Mathlete Training Centre
RIPMWC 2018

1. If the positive even integers are arranged in rows of eleven as shown below, then "2018" will appear in the m^{th} row and n^{th} column. Find $m + n$.

(Eg. "58" appears in the 3rd row and 7th column, so that $m+n=10$)

2	4	6	8	10	12	14	16	18	20	22
24	26	28	30	32	34	36	38	40	42	44
46	48	50	52	54	56	58	60	62	64	66
...	...	...	...	...	...	...	...	...	...	...

2. The figure below is composed of three $\frac{1}{4}$ - arcs of a circle of radius 2 cm connected to a $\frac{3}{4}$ - arc of a circle. Find the area enclosed by the figure in cm^2.
You may take $\pi=\frac{22}{7}$ in your calculations.

3. Calculate

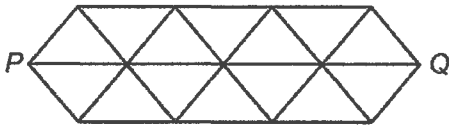
$\frac{1}{2}$ (2019×2018 − 2018×2017 + 2017×2016 − 2016×2015 + ... + 5× 4 − 4×3 + 3×2 − 2×1)

4. Calculate

$(403\frac{3}{5} + 183\frac{5}{11} + 155\frac{3}{13} + 118\frac{12}{17}) \div (\frac{1009}{15} + \frac{1009}{33} + \frac{1009}{39} + \frac{1009}{51})$.

5. In a class of pupils, 80% participated in basketball, 85% participated in football, 74% participated in softball and 68% participated in squash. Find the minimum percentage of pupils who participated in all the four sports events.

6. How many paths, which follow the line segments in the diagram below, are there from P to Q if all the paths must always be moving to the right?



7. A particular cattle is fed 7 kg, 8 kg and 9 kg of special food on Day 1, 2 and 3 respectively by a farmer. From Day 4 onwards, the amount of food fed to the cattle follows the following rule:

   (i) if the total amount of food fed to the cattle in the past 3 days is 24 kg or more, the cattle will be fed 2 kg less than the day before.
   (ii) if the total amount of food fed to the cattle in the past 3 days is less than 24 kg, the cattle will be fed 1 kg more than the day before.

   Calculate the minimum number of days for the total amount of food fed to the cattle to exceed 2018 kg.

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8. Two motor-cyclists John and Kevin were 800 km apart and travelling towards each other at a constant speed. They started at the same time, meeting after 8 hours. If Kevin started $1\frac{1}{2}$ hours later than John, they would be 70 km apart 8 hours after John started. At what speed was John travelling in km/h?

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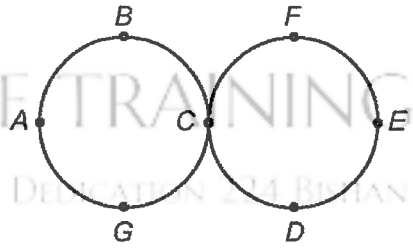
9. The diagram shows 2 circles, each with radius 3 cm and touching at point C. The points A, B, C, D, E, F and G are positioned such that all the arcs AB, BC, CD, DE, EF, FC, CG and GA are all equal in length. An ant walks along the figure "8" path $EFCGABCDE$ in that order and after which it retraces the path again and again.



After the ant has walked 2018π , where is the ant?

10. Find the exact number of minutes after 3.00 pm when the minute and hour hands are first at $90°$ to each other.

11. Eight pupils from Victory Primary School take a Mathematics test, but none of the pupils wrote his/her name on the test. The tests are therefore handed back to the pupils at random. In how many ways can exactly 5 of the 8 pupils get the correct test back?

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12. What are the last 2 digits on the right in the expansion of the expression $2^{2018201} - 8$?

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13. A 6-digit number starting with 18, $18ABCD$, is a multiple of 6, 7, 9 and 10. Find $(A + B + C + D)$ for the smallest such number?

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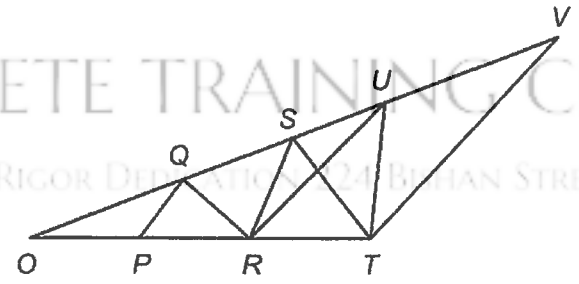
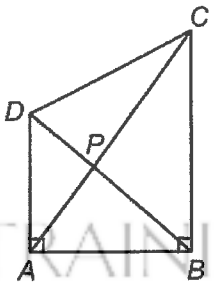
14. In triangle OTV, points P and R are on the side OT and points Q, S and U are on the side OV. Given that the areas of $\triangle OPQ$, $\triangle PQR$, $\triangle QRS$, $\triangle RST$ and $\triangle STU$ are all equal to 30cm^2, find the area of $\triangle SRU$ in cm^2.



15. A 14-digit number $666666XY444444$ is a multiple of 26. If X and Y are both positive, what is the smallest value of $X + Y$?

16. As shown in the figure below, $ABCD$ is a trapezium with $\angle\text{BAD} = \angle\text{ABC} = 90°$ and its area is equal to 90cm^2. AD=8cm and BC=10cm. AC and BD are diagonals in the trapezium. Find the area of triangle ABP in cm^2.



17. The first 2018 integers (1, 2, 3, ..., 2017, 2018) are written on the blackboard. What is the minimum number of integers that should be erased from the blackboard, so that the last digit of the product of the remaining integers is 2?

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18. Calculate

$$\frac{1}{5^5+1}+\frac{1}{5^5+5}+\frac{1}{5^5+5^2}+\ldots+\frac{1}{5^5+5^8}+\frac{1}{5^5+5^9}+\frac{1}{5^5+5^{10}}$$

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19. 25 identical 1-dollar coins are to be distributed to 3 brothers. In how many ways can this be done if each brother must get at least \$5?

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20. Find the total number of ways that 270 can be written as a sum of at least 2 consecutive positive integers.

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