

**CIPHERING PROBLEMS**  
**HIGH SCHOOL MATHEMATICS TOURNAMENT**  
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1. Find the set of all numbers satisfying the inequality  $x^2 - 7x > -6$ . Express your answer using either set notation or interval notation.
2. Solve the following equation for  $x$ :  $\log_2 x + \log_2(x + 6) = 4$ .
3. If  $\sin \alpha = \frac{3}{5}$  and  $\cos \alpha < 0$ , what is  $\sin 2\alpha$ ?
4. The width of a rectangle is one foot more than its height. Determine the perimeter of the rectangle, in feet, if its area is one square foot.
5. If the radius of a right circular cylinder is increased by 50% and the height remains constant, what is the corresponding percent increase in the volume of the cylinder?
6. For the function  $f(x) = ax^2 + bx + c$ , where  $f(0) = 1$ ,  $f(1) = 3$ , and  $f(2) = 2$ , what is  $a$ ?
7. An equilateral triangle is inscribed in a circle with a radius of 2 inches. Determine the length, in inches, of each of the edges of the equilateral triangle.
8. The mean score on a test is 75. A grading error is discovered on one student's test, and that student's score is increased by 10 points. If the revised mean is 75.4, how many students took the test?
9. Three boxes each contain the integers 0,1,2,...,9. One number is randomly drawn from each box. What is the probability that precisely 2 of these numbers will be the same? Express your answer as a simplified fraction.
10. A coin is rolled without slipping along the outer edge of a rectangle until it returns to its initial position. The coin is constrained to move in the plane containing the rectangle. If the width of the rectangle is twice the circumference of the coin and its length is twice its width, how many revolutions will the coin make?
11. For the function  $f(x) = x^4 + ax^3 + bx^2 + cx + 2$ , where  $-1$  is a triple root of  $f(x)$ , what is  $a$ ?
12. A time trial for a car race consists of two laps around a race track. Driver 8 averages 180 miles per hour on the first lap, but, due to mechanical difficulties, only 120 miles per hour on the second lap. What is Driver 8's average speed for the time trial in miles per hour?