

Shawnee State University S.U.M.S May 9th 2025

Individual Mathematics Competition Test Instructions

Name: _____ School: _____

1. Silence and put away your cell phone.
2. Make sure to print your name and school at the top of this page.
3. Calculators are allowed but are not necessary.
4. All your work on a problem should be in the space provided below the problem on the exam. You may turn in work on additional paper provide you indicate your name and the problem your work is for.
5. Any work on scrap paper that is not to be considered in scoring should be discarded.
6. Show your supporting work, indicating as to how you arrived at your solution. Proper communication of mathematical results counts; clarity is important.
7. Give exact values for your answers. For example, $\sqrt{3}$ is an exact answer. 1.732 is an approximation of $\sqrt{3}$ not an exact value. 1.732050808 is better approximation (more precise) but is still not an exact value.

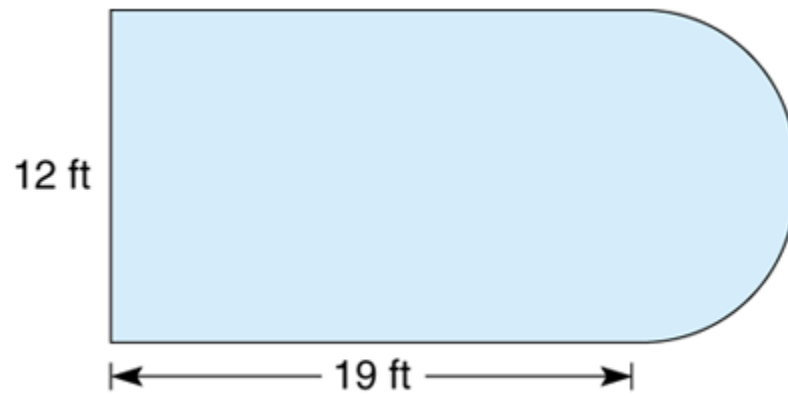
1. Algebraically find all x -intercepts of $y = 2 \sin x + 2 \cos x - \sqrt{6}$

2. If $\tan \theta = \frac{7}{5}$ and θ is in quadrant III, find $\sec \theta$.

3. A six-sided die is rolled seven times.
Find the probability of getting exactly two fours.

4. Al and Bob are two of 10 people who will be seated in a row of 10 chairs. How many possible seatings of the 10 people have Al and Bob seated next to each other.

5. The dimensions of a figure are shown below where the curve at the right is a semicircle. Find the perimeter of this figure. Give the exact answer.

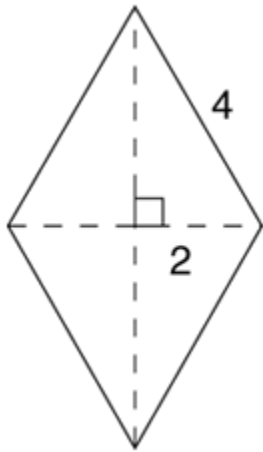


6. Ashley flips a coin 3 times. Later all he can remember is that 2 of the 3 flips were heads. He does not remember the outcome of the other flip. What is the probability that all 3 flips were heads?

7. The product of 2 numbers is 736. The sum of the 2 numbers is 55. Find the 2 numbers.

8. Cans of soda pop are typically sold in rectangular boxes containing 6 cans. If a can of soda pop has a diameter of 2.6 inches (or 6.62 cm) and a height of 4.8 inches (or 12.2 cm) and the 6 cans (arranged in 2 rows and 3 columns) fit exactly into the box so that they touch the sides, top, and bottom of the box, how many cubic inches (or cm) of space in the box is not occupied by cans? Round your final answer to 3 decimal places.

9. Given the following rhombus and using the fact that diagonals of a rhombus are perpendicular and bisect each other, find the exact area of the rhombus.



10. One cube has a side with a length of 2 m and another cube has a side with a length of 3 m. What is the ratio of the smaller cube's height to the larger cube's height? What is the ratio of the smaller cube's surface area to the larger cube's surface area? What is the ratio of the smaller cube's volume to the larger cube's volume? In each case, are the units needed? Why or why not?