



Directions: *No calculators or reference materials are permitted. You may use a pencil, an eraser and your examination paper as scratch paper. Additional pencils and scratch paper will be provided if you raise your hand. There is no partial credit for this exam.*

1. Compute the sum of the prime factors of $2^{16} - 1$.

ANS: 282.

2. Joe has quarters, dimes and nickels worth \$96.15. He has five times as many dimes as quarters and three more nickels than dimes. How many quarters, dimes, and nickels does Joe have?

ANS: 96 quarters, 480 dimes and 483 nickels.

3. Find the missing value of A , B , and C , where $A > B > C$, in the following subtraction problem.

$$ABC - CBA = CAB$$

ANS: $A = 9, B = 5, C = 4$

4. Four circles with unit radii are arranged in a "square" and enclosed in a shortest possible perimeter. The circles are then arranged in a "parallelogram." What is the difference in perimeters of these arrangements?

ANS: 0 units.

5. The center of a circle of radius $\sqrt{2}$ lies on the circumference of a circle of radius 1. Find the area of the smaller lune formed by the two circles.

ANS: 1

6. When m numbers are inserted between 5 and 45, they form an arithmetic sequence with a common difference d . Find d in terms of m .

ANS: $d = \frac{40}{m+1}$

7. Find the value in base five of $423_5 + 304_5 + 241_5 + 342_5$.

ANS: 2420_5

8. Three cubes of volume 1, 8, and 27 are glued together at their faces. What is the smallest possible area of the resulting configuration?

ANS: 72 square units.