Mu Alpha Theta National Convention: Denver, 2001

Ciphering – Euclidean Division

0. Two towers, A and B, are 100 meters apart on a flat field. Tower A is fifty meters tall, and from its top, one must look up at 60° above horizontal to see the top of tower B. What is the height of tower B, in meters? Note that the towers are perpendicular to the level ground.

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1. How many natural numbers less than 200 have exactly three positive integral factors?

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2. What is the product of the roots of $x^2 - 15x + 32 = 0$?

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3. How many of the listed numbers are divisible by 6?

I. 248
II. 1497
III. 28974
IV. 7822
V. 5439
VI. 91272

4. At what point does the line containing the points $(3, 8)$ and $(-2, 68)$ cross the x-axis?

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5. What is the greatest common factor of 252 and 426?

6. A cube has a surface area of 486 square centimeters. What is the volume of the cube, in cubic centimeters?

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7. Seventy percent of the students in a certain math class are girls. The average grade for a boy in the class is forty percent, but the average grade for a girl in the class is eighty percent. What is the average grade for the class as a whole, to the nearest percent?

8. Solve the system of equations for the value of y.

$$2x - 3y = -16$$
$$3x - y = -17$$

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9. What is the sum of all the integer multiples of three between 100 and 200?

10. What is the length, in meters, of a side of an equilateral triangle, the area of which is $24\sqrt{3}$ square meters?

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11. What is the value of the fifth term of a geometric sequence whose first term is $\frac{5}{6}$ and whose second term is $\frac{15}{2}$?

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12. Evaluate: $\dfrac{\frac{3}{4}-\frac{2}{5}}{\frac{1}{6}+\frac{1}{4}}$

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13. A bag contains four camel-colored marbles and three eggshell-colored marbles. What is the probability that when three marbles are simultaneously drawn from this bag, they are all the same color?

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14. What is the sum of all the natural numbers less than 100 that are not divisible by 5?

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15. A right circular cone with base radius 6 centimeters and height 12 centimeters is cut by a plane parallel to the base and 6 centimeters from it. The cone-shaped portion is removed, leaving a truncated cone. What is the volume of this truncated cone, in cubic centimeters?

16. Five students take a test on which scores are integers from 0 to 100, inclusive, getting scores of 62, 40, 47, 28, and 43. If two more students take the test the next day, what is the largest amount by which the mean of the scores could change?

17. Determine the sum of the first eight terms of the geometric sequence with first term 1 and common ratio 3.