MATHEMATICS (updated 5/7/08)

Director's Comments

I make every attempt to minimize errors on the keys and make sure that the problems are valid, workable, and the correct answer is available. However, with all of my efforts and the efforts of the person(s) who proofs the tests, ERRORS HAPPEN. I will try to post any corrections to the current years tests and any comments pertaining to errors or problem statements in the sections below. If any one knows of any errors or thinks there are errors please email me so I can address them. If a constructive comment on a particular problem is sent to me I will address it and other items in the "Off on a Tangent" section below. Your report of errors and constructive comments will assist me in making the tests better.

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UIL Test Comments — 2008

SAC - - - > #9 should be 180 degrees
#25, 26, & 27 are samples of new questions (see Off on a Tangent below)
*** special note on rewording the "angle of rotation" problems -- see below ***

A - - - > #14 answers (B) or (E) are acceptable (see Off on a Tangent below)
#38 answers (A) or (E) are acceptable (see Off on a Tangent below)

B - - - > #11 should be (C) line

District 1 - - - > #20 should be (B)

District 2 - - - > #22 should be (D)

Regional - - - > #21 -- No error was reported at test time, however a second answer was sent in as being possible. (see Off on a Tangent below)
#35 -- No error was reported at test time, however a big debate has surfaced concerning answers (A), (B), & (C). (see Off on a Tangent below)

State - - - > #12 & #45 -- No errors were reported at test time, however some interesting issues surfaced the following day. (see Off on a Tangent below)

TMSCA Test Comments — 2008 (tests I wrote for TMSCA)

 # 6 - - - > No errors reported
*** special note on rewording the "angle of rotation" problems - see below ***

 # 12 - - - > #27 is an invalid problem. If you do the computation, y will be .5 +2.5i, however y^2 does not equal 1 - i. Nor does y^3 equal 3 + 2i.
#44 has a typo. The first line should say lap 1 not lap 2.
#48 has a typo. Two answers (A & D) are the same. Answer D was supposed to be 2sqrt(5)/3.
#51 has a technical issue. The equal areas of the sectors of spinner I are implied but not stated as such, as are the sectors of spinner II and the sectors of spinner III.

State - - - > #39 had an extraneous "*" by one of the answer choices. Delete the "*". Other than that the problem and answer are both valid and correct.
#59 should be answer (D) 7%.

Canton Test Comments — 2008 (tests I wrote for Canton)

Fall Invitational - - - > #6 had an error in the quadratic. It should have been 4x^2 + 20x +25.

Spring Invitational - - - > No errors reported

Off on a Tangent

Article 1. NEW QUESTIONS FOR THIS YEAR'S MATHEMATICS CONTEST

Earlier this summer I was thinking about some things I wanted to share at this year's Student Activity Conferences (SAC). I shared the following information with those who attended one of the SACs this fall. If you were unable to attend you will find this information helpful to you. You will see some new questions on the mathematics contests this year. Here are the areas and limitations I will be using to create the new questions.

1) **Mathematicians**: I will be asking general questions about the mathematicians and their contributions to mathematics. I have limited this year's group to the following 15 people:
Agnesi; Archimedes; Boole, George; Byron, Ada (Lady Lovelace); Descartes, Rene; Diophantus; Erastosthenes; Euclid; Euler, Leonard; Germain, Sophie; Hypatia; Kovalevsky, Sonya; Napier, John; Ptolemy, Claudius; Venn, John.
2) **Vectors**: The questions in this area will include magnitude, length, norm, direction, addition, subtraction, scalar multiplication, dot products, cross products, component vectors, parallel vectors, perpendicular vectors, normal vector, null vector, pseudo-vector and unit vector.
3) **Permutations/Combinations:** The questions in this area will include with/without replacement and with/without repetition.
4) **The quadratic equation $Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$**: The questions in this area will include graph identification, the angle of rotation about the origin given the equation and/or its parent equation, and the rotation of points about the origin.

***** special note on rewording the "angle of rotation" problems *****
I have not been real happy with my original wording of this problem:
Let 5x^2 + 8xy + 3y^2 + 4 = 0. What is the angle of rotation from it's parent function?
So, you will see a change in the wording beginning with the TMSCA State meet test.
Tests you will see prior to the TMSCA State test are already complete and will contain the original wording. The new wording will be:
Find the angle of rotation, theta (nearest degree), where 0 < theta < 90 degrees, such that the conic 5x^2 + 8xy + 3y^2 + 4 = 0 contains no xy term in its equation.

UIL Test A 2008

#14 created some great discussion and led to the re-wording of future test problems. (See "special note" above) If anyone finds any arguments to the following two case, feel free to contact me for further discussion.
Case I -- 150 degrees (could have been -30 degrees as well)
This answer works in the formula for finding the angle of rotation from its standard equation that contains no xy term. The standard equation becomes 3x^2 - y^2 = 2, which is a hyperbola symmetric about the x-axis.

Case II -- 60 degrees
This answer also works in the formula for finding the angle of rotation from its standard equation that contains no xy term. The standard equation becomes x^2 - 3y^2 = - 2, which is a hyperbola symmetric about the y-axis.

#38 has two answers that can be justified as being correct. Ada Byron (Lady Lovelace) is considered to be the first computer programmer because of the work she did with Babbage's machine. Since programming is a major part of computer science, it would be difficult to against her being one of the founders of the field of computer science. So, answer (A) could be a correct answer.
George Boole is considered as one of the founders of computer science, not only because of his Boolean Algebra, but because of his Boolean Logic.
So, answer (E) without a doubt would be a correct answer.

UIL Regional 2008

#21 had a correct answer (C) on the key, however a student sent in the possibility that Betty could make more than 3 obtuse triangles by adding two of the segments together to form one side. I went through all of the combinations if two sides were added together to create one side (i.e. 3+4, 5, 8 would give a triangle with side lengths of 5, 7, & 8.) Using this idea I came up with 8 different obtuse triangles. To avoid this issue I will change the future problems to read:
How many different obtuse triangles can she make using only 3 line segments at a time?

#35 -- Statement (B) is obviously a false statement. It was brought to my attention that statement (C) is a false statement as well. I agree. Statement (A) is where the debate occurred and is still be debated. It appears that some fell the function is continuous at 3 and others feel it is not. I believe the issues surrounding the debate involve continuity at a point, continuity on a closed interval, limit definitions, and cluster points. The discussion is still going on, so a decision concerning statement (A) has still not been decided.

UIL State 2008

#12 -- The polynomial given can be tested using Descartes Rule of Signs to determine that there can be 3 or 1 solutions, however the polynomial given be graphed on the graphing calculator which displays 1 solution only. The purpose of this problem was to have students use the Rule of Signs. Future problems like this one will contain some variable coefficients instead of all numeric coefficients. (i.e. x^4 + x^3 - px^2 + qx = 2, where p & q are positive numbers.)

#45 -- The sum of the four variables is **4 IF** the determinant of the left hand matrix is **1**, which was the intention of the problem. As it turns out, all of the answers are possible. One other quick sum would be **- 4 IF** the determinant of the left hand matrix is **-1**. Infinite sums can be found based on the determinant being a value other than -1 or 1. Future problems like this one will be addressed in various ways in order to remove multiple solutions.

Have a great summer. See you at one of the SACs

2008 SAC Dates

Sept. 20 – Tyler Junior College, Tyler
Oct. 4 – University of Texas, AUSTIN
Oct. 18 – West Texas A&M University, Canyon
Nov. 1 – A&M UNIVERSITY, Corpus Christi

Good Luck! Work Hard! Play Fair!

I am off on another tangent ...