARPET SALE
   Regular $9.99 per square meter
   On Sale at 20% OFF

7. Jenny is 60 inches tall. That is 10 inches taller than Maria. The difference between Joe's height and Jenny's height is 2 inches more than between Joe's and Maria's height. How tall are Maria and Joe?

8. A man bought a horse for $60, sold it for $70, then bought it back for $80, and finally sold it for $90. How dollars did he make or lose on this series of transactions?

9. I have four card tables that seat four people, one on each side. If I decide to group the tables to form one large group, how many different ways can the tables be arranged? (**All tables must share at least one side. Sharing only a corner is not allowed. Turns and flips are <u>not</u> different arrangements**.)

10. A man divides his cattle among his four sons so that the oldest get ½ the herd, the next son gets ¼ of the herd, the next 1/5 of the herd and the youngest son the remaining 20 cows. How many cattle are in the herd?

KEY

Name **6th Grade Problem Solving**

1. **18.3** _____
2. **108** _____
3. **1600** _____
4. **the 12th day** _____
5. **15.6** _____
6. **$159.84** _____
7. **Maria is 50 in. tall**

   Joe is 54 in. tall

   _____
8. **Made $20** _____
9. **5** _____
10. **400** _____