**Summary**

This mock test is intended to help prepare students for the UIL Mathematics Contest, as well as for the types of questions appearing on the SAT, SAT Subject Tests in math, ACT, and other tests.

It covers algebra I and II, geometry, trigonometry, analysis, pre-calculus, elementary calculus, and more.

The answer key with complete explanations is included in the back.

**Timing and Scoring**

UIL mathematics competitions allow 40 minutes for 60 multiple-choice questions.

If you were to answer every question, you would have to do so in an average of 40 seconds each. Thus, you will not likely be able to answer all of the questions. You will almost certainly find that you score better when you "skip around" and answer the questions that you feel most confident about and that you know you can answer quickly.

UIL scoring awards 6 points for each correct answer, 0 points for blanks, and -2 points for incorrect answers. Thus, if you can narrow your answer down to 3 or fewer choices, you should guess. If you cannot narrow down an answer to 3 or fewer choices, leave that question blank. (If you don't understand why we're giving that advice, please review the topic of mathematical expectation!)

You must write your answers on the answer sheet provided, using capital letters. No points will be awarded for writing your answers as lowercase letters (really). We've included an answer sheet with this exam, and strongly suggest that you use it to get in the habit of entering answers on the sheet using capital letters only.

**Materials**

Bring your own writing implements to the competition. The contest director will provide you with scratch paper. You may also write on the test — for instance, to mark up a geometry diagram, or use process of elimination on the answer choices.

You may use a calculator (the rules allow "any commercially available silent hand-held calculators that do not require auxiliary electric power and as long as they are not modified"). You may also bring a spare calculator.

A clock should be visible, but you may also bring your own timing device. No oral warnings will be given before time runs out, so you may wish to bring a watch or timer to better manage the 40 minutes.

You may not use a cell phone, iPod, etc., as a calculator or timing device (or for any other reason). You may not use any device that will make noise.

Official rules (which may change, or may have changed since this writing) are online at:

http://www.uiltexas.org/academics/mathematics

**How to Study (and Win!)**

We suggest taking this mock test under conditions as close as possible to UIL testing conditions. Time the test for 40 minutes. Do not take breaks. Do not do anything you wouldn't be able to do during the real test (don't check your phone, sip an iced coffee, consult with another student, take the test on your bed wearing your pajamas, etc.).
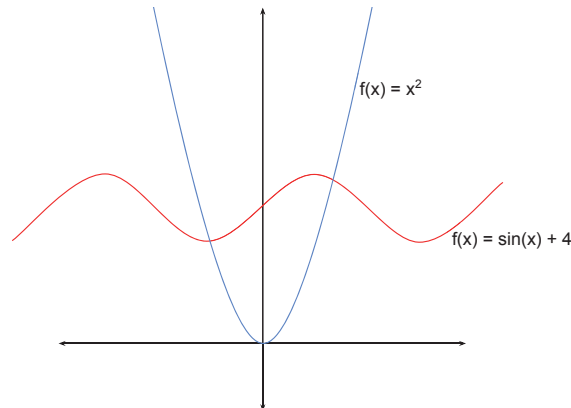
On your answer sheet, mark "g" next to any answer that's a guess, so you know to review those questions afterwards.

If you want to get hardcore about this (it's a competition, right?), use a lap timer to record how much time it takes you to answer each individual question. It's great to get a question right, but if it took you 4 minutes, that's way too slow for a UIL competition.

Once the 40 minutes are up, check the answer key and calculate your score (6 points for correct answers, 0 for blanks, -2 for incorrect answers.) Everyone wants to know their score, but just taking and scoring a test isn't going to help you improve. There's a lot more to do.

Next, go back and attempt the questions you were not able to answer during the 40-minute period. Record how much time it took to answer each of those questions.
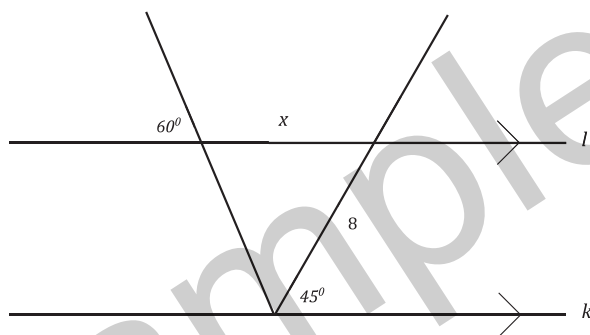
29. In the graph below, what best describes the area contained by the two functions in the interval between A and B?



f(x) = x²

f(x) = sin(x) + 4

A. $f(x) = sin(x) + 4 - x^2$   B. $f(x) = x^2 - sin(x) + 4$   C. $f(x) = x^2 - sin(x) - 4$   D. $f(x) = x^2$   E. $f(x) = -4x$

30. The angle of depression from the top of a straight, 60-meter-tall lighthouse to a boat on the ocean is 25. How far away is the boat?

A. 28 meters.   B. 54 meters.   C. 80 meters.   D. 112 meters.   E. 128 meters.

31. Max ran his favorite 3-mile trail at 7 mph and returned along the same route at 5 mph. What was his average speed for his entire run?

A. $\frac{35}{36}$ mph.   B. $\frac{36}{35}$ mph.   C. $\frac{35}{6}$ mph.   D. 6 mph.   E. $\frac{6}{7}$ mph.

32. The derivative of $f(x) = x^3 - 4x$ at the origin is -4. Which of these points does a line tangent to f(x) at the origin pass through?

A. (0, 4)   B. (-2, 4)   C. (-1, -4)   D. (1, 4)   E. (1, -4)

33. How many ways are there to form a committee of 3 seniors and 2 juniors from a class of 10 seniors and 12 juniors?

A. 720   B. 2,880   C. 7,920   D. 9,900   E. 95,040

34. Find the product of all the solutions of $8^{x^2+2x+1} = 32^{x^2-2}$

A. -6.5   B. -4   C. 0   D. 1   E. 3

35. In Mr. Freeman's class, everyone scored between 0 and 100, inclusive, and everyone has a different integer grade. The class average (arithmetic mean) is 88. If there are 6 students in the class, and if half of them scored above the class average, what is the lowest sum possible for the remaining grades?

A. 230   B. 231   C. 235   D. 242   E. 258

36. A pizza is cut into perfectly equal slices. After eating $\frac{1}{3}$ of this pizza, Davida gives away 2 slices. If $\frac{1}{3}$ of the pizza still remains, how much of the pizza is each slice?

A. $\frac{1}{10}$   B. $\frac{1}{8}$   C. $\frac{1}{6}$   D. $\frac{1}{4}$   E. $\frac{1}{3}$

37. Which of these mathematicians is thought to have written a treatise containing a doctrine on the golden mean?

A. Diophantus   B. Theano   C. Hypatia   D. Eratosthenes   E. Agnesi

38. Line $l_1$ passes through the points $(3, -2)$ and $(-3, -10)$. Line $l_2$ is perpendicular to $l_1$. Line $l_3$ is parallel to $l_2$. What is the slope of line $l_3$?

A. $-\frac{1}{2}$   B. $\frac{1}{2}$   C. $\frac{3}{4}$   D. $-\frac{3}{4}$   E. $\frac{4}{5}$

# 1 Problems

1. Find k when $3 \times (-6) - 2 \div (k - 7) + 23 = 3$

   A. $\frac{-9}{5}$   B. $\frac{26}{5}$   C. $\frac{41}{5}$   D. $\frac{44}{5}$   E. 8

2. Given the arithmetic sequence $a, 22, b, c, d, -2$, find $(a \times b) - (c \times d)$.

   A. $-256$   B. $-24$   C. 216   D. 408   E. 512

3. How many ways can the characters in the password TEXAS2014 be reordered so that the word "TEXAS" appears at either the beginning or the end of the new password?

   A. 24   B. 48   C. 2,880   D. 362,880   E. 725,760

4. What is the positive difference between the minimum possible number of intersections of 6 noncongruent straight lines in a plane and the maximum number of intersections of 6 noncongruent straight lines in a plane?

   A. 14   B. 15   C. 35   D. 36   E. 120
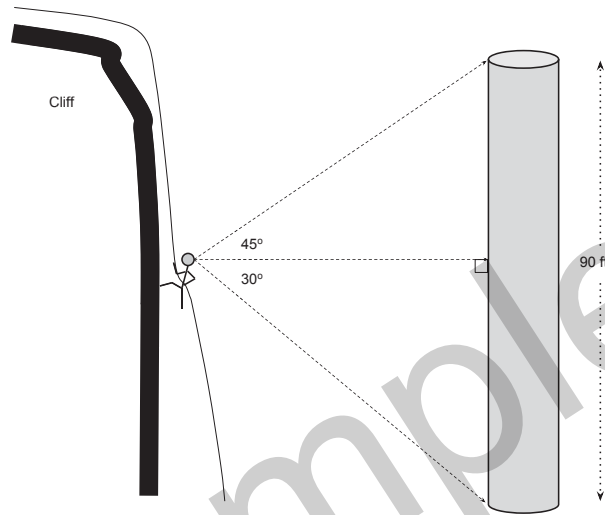
5. Given parallel lines $l$ and $k$:



   What is the length of $x$?

   A. 5.21   B. 5.62   C. 6.93   D. 7.65   E. 8.92

6. Romeo and Juliet are 1,400 meters apart. Romeo runs at 1 meter per second and Juliet runs at 0.75 meters per second. Romeo and Juliet begin running towards each other at the same time. When they meet, they embrace for 30 seconds. If they then continue running in opposite directions, how long will it have taken, in minutes and seconds, from their starting time until they are once again 1,400 meters apart?

   A. 13 minutes, 20 seconds   B. 13 minutes, 50 seconds   C. 26 minutes, 40 seconds   D. 27 minutes, 10 seconds   E. 28 minutes, 30 seconds

7. Mariposa makes $4,200 every month and spends $840 on continuing education. If she made a pie chart of her monthly spending and saving (in which 100% = $4,200), what would be the central angle of the sector of the pie slice representing continuing education?

   A. 20°   B. 36°   C. 72°   D. 84°   E. 200°

8. What is $1.\overline{01} - 0.\overline{10}$?

   A. 0.9   B. $0.\overline{90}$   C. 0.91   D. $0.\overline{91}$   E. $0.\overline{9091}$
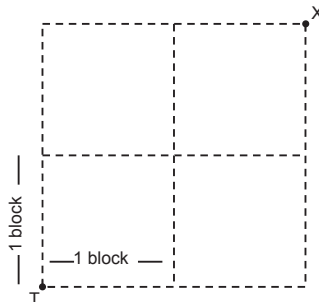
# 1   Problems

1. $1 \div 3 \left(-4-6\right) - \left|(-2)^3 - 6\right| \times 3 =$

   A. -140    B. -20    C. $-\frac{1}{72}$    D. 24    E. 66

2. Find the center of the circle $x^2 + 6y + y^2 - 6x = -3$:

   A. (3, -3)    B. (-3, 3)    C. (6, -6)    D. (-6, 6)    E. (-3, -6)

3. Jonathan is rappelling off a cliff and sights an enemy fort whose top is at an angle of elevation of 45° and whose base is sighted at an angle of depression of 30°. His position on the cliff is exactly level with the midpoint of the fortress.



   If he knows from previous intel that the fort is 90 feet high, how far (in feet?) must he hike across flat land to reach the enemy base?

   A. 48 feet    B. 52 feet    C. 66 feet    D. 78 feet    E. 85 feet

4. A mutant turtle hero in Midtown Manhattan must travel along NYC uptown and crosstown blocks to stop a certain crime occurring at point X. How many 4-block paths are there from the turtle hero to X



   A. 4    B. 5    C. 6    D. 7    E. 8