Welcome!

2011 = prime
2012 = 2 · 2 · 503
2013 = 3 · 11 · 61
2014 = 2 · 19 · 53
2015 = 5 · 13 · 31
$2016 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 * 3 * 7 = 2^5 3^2 7^1.$
2017 = prime
2018 = 2 · 1009
2019 = 3 · 673
2020 = 2 · 2 · 5 · 101

2016 is the 63rd triangular number, 1, 3, 6, 10, 15, 21, 28, 36, 45, 55, ... Triangular numbers are often denoted T_n. The recursive equation is $T_{n+1} = T_n + n$. The formula for T_n is $T_n = \dfrac{n(n+1)}{2}$.

The First Seven Members of the Series of Triangular Numbers

| 1 | 3 | 6 | 10 | 15 | 21 | 28 |
| $T(1)$ | $T(2)$ | $T(3)$ | $T(4)$ | $T(5)$ | $T(6)$ | $T(7)$ |

Daniel Plotnick
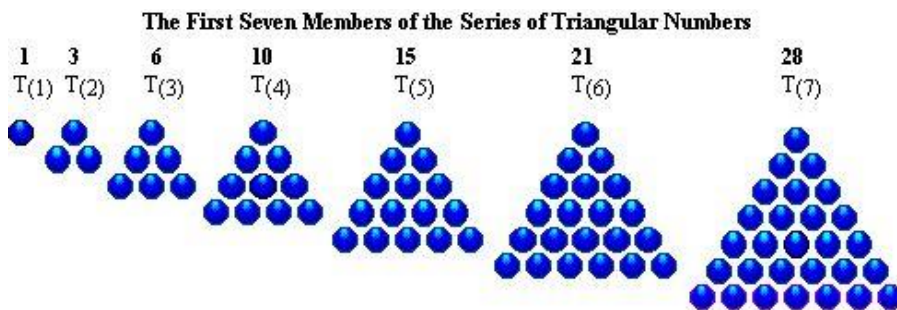
1) The product of the digits of the number 2016 subtracted from the sum of the digits of the number 2016 is

A) −9   B) 0   C) 1   D) 7   E) 9

2) 2016 is a "Harshad" number. A Harshad number is divisible by the sum of its digits. The next Harshad number after 2016 is how much greater than 2016?

A) 9   B) 7   C) 6   D) 5   E) 4

3) Let the numbers T(n) be defined by the recursion relation T(n) = T(n-1) + n, where T(1) = 1. Then T(2) = T(1) + 2 = 1 + 2 = 3, T(3) = T(2) + 3 = 3 + 3 = 6, and so on. The number 2016 appears in the sequence of numbers T(1), T(2), T(3), T(4), …. . What is the next number in the sequence after 2016?

A) 2076   B) 2079   C) 2080   D) 2100   E) None of these

4) How many square numbers are divisors of 2016?

A) 4   B) 5   C) 6   D) 7   E) None of these

5) What is the smallest number that when multiplied by 2016 results in a perfect cube?

A) 7   B) 49   C) 147   D) 294   E) 588

6) If I take the numbers 2, 0, 1, and 6 and place them in a hat and take out two of them. What is the probability that the product of the two numbers chosen is 0?

A) $\frac{1}{2}$ B) $\frac{1}{3}$ C) $\frac{1}{4}$ D) $\frac{1}{6}$ E) $\frac{1}{8}$

7) What is the smallest positive integer N that 17 must be multiplied by so that the fraction $\frac{17N}{2016}$ is not a repeating decimal?

A) 7   B) 9   C) 17   D) 63   E) 126

8) What is $2016^2 - 2017 \times 2015$

A) -2016   B) -1   C) 0   D) 1   E) 2016

9) What are the last two digits of 7^{2016}?

A) 01   B) 07   C) 49   D) 43   E) None of these

10) We know that $I^2 = ME$ and $I^3 = YOU$. If each distinct letter represents a unique digit such that the arithmetic holds, what is the value of E?

A) 4   B) 5   C) 6   D) 7   E) 9

11) Suppose we draw 64 points equally spaced around a circle and draw the line segments joining each point to every other, forming a 64-gon and all diagonals. How many diagonals are there?

A) 4032   B) 3904   C) 2016   D) 2015   E) 1952

12) How many trailing zeros does 2016! have? Here, the exclamation point! is the factorial operator $n! = n \times (n-1) \times (n-2) \ldots 2 \times 1$.

A) 506   B) 502   C) 499   D) 494   E) None of these

13) The area of a square is 2016. There is a circle inscribed in the square. The circle also has an equilateral triangle inscribed in the circle. What is the area of the triangle?

A) $\frac{504}{3}\sqrt{3}$ B) $189\sqrt{3}$ C) 378   D) $378\sqrt{3}$ E) $504\sqrt{3}$

14) 2016 is the Nth term of the ascending sequence that starts 0, 1, 2, 6, 10., 11, 12, 16, ... and consists of all distinct whole numbers that can be made using the digits 0, 1, 2 and 6. Find N.

A) 136   B) 135   C) 134   D) 132   E) 130

15) What is the units digit of the sum of the units digits of all the square numbers from 1 to the greatest square less than 2016, inclusive?

A) 6   B) 5   C) 3   D) 2   E) None of these

16) What row is 2017 on if the following pattern continues?

1st Row:	1		13		25	
2nd Row:	3		15		27	
3rd Row:	5	11	17	23	29	35	41
4th Row:		9		21		33	
5th Row:		7		19		31	

A) 1st   B) 2nd   C) 3rd   D) 4th   E) 5th

17) For integer m and positive integer n, define the operation § as $(m \mathbin{\S} n) = m - m^2 + m^3 - m^4 + m^5 - \cdots \pm m^n$. What is the value of $(-1 \mathbin{\S} 2016)$.

A) -2016   B) -1   C) 0   D) 1   E) 2016

18) The diagram shows a square ABCD in a semicircle with center O and another square PQRS inscribed in the entire circle with the same center. If the area of ABCD is 16, find the area of PQRS.
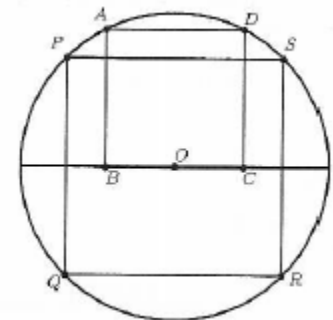

A) 30   B) 32   C) 40   D) 48   E) 50

19) Let ABCD be a rectangle, E be a point on BC such that BE = 2EC, and F be a point on AE such that AF = 3FE. If the area of ABCD is 1200, what is the area of the quadrilateral DFEC?

A) 100   B) 300   C) 350   D) 400   E) None of these

20) Two regular hexagons overlap in a rhombus shaped region of area $36\sqrt{3}$. What is the area of the non-overlapped region?

A) $72\sqrt{3}$ B) $144\sqrt{3}$ C) $180\sqrt{3}$ D) $216\sqrt{3}$ E) $288\sqrt{3}$

21) In the diagram, AB, AC, CD, and DB are respectively the diameters of the circles C_1, C_2, C_3, and C_4. If the circumference of C_1 is 2016, what is the sum of the circumferences of all four circles?
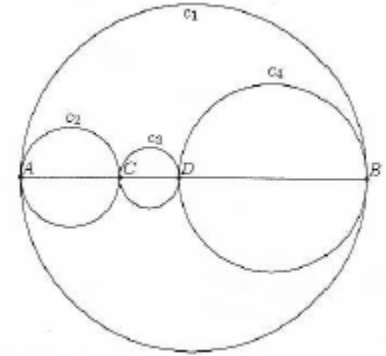
A) 8064   B) 7056   C) 6048   D) 5040   E) 4032

22) The diagram shows a 12 by 9 rectangle which is cut by a pair of parallel line segments into three parts with equal areas. If h denotes the distance between the parallel lines, find the value of $30h^2$
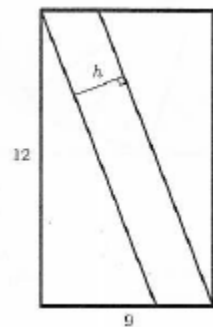
A) 72   B) 108   C) 144   D) 180   E) 216

23) Square ABCD with area 49 overlaps square EFGH with area 36 in a smaller square region of area 9 with points E and C as opposite vertices. If line segments BF and DH are drawn to form region ABFGHD, what is the perimeter of this hexagonal region?

A) 29   B) 31   C) 36   D) 41   E) 43

24) ABCD is a parallelogram. E is a point on the side AB such that the ratio of the area of the quadrilateral AECD to the area of the triangle ABC is 7:5. The ratio of AE : EB is
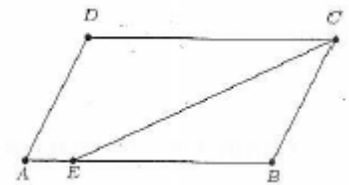
A) 2:3   B) 2:7   C) 3:4   D) 3:5   E) 5:7

25) How many ways are there to write 2016 as a difference of squares?

A) 5   B) 6   C) 11   D) 12   E) 16

26) Bonus! What is the next term in the following sequence?

    3, 13, 1113, 3113, 132113, 1113122113, ….