1. Pete buys 10 bags of apples, each of which contains 20 apples. If he eats 8 apples a day, how many days will it take him to eat the 10 bags of apples?

   A. 1 day.

   B. 4 days.

   C. 9 days.

   D. 16 days.

   E. 25 days.

2. A tortoise and a hare leave their dormitory for a study meeting in the library, a mile away, at the same time. The tortoise walks in a straight line to the library at a constant speed of two miles per hour. The hare walks at a constant speed of ten miles per hour, but decides to take a detour and stop for lunch on the way. If the hare's route from the dorm to lunch to the library is 1.5 miles long, what is the most time she can spend eating lunch if she doesn't want the tortoise to arrive at the library before her?

   A. 15 minutes

   B. 18 minutes

   C. 21 minutes

   D. 24 minutes

   E. 27 minutes

3. The OSU football team scores four times during a game, and each score is worth 3, 6, 7, or 8 points. How many numbers could represent OSU's total score at the end of the game?

   A. 17.

   B. 19.

   C. 21.

   D. 23.

   E. 25.

4. Solve for x: $3^{x+2} + 2^{x+2} + 2^x = 2^{x+5} + 3^x$.

   A. 1

   B. 2

   C. 3

   D. 4

   E. 5

5. Order from largest to smallest: $1^{10}, 2^9, 3^8, 4^7, 5^6, 6^5, 7^4, 8^3, 9^2, 10^1$.

   A. $3^8 > 6^5 > 4^7 > 5^6 > 7^4 > 2^9 = 8^3 > 9^2 > 10^1 > 1^{10}$.

   B. $4^7 > 5^6 > 3^8 > 6^5 > 7^4 > 2^9 = 8^3 > 9^2 > 10^1 > 1^{10}$.

   C. $6^5 > 3^8 > 5^6 > 4^7 > 7^4 > 2^9 = 8^3 > 9^2 > 10^1 > 1^{10}$.

   D. $6^5 > 4^7 > 3^8 > 5^6 > 7^4 > 2^9 = 8^3 > 9^2 > 10^1 > 1^{10}$.

   E. $4^7 > 5^6 > 6^5 > 3^8 > 7^4 > 2^9 = 8^3 > 9^2 > 10^1 > 1^{10}$.

6. Find the smallest positive integer n with the property that $1 + 2 + 3 + \cdots + n$ is a three-digit number, and all three digits of this number are the same.

   A. 33

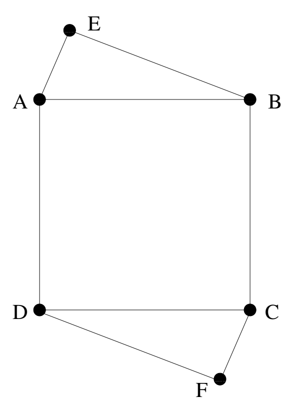
   B. 36

   C. 39

   D. 42

   E. 45

7. Square $ABCD$ has sides of length 17, and triangles ABE and CDF are right triangles with $AE = CF = 8$ and $BE = DF = 15$. Find EF.



   A. $20\sqrt{2}$

   B. 40

   C. $23\sqrt{2}$

   D. $\dfrac{769}{17}$

   E. $\dfrac{480}{17}$

8. An arithmetic series of 2017 positive integers adds to 2017,

$$a_1 + a_2 + \cdots + a_{2017} = 2017.$$

Find a_4.

A. 4
B. 2017
C. 1
D. 1005
E. 47

9. What is the largest two-digit number the becomes 75% greater when its digits are reversed?

A. 26
B. 35
C. 48
D. 57
E. 69

10. An equilateral triangle has two vertices at $(1, 0)$ and $(-1, 0)$, and its third vertex on the positive y-axis. It intersects the unit circle at four points: $(1, 0)$, $(-1, 0)$, A, and B. Find the equation of line AB.

A. $y = \dfrac{\sqrt{3}}{2}$
B. $y = \dfrac{1}{2}x + \dfrac{\sqrt{3}}{2}$
C. $y = \dfrac{1}{2}$
D. $y = -x\sqrt{3} + \sqrt{3}$
E. $y = x\sqrt{3} + \sqrt{3}$

11. The volume of a cube (measured in cubic yards) is equal to its surface area (measured in square feet). Find the length of a side.

    A. 2 feet

    B. 54 yards

    C. 27 yards

    D. 72 feet

    E. 6 yards

12. In pentagon $ABCDE$, the measures of angles A, B, C, D, and E, in order, form an arithmetic sequence. If $\angle A = 120°$, what is $\angle C$?

    A. $108°$

    B. $105°$

    C. $102°$

    D. $99°$

    E. $90°$

13. Consider circle O with radius 17. Points A and B are chosen on the circle so that the distance from O to line AB is 8. Find the length of line segment AB.

    A. 26

    B. 28

    C. 30

    D. 32

    E. 34

14. How many polynomials $p(x)$ with integer coefficients satisfy $p(3) = 20$ and $p(5) = 17$?

    A. 2017.

    B. Two.

    C. None.

    D. One.

    E. Infinitely many.

15. Find the remainder when $2018^{2017} - 2016^{2017}$ is divided by 2017.

   A. 2

   B. 3

   C. 4

   D. 5

   E. 6

16. The circles $x^2 + y^2 = 289$ and $(x-5)^2 + (y-12)^2 = 169$ intersect in two points P and Q. Find the equation of line PQ.

   A. $12x - 5y = 60$

   B. $12x - 5y = 120$

   C. $10x + 24y = 289$

   D. $5x + 12y = 60$

   E. $5x - 12y = 120$

17. Find the last digit of 2017^{2017}.

   A. 7

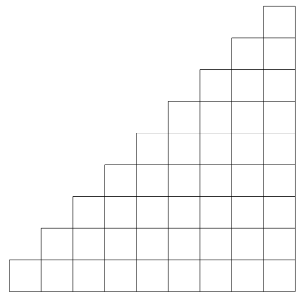
   B. 9

   C. 1

   D. 3

   E. 5

18. A **Triangle Sudoku** puzzle is defined as follows: nine 9's, eight 8's, seven 7's, six 6's, five 5's, four 4's, three 3's, two 2's, and one 1 must be placed in the triangular array of boxes below in such a way that no row or column contains two copies of the same number.



How many solutions are there to the triangle sudoku puzzle?

A. 0

B. 1

C. 512

D. 2520

E. 362880

19. Consider triangle ABC with side lengths a, b, c. Given that $\angle A + \angle B = \angle C$ and $4a^2 = c^2$, find the ratio $\angle B : \angle A$.

A. 1:1

B. 3:2

C. 2:1

D. 2:3

E. 1:2

20. When Pistol Pete walks his dog, he always walks around a perfect square with side length 2017 feet. If Pete holds the dog on a five-foot leash, find the area through which the dog could travel during the walk.

A. $80580 + 25\pi$ square feet.

B. $80580 + 100\pi$ square feet.

C. 80680 square feet.

D. 4149369 square feet.

E. $80680 + 25\pi$ square feet.

21. Let ABC be an isosceles triangle with $AB = AC$. Draw altitudes AD, BE, and CF. Which, if any, of the statements below must be true?

(I) $\dfrac{1}{AD} = \dfrac{1}{BE} + \dfrac{1}{CF}$.

(II) D lies between B and C.

(III) E lies between A and C.

(IV) $2 \times AD \geq BE$.

(V) $AD \leq BE$.

A. (II) and (III) only.

B. (II) or (III), but not both.

C. (I), (III), and (IV) only.

D. (II) and (IV) only.

E. (II) and (V) only.

22. A grasshopper starts at the origin and wants to move to the point $(20, 17)$. It can move only by jumping east or north, and can only jump distances of exactly three or five units. How many distinct sequences of jumps can it take to reach its destination?

A. $\dfrac{5!6!}{4!4!}$

B. 4^9

C. $\dfrac{9!}{4!5!} + \dfrac{11!}{9!2!}$

D. $\dfrac{11!}{5!6!}$

E. $\dfrac{9!}{4!4!} + \dfrac{11!}{5!4!}$

23. Let x, y, z be real numbers such that $x+y+z = 2$, $x^2+y^2+z^2 = 30$, $x^3+y^3+z^3 = 116$. Compute xyz.

A. 10

B. 12

C. 15

D. 16

E. 18

24. Let $f(x)$ be a function defined on the real numbers with the properties

- $f(a+b) = f(a)f(b)$ for all real numbers a and b.
- $f(1) = 2$.

Find $f(2017)$.

A. 4034

B. 2

C. 2^{2017}

D. 2017!

E. 2018

25. How many distinct real roots does the equation $x^7 - 7x^4 - 16 = 0$ have?

A. 1

B. 2

C. 3

D. 4

E. 5