Directions: If units are appropriate include them in your answer.

1. Express \( \frac{2^{12} - 2^{10}}{8^{(14/3)}} \) as a rational number in lowest terms.

2. Solve for \( x \): \( 4^x + 4^{x+1} = 160 \).

3. A shepherd loses two-thirds of his flock and then finds four-fifths of these. What fraction of the flock does he have left?

4. How many prime numbers have the property that the sum of their digits is 4 and none of their digits is 0? (Example: 13)

5. For nonzero real numbers \( a \) and \( b \) define \( a \oplus b = \frac{1}{a} + \frac{1}{b} \). Find all values of \( c \) such that \( (1 \oplus 2) \oplus c = 1 \oplus (2 \oplus c) \).

6. A player plays a game in which two regular six-sided dice are rolled. The player wins if the product of the two numbers rolled is either odd or a multiple of 5. What is the probability that the player wins?

7. The base 3 representation of the integer \( n \) is 2212112. What is the base 9 representation of \( n \)?

8. The distribution of the 37 test scores in a math class is given in the stem and leaf plot where, for example, 5 | 6 represents a score of 56, etc. What percentage of the scores are at most 5 points from the value of the median score? Express your answer to the nearest whole number.

**Test Scores**

<table>
<thead>
<tr>
<th>5</th>
<th>8 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0 2 2 5 5 8 8</td>
</tr>
<tr>
<td>7</td>
<td>0 1 2 2 3 5 5 5 6 8</td>
</tr>
<tr>
<td>8</td>
<td>1 3 5 5 6 8 8 9 9</td>
</tr>
<tr>
<td>9</td>
<td>0 1 2 3 8 8 9 9</td>
</tr>
</tbody>
</table>
9. The sum of the perimeters of two equilateral triangles is 45 inches, and the area of the larger one is 16 times the area of the smaller one. What is the area, in square inches, of the larger triangle? Express your answer in simplest radical form.

10. How many subsets of \{1, 2, 3, 4, 5, 6, 7\} have either 4 or 6 as their largest element?

11. What is the greatest common divisor of 400,000 and 20!, where 20! = (20)(19) \cdots (2)(1) ?

12. Find all ordered pairs of positive integers \((x, y)\) that satisfy the equation \(\frac{1}{x} + \frac{1}{y} = \frac{1}{7}\). Write your answer as a list of ordered pairs.

13. Given that \(m = \sqrt{x + 43}, n = \sqrt{x + 16}\) and \(x\) are positive integers, what is the value of the product \(mn\)?

14. The rectangle ABCD has points W,X,Y and Z on sides AB, BC, CD and DA respectively so that AW=\(\frac{1}{2}\)AB , BX=\(\frac{1}{2}\)BC , CY=\(\frac{1}{3}\)CD and AZ=\(\frac{1}{4}\)DA. Find the ratio of the area of quadrilateral WXYZ to that of the area of rectangle ABCD.

15. How many different finite sequences (of one or more terms) of consecutive integers (positive, negative or 0) have a sum of 105?

16. A pigeon can fly at a constant speed of 25 miles per hour in a wind-free environment. What is the pigeon’s average speed on a round trip where it faces a 5 mile per hour headwind on the way out and a 5 mile per hour tailwind on the return leg?

17. What is the smallest real number \(k\) whose distance from \(-1\) is equal to twice its distance from \(3\)?
18. As shown in the diagram, region R in the plane has vertices (0, 0), (0, 5), (4, 5), (4, 1), (10, 1) and (10, 0). Find $m$ such that the line $y = mx$ partitions R into two subregions of equal area.

19. If 80 is divided by the positive integer $n$, the remainder is 4. What is the remainder when 154 is divided by $n$?

20. For each real number $x$, let $g(x)$ be the minimum value of the numbers $4x + 2, x + 3, -2x + 5$. (For example if $x = 2$ then the three numbers are 10, 5, 1, so $g(2) = 1$.) Find the maximum value of $g(x)$.

21. Find the area of the quadrilateral pictured.