INSTITUTE OF MATHEMATICS EDUCATION

JMO 2020 (Junior Mathematics Olympiad) – Std. V and VI

Maximum Marks : 100 **Date : 02/02/2020**

Time : 10.00 am to 12.00 pm

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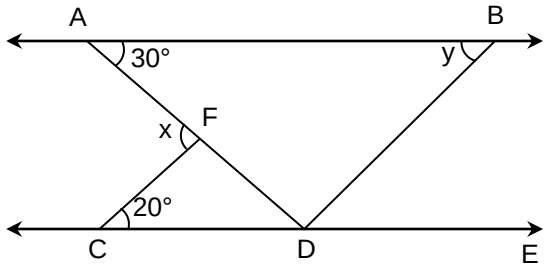
1. How many numbers are between 99 and 1000 such that 3 occurs at least once? (6 marks)

2. In the figure given below, line AB || line CE and seg CF || seg BD. (6 marks)
Find x + y and x – y.



3. If $(x)_{10} = (5227)_{8,}$ then find x (6 marks)
Also $(x)_{10} = (y)_5$ $(x)_{10} = (z)_{11}$. Find y and z.

4. Simplify and get the value of $\frac{13}{4}\left[\frac{1}{1560}+\frac{1}{1640}+\frac{1}{1722}+\frac{1}{1806}\right]$. (6 marks)

5. If sequence is defined as $t_n = 2t_{n-1} - t_{n-2}$ and $t_1 = 4$, $t_2 = 9$, then generate first 10 terms of the sequence. Divide each term of the sequence and get another sequence of remainders. Find the sum of first 200 remainders. (6 marks)

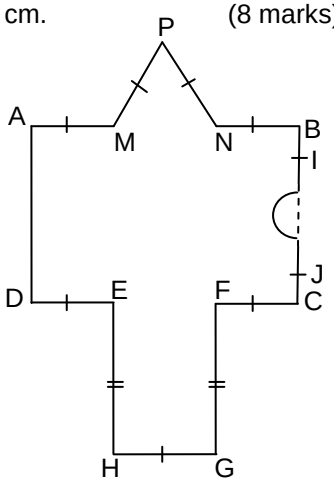
6. Decipher values of all given alphabets. (8 marks)

$$
\begin{array}{r|l}
 & \text{B C D} \\
\hline
\text{C D} & \text{A B C D} \\
- & \text{C D} \\
\hline
 & \text{E C} \\
- & \text{D F} \\
\hline
 & \text{B C D} \\
 & \text{B C D} \\
\hline
 & 0\ 0\ 0
\end{array}
$$

7. If $50!\left[\frac{1}{49!}-\frac{1}{50!}\right]\times 51!\left[\frac{1}{50!}-\frac{1}{51!}\right]=x$, then find x. Also find highest power of 35 dividing x. (8 marks)

8. 12 divides ab, where a, b $\in$ N but 12 does not divide a or b. (8 marks)
(i) If 1 < a < b, find at least 10 pairs of (a, b) where a, b are two digit integers.
(ii) Is it necessary for a and b to be relatively prime?

9. In the adjacent figure, □ ABCD is a square with AD = 12 cm. (8 marks)
Also, EH = $\frac{3}{2}$ EF.
Then find area of whole figure $\left(\sqrt{3} = 1.73, \pi = 3.14\right)$.



10. In the given magic square, the smallest number is $\frac{1}{15}$. (8 marks)
The largest number is $\frac{3}{5}$.
The middle number is $\frac{1}{3}$.
(i) Find magic constant.
(ii) Complete the magic square.

	$\frac{1}{15}$	
	$\frac{1}{3}$	
	$\frac{3}{5}$	

11. A number of 4 different digits is to be formed from digits 1, 2, 3, 4, 5, 6 and 7. (10 marks)
(i) How many such numbers can be formed?
(ii) How many of them are greater than 3400?
(iii) How many are divisible by 4?

12. (A) Identify the base and complete the sum if all the boxes have same digit. Also write the answer in decimal system. (6 marks)

$$\begin{array}{rcccc} & 2 & 5 & \square & 6 \\ + & 1 & 3 & 4 & 2 \\ + & \square & 6 & 6 & 2 \\ + & 3 & 2 & 2 & 4 \\ \hline 1 & 5 & \square & \square & 0 \end{array}$$

12. (B) Subtract (Write the answer in base 9) (4 marks)

$$\begin{array}{r} {}_{-}3\ \ t\ \ e\ \ 5_{12} \\ 2\ \ 1\ \ t\ \ 3_{12} \\ \hline (\qquad\qquad)_9 \end{array}$$

13. Given sequence T = 2, 46, 81012, 14161820, …….. (10 marks)
T_n has n natural numbers with n (n + 1) as its last block of digits.
Find (a) 10^{th} term (T_{10})
(b) Number of digits in 50^{th} term (T_{50})
(c) In which term does number 2020 appear?

Answers

1. 252

2. $x + y = 70°$
$x - y = 30°$

3. x = 2751, y = 42001, z = 2081 **4.** $\frac{1}{129}$ **5.** 300

6. A = 3, B = 1, C = 2, D = 5, E = 6, F = 0

7. x = 2450 and highest power is 2.

8. (16, 18), (16, 21), (20, 21), (20, 27), (20, 30), (15, 20), (15, 28), (18, 20), (18, 28), (32, 39).
It is not necessary that 'a' and 'b' should be relatively prime.

9. Area = 168.54 sq.cm, Perimeter = 66.28 cm

10. (i) Magic constant is 1.
(ii)

$\frac{8}{15}$	$\frac{1}{15}$	$\frac{2}{5}$
$\frac{1}{5}$	$\frac{1}{3}$	$\frac{7}{15}$
$\frac{4}{15}$	$\frac{3}{5}$	$\frac{2}{15}$

11. (i) 840 (ii) 500 (iii) 200

12. (A)

Base is 7. All the boxes have same digit 4. $(4341)_{10}$

12. (B)
$(4145)_9$

13. (i) 92949698100102104106108110 (ii) 200 (iii) 45^{th} term

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