**In Class Problems**

**Class 1**

**Easy**

1.The sum of two prime numbers is 85. What is the product of these two prime numbers?

$\textbf{(A) }85\qquad\textbf{(B) }91\qquad\textbf{(C) }115\qquad\textbf{(D) }133\qquad \textbf{(E) }166$

2.Eleven members of the Middle School Math Club each paid the same amount for a guest speaker to talk about problem solving at their math club meeting. They paid their guest speaker $\textdollar\underline{1}\underline{A}\underline{2}$. What is the missing digit A of this 3-digit number?

$\textbf{(A) }0\qquad\textbf{(B) }1\qquad\textbf{(C) }2\qquad\textbf{(D) }3\qquad\textbf{(E) }4$

3.The first AMC 8 was given in 1985 and it has been given annually since that time. Samantha turned 12 years old the year that she took the seventh AMC 8. In what year was Samantha born?

$\textbf{(A) }1979\qquad\textbf{(B) }1980\qquad\textbf{(C) }1981\qquad\textbf{(D) }1982\qquad \textbf{(E) }1983$

**Medium**

4.Which of the following integers cannot be written as the sum of four consecutive odd integers?

$\textbf{(A)}\text{ 16}\qquad\textbf{(B)}\text{ 40}\qquad\textbf{(C)}\text{ 72}\qquad\textbf{(D)}\text{ 100}\qquad\textbf{(E)}\text{ 200}$

5.If $n$ and $m$ are integers and $n^2+m^2$ is even, which of the following is impossible?

$\textbf{(A) }n$ and $m$ are even $\qquad\textbf{(B) }n$ and $m$ are odd $\qquad\textbf{(C) }n+m$ is even $\qquad\textbf{(D) }n+m$is odd $\qquad \textbf{(E) }$ none of these are impossible

6.What is the ratio of the least common multiple of 180 and 594 to the greatest common factor of 180 and 594?

$\textbf{(A)}\ 110 \qquad \textbf{(B)}\ 165 \qquad \textbf{(C)}\ 330 \qquad \textbf{(D)}\ 625 \qquad \textbf{(E)}\ 660$

7.Each of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 is used only once to make two five-digit numbers so that they have the largest possible sum. Which of the following could be one of the numbers?

$\textbf{(A)}\hspace{.05in}76531\qquad\textbf{(B)}\hspace{.05in}86724\qquad\textbf{(C)}\hspace{.05in}87431\qquad\textbf{(D)}\hspace{.05in}96240\qquad\textbf{(E)}\hspace{.05in}97403$

8.How many digits are in the product $4^5 \cdot 5^{10}$?

$\textbf{(A) } 8 \qquad\textbf{(B) } 9 \qquad\textbf{(C) } 10 \qquad\textbf{(D) } 11 \qquad\textbf{(E) } 12$

**Hard**

9.A baseball league consists of two four-team divisions. Each team plays every other team in its division $N$ games. Each team plays every team in the other division $M$ games with $N>2M$and $M>4$. Each team plays a $76$-game schedule. How many games does a team play within its own division?

$\textbf{(A) } 36 \qquad \textbf{(B) } 48 \qquad \textbf{(C) } 54 \qquad \textbf{(D) } 60 \qquad \textbf{(E) } 72$

10.Let $z$ be whole numbers. If $2^w \cdot 3^x \cdot 5^y \cdot 7^z = 588$, then what does $2w + 3x + 5y + 7z$equal?

$\textbf{(A) } 21\qquad\textbf{(B) }25\qquad\textbf{(C) }27\qquad\textbf{(D) }35\qquad\textbf{(E) }56$

11.What is the **tens** digit of $7^{2011}$?

$\textbf{(A) }0\qquad\textbf{(B) }1\qquad\textbf{(C) }3\qquad\textbf{(D) }4\qquad\textbf{(E) }7$

12.What is the smallest positive integer that is neither prime nor square and that has no prime factor less than 50?

$\textbf{(A)}\hspace{.05in}3127\qquad\textbf{(B)}\hspace{.05in}3133\qquad\textbf{(C)}\hspace{.05in}3137\qquad\textbf{(D)}\hspace{.05in}3139\qquad\textbf{(E)}\hspace{.05in}3149$

13.The 7-digit numbers $\underline{7} \underline{4} \underline{A} \underline{5} \underline{2} \underline{B} \underline{1}$ and $\underline{3} \underline{2} \underline{6} \underline{A} \underline{B} \underline{4} \underline{C}$ are each multiples of 3. Which of the following could be the value of $C$?

$\textbf{(A) }1\qquad\textbf{(B) }2\qquad\textbf{(C) }3\qquad\textbf{(D) }5\qquad\textbf{(E) }8$

1. **E**
2. **D**
3. **A**
4. **D**
5. **D**
6. **C**
7. **C**
8. **D**
9. **B**
10. **A**
11. **D**
12. **A**
13. **A**

**Class 2**

**Easy**

1.A sequence of numbers starts with $1$, $2$, and $3$. The fourth number of the sequence is the sum of the previous three numbers in the sequence: $1+2+3=6$. In the same way, every number after the fourth is the sum of the previous three numbers. What is the eighth number in the sequence?

$\textbf{(A)}\ 11\qquad\textbf{(B)}\ 20\qquad\textbf{(C)}\ 37\qquad\textbf{(D)}\ 68\qquad\textbf{(E)}\ 99$

2.The ten-letter code $\text{BEST OF LUCK}$ represents the ten digits $0-9$, in order. What 4-digit number is represented by the code word $\text{CLUE}$?

$\textbf{(A)}\ 8671 \qquad \textbf{(B)}\ 8672 \qquad \textbf{(C)}\ 9781 \qquad \textbf{(D)}\ 9782 \qquad \textbf{(E)}\ 9872$

3.Barney Schwinn notices that the odometer on his bicycle reads $1441$, a palindrome, because it reads the same forward and backward. After riding $4$ more hours that day and $6$ the next, he notices that the odometer shows another palindrome, $1661$. What was his average speed in miles per hour?

$\textbf{(A)}\ 15\qquad \textbf{(B)}\ 16\qquad \textbf{(C)}\ 18\qquad \textbf{(D)}\ 20\qquad \textbf{(E)}\ 22$

4.What is the sum of the two smallest prime factors of $250$?

$\mathrm{(A)}\ 2 \qquad\mathrm{(B)}\ 5 \qquad\mathrm{(C)}\ 7 \qquad\mathrm{(D)}\ 10 \qquad\mathrm{(E)}\ 12$

**Medium**

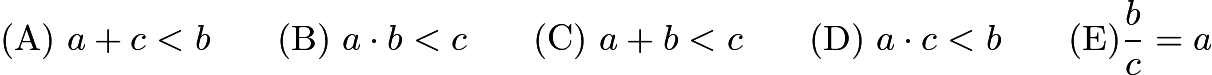
5.What is the sum of the prime factors of $2010$?

$\textbf{(A)}\ 67 \qquad\textbf{(B)}\ 75\qquad\textbf{(C)}\ 77\qquad\textbf{(D)}\ 201\qquad\textbf{(E)}\ 210$

6.For any positive integer $n$, define $\boxed{n}$ to be the sum of the positive factors of $n$. For example, $\boxed{6} = 1 + 2 + 3 + 6 = 12$. Find  .

$\mathrm{(A)}\ 13 \qquad \mathrm{(B)}\ 20 \qquad \mathrm{(C)}\ 24 \qquad \mathrm{(D)}\ 28 \qquad \mathrm{(E)}\ 30$

7.Let $a, b$ and $c$ be numbers with $0 < a < b < c$. Which of the following is impossible?



8.The positive integers $x$ and $y$ are the two smallest positive integers for which the product of $360$and $x$ is a square and the product of $360$ and $y$ is a cube. What is the sum of $x$ and $y$?

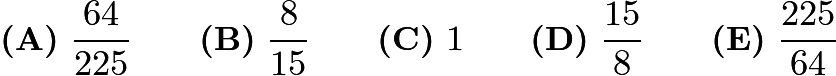
$\textbf{(A)}\ 80\qquad\textbf{(B)}\ 85\qquad\textbf{(C)}\ 115\qquad\textbf{(D)}\ 165\qquad\textbf{(E)}\ 610$

**Hard**

9.The hundreds digit of a three-digit number is $2$ more than the units digit. The digits of the three-digit number are reversed, and the result is subtracted from the original three-digit number. What is the units digit of the result?

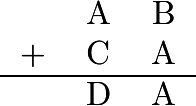
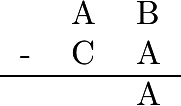
$\textbf{(A)}\ 0 \qquad\textbf{(B)}\ 2\qquad\textbf{(C)}\ 4\qquad\textbf{(D)}\ 6\qquad\textbf{(E)}\ 8$

10.Andy and Bethany have a rectangular array of numbers with $40$ rows and $75$ columns. Andy adds the numbers in each row. The average of his $40$ sums is $A$. Bethany adds the numbers in each column. The average of her $75$ sums is $B$. What is the value of $\frac{A}{B}$?



11.How many whole numbers between 1 and 1000 do not contain the digit 1?

$\textbf{(A)}\ 512\qquad\textbf{(B)}\ 648\qquad\textbf{(C)}\ 720\qquad\textbf{(D)}\ 728\qquad\textbf{(E)}\ 800$

12.The letters $A$, $B$, $C$ and $D$ represent digits. If  and , what digit does $D$ represent?

$\textbf{(A)}\ 5\qquad\textbf{(B)}\ 6\qquad\textbf{(C)}\ 7\qquad\textbf{(D)}\ 8\qquad\textbf{(E)}\ 9$

13.What is the correct ordering of the three numbers, $10^8$, $5^{12}$, and $2^{24}$?

$\textbf{(A)}\ 2{}^2{}^4<10^8<5{}^1{}^2$

$\textbf{(B)}\ 2{}^2{}^4<5{}^1{}^2<10^8$

$\textbf{(C)}\ 5{}^1{}^2<2{}^2{}^4<10^8$

$\textbf{(D)}\ 10^8<5{}^1{}^2<2{}^2{}^4$

$\textbf{(E)}\ 10^8<2{}^2{}^4<5{}^1{}^2$

1. **D**
2. **A**
3. **E**
4. **C**
5. **C**
6. **D**
7. **A**
8. **B**
9. **E**
10. **D**
11. **D**
12. **E**
13. **A**

**Homework Problems**

**Easy**

1.Find the number of two-digit positive integers whose digits total $7$.

$\textbf{(A)}\ 6 \qquad\textbf{(B)}\ 7 \qquad\textbf{(C)}\ 8 \qquad\textbf{(D)}\ 9 \qquad\textbf{(E)}\ 10$

2.Aunt Anna is $42$ years old. Caitlin is $5$ years younger than Brianna, and Brianna is half as old as Aunt Anna. How old is Caitlin?

$\text{(A)}\ 15 \qquad \text{(B)}\ 16 \qquad \text{(C)}\ 17 \qquad \text{(D)}\ 21 \qquad \text{(E)}\ 37$

3.Which of these numbers is less than its reciprocal?

$\text{(A)}\ -2 \qquad \text{(B)}\ -1 \qquad \text{(C)}\ 0 \qquad \text{(D)}\ 1 \qquad \text{(E)}\ 2$

4.How many whole numbers lie in the interval between $\frac{5}{3}$ and $2\pi?$

$\text{(A)}\ 2 \qquad \text{(B)}\ 3 \qquad \text{(C)}\ 4 \qquad \text{(D)}\ 5 \qquad \text{(E)}\ \text{infinitely many}$

5.Which of the following numbers has the smallest prime factor?

$\mathrm{(A)}\ 55 \qquad\mathrm{(B)}\ 57 \qquad\mathrm{(C)}\ 58 \qquad\mathrm{(D)}\ 59 \qquad\mathrm{(E)}\ 61$

6.What is the smallest possible average of four distinct positive even integers?

$\text{(A)}\ 3 \qquad \text{(B)}\ 4 \qquad \text{(C)}\ 5 \qquad \text{(D)}\ 6 \qquad \text{(E)}\ 7$

7.The year 2002 is a palindrome (a number that reads the same from left to right as it does from right to left). What is the product of the digits of the next year after 2002 that is a palindrome?

$\text{(A)}\ 0 \qquad \text{(B)}\ 4 \qquad \text{(C)}\ 9 \qquad \text{(D)}\ 16 \qquad \text{(E)}\ 25$

8.I'm thinking of two whole numbers. Their product is 24 and their sum is 11. What is the larger number?

$\text{(A)}\ 3 \qquad \text{(B)}\ 4 \qquad \text{(C)}\ 6 \qquad \text{(D)}\ 8 \qquad \text{(E)}\ 12$

9.The digits 1, 2, 3, 4 and 9 are each used once to form the smallest possible **even** five-digit number. The digit in the tens place is

$\text{(A)}\ 1 \qquad \text{(B)}\ 2 \qquad \text{(C)}\ 3 \qquad \text{(D)}\ 4 \qquad \text{(E)}\ 9$

10.$(6?3) + 4 - (2 - 1) = 5.$ To make this statement true, the question mark between the 6 and the 3 should be replaced by

$\text{(A)} \div \qquad \text{(B)}\ \times \qquad \text{(C)} + \qquad \text{(D)}\ - \qquad \text{(E)}\ \text{None of these}$

11.Which triplet of numbers has a sum NOT equal to 1?

$\text{(A)}\ (1/2,1/3,1/6) \qquad \text{(B)}\ (2,-2,1) \qquad \text{(C)}\ (0.1,0.3,0.6) \qquad \text{(D)}\ (1.1,-2.1,1.0) \qquad \text{(E)}\ (-3/2,-5/2,5)$

12.The ratio of the number of games won to the number of games lost (no ties) by the Middle School Middies is $11/4$. To the nearest whole percent, what percent of its games did the team lose?

$\text{(A)}\ 24 \qquad \text{(B)}\ 27 \qquad \text{(C)}\ 36 \qquad \text{(D)}\ 45 \qquad \text{(E)}\ 73$

13.Bicycle license plates in Flatville each contain three letters. The first is chosen from the set {C,H,L,P,R}, the second from {A,I,O}, and the third from {D,M,N,T}.

When Flatville needed more license plates, they added two new letters. The new letters may both be added to one set or one letter may be added to one set and one to another set. What is the largest possible number of ADDITIONAL license plates that can be made by adding two letters?

$\text{(A)}\ 24 \qquad \text{(B)}\ 30 \qquad \text{(C)}\ 36 \qquad \text{(D)}\ 40 \qquad \text{(E)}\ 60$

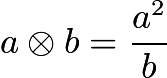
**Medium**

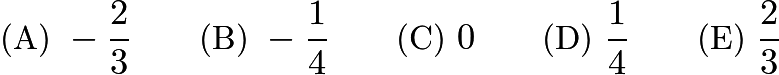
14.The number 64 has the property that it is divisible by its units digit. How many whole numbers between 10 and 50 have this property?

$\text{(A)}\ 15 \qquad \text{(B)}\ 16 \qquad \text{(C)}\ 17 \qquad \text{(D)}\ 18 \qquad \text{(E)}\ 20$

15.What is the units digit of $19^{19} + 99^{99}$?

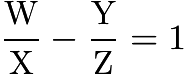
$\text{(A)}\ 0 \qquad \text{(B)}\ 1 \qquad \text{(C)}\ 2 \qquad \text{(D)}\ 8 \qquad \text{(E)}\ 9$

16.The operation $\otimes$ is defined for all nonzero numbers by . Determine $[(1\otimes 2)\otimes 3] - [1\otimes (2\otimes 3)]$.



17.You have nine coins: a collection of pennies, nickels, dimes, and quarters having a total value of $$1.02$, with at least one coin of each type. How many dimes must you have?

$\text{(A)}\ 1 \qquad \text{(B)}\ 2 \qquad \text{(C)}\ 3 \qquad \text{(D)}\ 4 \qquad \text{(E)}\ 5$

18.Each of the letters $\text{W}$, $\text{X}$, $\text{Y}$, and $\text{Z}$ represents a different integer in the set $\{ 1,2,3,4\}$, but not necessarily in that order. If , then the sum of $\text{W}$ and $\text{Y}$ is

$\text{(A)}\ 3 \qquad \text{(B)}\ 4 \qquad \text{(C)}\ 5 \qquad \text{(D)}\ 6 \qquad \text{(E)}\ 7$

**Hard**

19.A whole number larger than $2$ leaves a remainder of $2$ when divided by each of the numbers $3, 4, 5,$ and $6$. The smallest such number lies between which two numbers?

$\textbf{(A)}\ 40\ \text{and}\ 49 \qquad \textbf{(B)}\ 60 \text{ and } 79 \qquad \textbf{(C)}\ 100\ \text{and}\ 129 \qquad \textbf{(D)}\ 210\ \text{and}\ 249\qquad \textbf{(E)}\ 320\ \text{and}\ 369$

20.Terri produces a sequence of positive integers by following three rules. She starts with a positive integer, then applies the appropriate rule to the result, and continues in this fashion.

Rule 1: If the integer is less than 10, multiply it by 9.

Rule 2: If the integer is even and greater than 9, divide it by 2.

Rule 3: If the integer is odd and greater than 9, subtract 5 from it.

A sample sequence: $23, 18, 9, 81, 76, \ldots .$

Find the $98^\text{th}$ term of the sequence that begins $98, 49, \ldots .$

$\text{(A)}\ 6 \qquad \text{(B)}\ 11 \qquad \text{(C)}\ 22 \qquad \text{(D)}\ 27 \qquad \text{(E)}\ 54$

21.When $1999^{2000}$ is divided by $5$, the remainder is

$\text{(A)}\ 4 \qquad \text{(B)}\ 3 \qquad \text{(C)}\ 2 \qquad \text{(D)}\ 1 \qquad \text{(E)}\ 0$

22.On a twenty-question test, each correct answer is worth 5 points, each unanswered question is worth 1 point and each incorrect answer is worth 0 points. Which of the following scores is **NOT**possible?

$\text{(A)}\ 90 \qquad \text{(B)}\ 91 \qquad \text{(C)}\ 92 \qquad \text{(D)}\ 95 \qquad \text{(E)}\ 97$

23.There are 24 four-digit whole numbers that use each of the four digits 2, 4, 5 and 7 exactly once. Only one of these four-digit numbers is a multiple of another one. Which of the following is it?

$\text{(A)}\ 5724 \qquad \text{(B)}\ 7245 \qquad \text{(C)}\ 7254 \qquad \text{(D)}\ 7425 \qquad \text{(E)}\ 7542$

24.Three generous friends, each with some cash, redistribute their money as follows: Ami gives enough money to Jan and Toy to double the amount that each has. Jan then gives enough to Ami and Toy to double their amounts. Finally, Toy gives Ami and Jan enough to double their amounts. If Toy has $36 when they begin and $36 when they end, what is the total amount that all three friends have?

$\text{(A)}\ 108\text{ dollars} \qquad \text{(B)}\ 180\text{ dollars} \qquad \text{(C)}\ 216\text{ dollars} \qquad \text{(D)}\ 252\text{ dollars} \qquad \text{(E)}\ 288\text{ dollars}$

1. **B**
2. **B**
3. **A**
4. **D**
5. **C**
6. **C**
7. **B**
8. **D**
9. **E**
10. **A**
11. **D**
12. **B**
13. **D**
14. **C**
15. **D**
16. **A**
17. **A**
18. **E**
19. **B**
20. **D**
21. **D**
22. **E**
23. **D**
24. **D**