ONLINE ROUND

MATHEMATICS CHALLENGE

AGE CATEGORY: HONEYBEE (14-15 YEARS OLD)

Maths Topics for Honeybee: 14-15 Years Old

Mathematics Knowledge Test will assess the following topics:

Number: Understanding and using numbers and number relationships, including integers, fractions, decimals, and percentages, and applying concepts of addition, subtraction, multiplication, and division. This includes topics such as prime numbers, factors and multiples, powers and roots, estimation, and mental and written methods for calculations.

Algebra: Understanding and using algebraic concepts and notation, including equations, expressions, formulae, and functions, and solving equations and inequalities. This includes topics such as simplifying expressions, solving linear and quadratic equations, and graphing linear and quadratic functions.

Ratio, proportion, and rates of change: Understanding and using concepts of ratio, proportion, and rates of change, including solving problems involving these concepts. This includes topics such as direct and inverse proportion, and solving problems involving rates of change.

Geometry and measures: Understanding and using concepts of geometry, including points, lines, angles, shapes, and symmetry, and understanding and using standard units of measure, including length, area, volume, weight, and time. This includes topics such as properties of geometric shapes, constructing geometric figures, and solving problems involving measurements, understanding and using theorems and postulates related to geometric figures, such as the Pythagorean theorem, the properties of triangles and circles, and the concepts of parallel and perpendicular lines.

Statistics: Understanding and using concepts of statistics, including collecting, representing, and interpreting data using tables, graphs, and probability. This includes topics such as measures of central tendency, probability, and statistical diagrams.

Trigonometry: Understanding and using concepts of trigonometry such as right triangle trigonometry, the unit circle and trigonometric functions. Solving problems involving trigonometric ratios and angles, and understanding the relationship between trigonometry and geometry.

Vectors: Understanding and using vector algebra and geometry, including vector addition and subtraction, scalar multiplication and vector products.

1. Given that $64x + 36y = 1064$ and $36x + 64y = 1036$.
   What is the value of $x^2 - y^2$?

   A. 21
   B. 22
   C. 23
   D. 24

2. Let x and y be positive real numbers with $x > y$
   and $\frac{x}{y} + \frac{y}{x} = 2\sqrt{5}$.

   What is the value of $\frac{x^2 - y^2}{xy}$?

   A. 3
   B. 4
   C. $2\sqrt{3}$
   D. $3\sqrt{3}$

3. If Mr. Free drives at a speed of 20 miles per hour, he is 5 minutes late for the school.
If he drives at the speed of 30 miles per hour, he is 5 minutes early for the school.

At what speed should he drive to arrive at the school just in time?

  A. 28mph
  B. 26mph
  C. 25mph
  D. 24mph

4. For how many integers value of n, the fraction $\frac{3n+1}{2n+1}$ is also an integer?

  E. None
  F. 1
  G. 2
  H. 3

5. One of the methods used in calculating pediatric doses for a child is the Young's rule.
It states that the child dosage is equal to the adult dosage multiplied by the child's age in years, divided by the sum of 12 plus the child's age.

$$D = \frac{ac}{c + 12}$$

where D is dosage for a child, c is the age of the child,

and a is the dosage of an adult.

Thomas needs to start taking a pill by this year, and his father realises that in 8 years his son will need to get this pill in the doubled amount.

What is Thomas's present age?

A. 4
B. 6
C. 8
D. 9

6. In a school trip, the ratio of the number of girls to the number of boys is 5:6 and the ratio of the number of boys to the number of teachers is 10:3.

4 more teachers need to join the trip, so the ratio of the number of teachers to the number of all students becomes 11:2.

What is the number of people who join this trip with new teachers?

    A. 260
    B. 240
    C. 200
    D. 180

7. Given that $\dfrac{2}{x} + \dfrac{3}{y} = 13$ and $\dfrac{1}{x} + \dfrac{1}{y} = 5$.

What is the value of $x + y$?

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

    B. $\dfrac{7}{10}$

    C. $\dfrac{7}{12}$

    D. $\dfrac{8}{15}$

8.   What is the value of x, if $2023x + 2023 = 2023^2$?
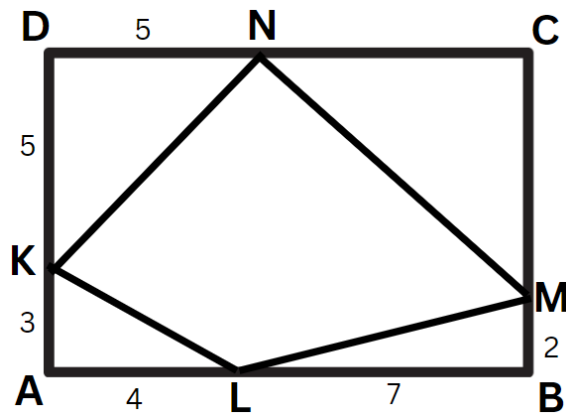
A. 1
B. 2022
C. 2023
D. 2023^2

9.   What is half of the number 2^{2023} ?

A. 1^{2023}
B. $2^{1011.5}$
C. 2^{2022}
D. $1^{1011.5}$

10. ABCD is a rectangle.
   What is the area of quadrilateral KLMN?

   A. 44.5
   B. 45
   C. 50
   D. 52.5

11. Given that $2023x + 2023^2 = 2023y$
   and $2023y + 2023^2 = 2023z$

   What is the value of $\frac{x+z}{y}$?

   A. 1
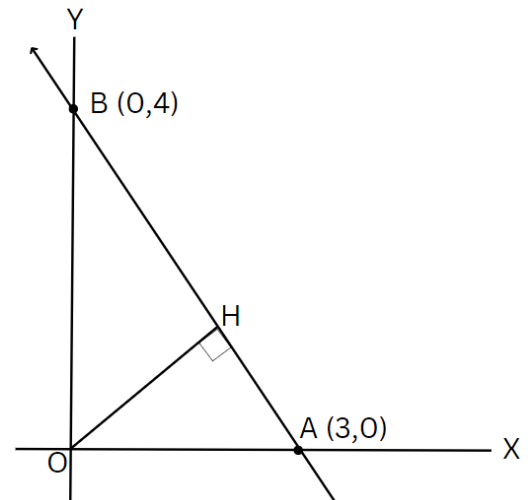   B. 2
   C. 2022
   D. 2023

12. What is the exact value of the below?

$$\frac{2}{1+\sqrt{3}} + \frac{2}{\sqrt{3}+\sqrt{5}} + \frac{2}{\sqrt{5}+\sqrt{7}} + \cdots + \frac{2}{\sqrt{2021}+\sqrt{2023}}$$

A. $\sqrt{2023}$
B. $1 + \sqrt{2023}$
C. $\sqrt{2023} - 1$
D. $\sqrt{2023} + 2$

13. What is the length of height OH?

A. 5
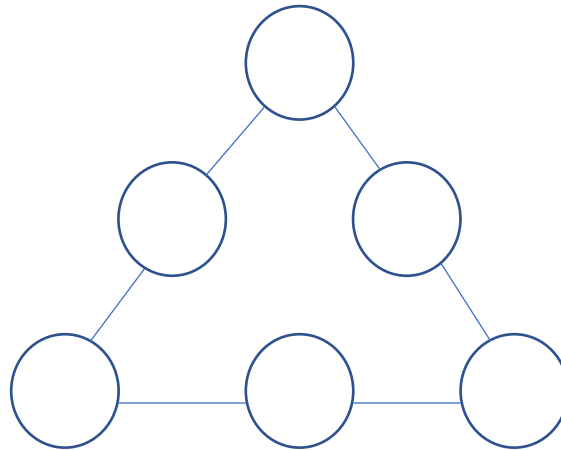B. 4.8
C. 3.6
D. 2.4

14. Given that $\frac{2023x+y}{x} = 2025$

What is the value of $\frac{2023y+2022x}{y}$?

A. 2022
B. 2023
C. 3034
D. 3025

15. The numbers 1, 3, 5, 7, 9, and 11 are placed in the triangle's circles.So that the sum of the numbers on each side of the triangle is 15.
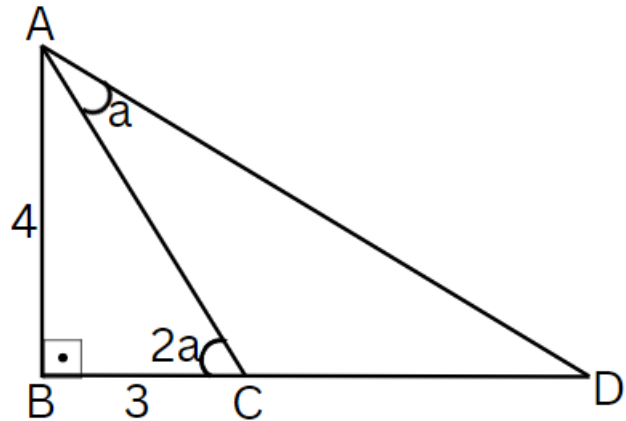What is the sum of the numbers on the corners?

A. 9
B. 13
C. 15
D. 17

16. What is the last digit of the number 2023^{2023}?

A. 9
B. 7
C. 3
D. 1

17. Given that $\angle ACB = 2\angle CAD$.

What is the length of AD?

A. 5
B. 6
C. $4\sqrt{2}$
D. $4\sqrt{5}$

18. The mean and median of 11 positive integers is 7.
And their unique mode is 8.

What is the largest possible value of the greatest of these numbers?

A. 18
B. 20
C. 25
D. 30

19. What is the area of a rectangle with perimeter of 22cm, and diagonal of 7cm?

    A. $36cm^2$
    B. $32cm^2$
    C. $30cm^2$
    D. Not enough information

20. In how many ways can we choose 8 different integers from 1 to 11 inclusive, such that their product is a square?

    A. 1
    B. 2
    C. 3
    D. 4

21. $\frac{2}{3}$ of a number increased by $\frac{1}{4}$ of the same number is equal to 33.
Which number is this?

    A. 12
    B. 24
    C. 36
    D. 44

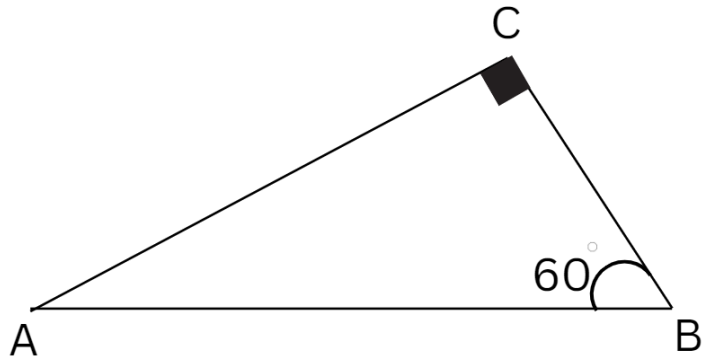22. How many different letters of the word "MATHEMATICS" have a line of symmetry?

   A. 7
   B. 6
   C. 5
   D. 4

23. It is given that A = $\begin{pmatrix} a \\ b \end{pmatrix}$ and B = $\begin{pmatrix} 3 \\ 5 \end{pmatrix}$. If it is also true that 2A − 3B = $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$, then a ÷ b = ?

   A. $\frac{2}{3}$

   B. $\frac{3}{5}$

   C. $\frac{3}{2}$

   D. $\frac{10}{3}$

24. If the length of hypotenuse is $5\sqrt{3}$ units, then what is the length of the right side opposite to 60°? ($\sin 60° = \frac{\sqrt{3}}{2}$)

A. $\sqrt{3}$
B. $2\sqrt{3}$
C. 7.5
D. $2.5\sqrt{3}$

25. ABC is a triangle in which angle ABC $= 90°$
p and q are integers such that

the coordinates of A are (p , 10)
the coordinates of B are (-1 , -5)
the coordinates of C are (8 , q)

Given that the gradient of AC is $-\frac{6}{7}$
What are the value of p and the value of q?

A. $p = -2$ and $q = -6$
B. $p = -6$ and $q = -2$
C. $p = -3$ and $q = -1$
D. $p = -6$ and $q = -3$