MBA PIONEER 2024

Quantitative Aptitude

DPP:05

Remainder Theorem I

Q1 (81 × 160 × 122 × 42) when divided by 39 gives remainder :
(A) 13 (B) 24
(C) 29 (D) 37

Q2 Find the remainder when $(1332)^{612}$ is divided by 11.
(A) 1 (B) 2
(C) 3 (D) 5

Q3 3m + 6 and 3m − 6 when divided by 7 gives remainder 1 and 3 respectively. Find the least positive integral value of m.

Q4 $5!\left(1-\frac{1}{1!}+\frac{1}{2!}-\frac{1}{3!}\right)$ when divided by 12 gives remainder
(A) 0 (B) 4
(C) 6 (D) 8

Q5 $\frac{3^{93}+(17576)^{16}}{26}$ gives the remainder as:
(A) 3 (B) 2
(C) 1 (D) 25

Q6 Find the remainder when $(23)^{117}$ is divided by 7.
(A) 0 (B) 1
(C) 2 (D) 6

Q7 $(70)^{420}$ when divided by 17 gives remainder.
(A) 0 (B) 1
(C) 15 (D) 16

Q8 Find the remainder when (0! + 1! + 2! + 3! + ... + 716!) is divided by 24.
(A) 9 (B) 10
(C) 17 (D) 23

Q9 Find the remainder when $14264^{(1^2+2^2+3^2+.....+19^2)}$ is divided by 5.
(A) 4 (B) 2
(C) 1 (D) 0

Q10 Find the unit digit of $31^{24} \times 68^{57} + 24^{31} \times 58^{86}$ + 2516 + 3195.

Q11 Find the remainder when $(7!)^{7!}$ is divided by (6! + 4319).
(A) 0 (B) 1
(C) 2 (D) 5038

Q12 7^{2n-1} when divided by 3^{2n-3} gives remainder 1. What is the least possible value of n?
(A) 2 (B) 1
(C) 3 (D) 4

Q13 Let A = 6666 .... 666,. such that 6 repeats 402 times. Find the remainder when A is divided by 22.
(A) 0 (B) 1
(C) 2 (D) 21

Q14 What is the remainder when $(3808 \times 3809^2 \times 3810^3)$ is divided by 9?
(A) 8 (B) 7
(C) 0 (D) 6

Q15 Find the remainder when $(1!)^4 + (2!)^4 + (3!)^4 + ... + (1728!)^4$ is divided by 1728.
(A) 0 (B) 1
(C) 1313 (D) 1727

Q16

The remainder when $(19^{25} + 27^{25})$ is divided by 23, is :

(A) 1 (B) 17

(C) 22 (D) 0

Q17 2^{612} when divided by 15 gives remainder.

(A) 0 (B) 1

(C) 13 (D) 14

Q18 Find the remainder when 13(5!) + 13(8!) is divided by 40321.

Q19 What is the remainder when $(1!^3 + 2!^3 + 3!^3 + 4!^3 + 5!^3 + ... + 25!^3)$ is divided by 1000?

(A) 0 (B) 5

(C) 49 (D) 112

Q20 $x^3 - 3x^2 + 5x + 7$ when divided by $(x - a)$ gives the remainder as 13. Then a is equals to :

(A) 1 (B) 2

(C) 3 (D) 4

Q21 Find the remainder when $(x^{73} - 1)$ is divided by $(x - 1)$

Q22 110 is the least possible three digit number when a number leaves remainder n, on being divided by 4, 6 and 9. Find the value of n.

(A) 0 (B) 1

(C) 2 (D) 3

Q23 A number when divided by 6 leaves remainder 4 whereas when divided by 9 leaves remainder 1. Find the highest such two digit number.

(A) 84 (B) 94

(C) 76 (D) None of these

Q24 A number N when divided by 6, 8, 11 and 14 leaves respectively 4, 6, 5 and 12 as remainders. Find the value of N if it's known that N is the least 4 digit number.

(A) 1000 (B) 1002

(C) 1003 (D) 1006

Q25 If N! is completely divisible by 13^{29} but not by 13^{30}, then find the sum of digits of largest such number(N).

(A) 12 (B) 10

(C) 7 (D) 6

Q26 $9^x + 11^x$ when divided by 10 leaves remainder t. If x is an even number, then find t.

(A) 0 (B) 2

(C) 3 (D) 5

Q27 If $(6^m + 9^m + 11^m + 1^m)$ is divided by 10, then we get 9 as remainder, m can be :

(A) 4 (B) 5

(C) 7 (D) None of these

Q28 $(121 \times 123 \times 126 \times 127 \times 12b)$ $(b \in N)$ when divided by 10 leaves remainder 2. Find the least possible value of b.

Q29 Find the remainder when $21^{21^{32}}$ is divided by 11.

(A) 0 (B) 1

(C) 10 (D) 5

Q30 The last digit of the expression $222^{555} + 555^{222} + 444^{999} + 999^{444}$ is

Answer Key

Q1	(B)
Q2	(A)
Q3	3
Q4	(B)
Q5	(C)
Q6	(B)
Q7	(D)
Q8	(B)
Q9	(C)
Q10	5
Q11	(B)
Q12	(A)
Q13	(A)
Q14	(C)
Q15	(C)
Q16	(D)
Q17	(B)
Q18	1547
Q19	(C)
Q20	(B)
Q21	0
Q22	(C)
Q23	(D)
Q24	(D)
Q25	(A)
Q26	(B)
Q27	(A)
Q28	2
Q29	(C)
Q30	8

Hints & Solutions

Q1 Text Solution:

$\frac{81\times160\times122\times42}{39}$

$\xrightarrow{R}\frac{3\times4\times5\times3}{39}$

(R → Remainder theorem transformation)

$\xrightarrow{R}\frac{180}{39}$

$\xrightarrow{R}\frac{24}{39}$

So, remainder = 24

Ans. B

Q2 Text Solution:

$\frac{(1332)^{612}}{11}=\frac{(1331+1)^{612}}{11}$

$\Rightarrow 1\left[\begin{array}{c}\frac{(a^n+1)^p}{a} gives remainder = 1 \\ a\in N, p\in N\end{array}\right]$

Ans. A

Q3 Text Solution:

If m = 3,

then 3m + 6 = 15

So, $\frac{15}{7}\xrightarrow{R}1$

and 3m – 6 = 3 (at m = 3)

So, $\frac{3}{7}\xrightarrow{R}1$

Ans. 3

Q4 Text Solution:

$5!\left(1-\frac{1}{1!}+\frac{1}{2!}-\frac{1}{31}\right)$

$=120\times\left(\frac{1}{2}-\frac{1}{6}\right)=120\times\frac{1}{3}=40$

So, $\frac{40}{12}\xrightarrow{R}4$

Ans. B

Q5 Text Solution:

$\frac{3^{93}+(17576)^{16}}{26}$

$=\frac{(3^3)^{31}}{26}+\frac{(26^3)^{16}}{26}$

$=\frac{(27)^{31}}{26}+\frac{(26)^{48}}{26}$

$\xrightarrow{R}$1 + 0

$\xrightarrow{R}$1

Ans. C

Q6 Text Solution:

$\frac{(23)^{117}}{7}$

$\xrightarrow{R}\frac{(2)^{117}}{7}$

$\xrightarrow{R}\frac{(2^3)^{39}}{7}$

$\xrightarrow{R}1$

Ans. B

Q7 Text Solution:

$\frac{(70)^{420}}{17}$

$\xrightarrow{R}\frac{(2)^{420}}{17}\xrightarrow{R}\frac{(2^4)^{105}}{17}$

$\xrightarrow{R}\frac{(-1)^{105}}{17}$

$\xrightarrow{R}16$

Ans. D

Q8 Text Solution:

$\frac{(0!+1!+2!+31+.......+716!)}{24}$

$\xrightarrow{R}\frac{0!+1!+2!+3!}{24}+\frac{4!+5!+.......+}{24}$

Since 4! is 24 so every term after 4! will be divisible by 24 and will give remainder as 0.

So,

$\xrightarrow{R}\frac{10}{24}+0$

$\xrightarrow{R}10$

Ans. **B**

Q9 Text Solution:

$14264^{(1^2+3^2+......+19^2)}$

Now, $\frac{14264^{Evenpower}}{5}$ *is same as* $\frac{4^{even\ power}}{5}$

Now, $\frac{4^{even\ number}}{5}=\frac{(-1)^{even\ number}}{5}\xrightarrow{R}1$

Ans. C

Q10 Text Solution:

Let us calculate the unit's digits of the each of the terms first

$31^{24} = 1$, $68^{57} = 8$, $24^{31} = 4$, $58^{86} = 4$

The unit digit of the given expression will be

$= 1 \times 8 + 4 \times 4 + 6 + 5$

$= 8 + 16 + 11$

$= 35$

Therefore, the required unit's digit is 5.

Q11 Text Solution:

$\frac{(7!)^{7!}}{6!+4319}$

$= \frac{(5040)^{5040}}{5039}$

$\xrightarrow{R} \frac{(5039+1)^{5040}}{5039}$

$\xrightarrow{R} 1$

Ans. B

Q12 Text Solution:

At n = 2, we get

$\frac{7^{4-1}}{3^{4-3}}$

$= \frac{7^3}{3}$

$= \frac{343}{3}$

$\xrightarrow{R} 1$

Ans. A

Q13 Text Solution:

A pattern of remainders can be observed here such that 6 when written odd number of times gives remainder as 6 when divided by 22 and gives the remainder 0 when it is written even number of times. Here, 6 is written 402 times which is even.

Therefore, the required remainder will be 0.

Ans. A

Q14 Text Solution:

$\frac{3808 \times 3809^2 \times 3810^3}{9}$

$\xrightarrow{R} \frac{1 \times 2^2 \times 3^3}{9}$

$\xrightarrow{R} 0$

Ans. **C**

Q15 Text Solution:

$1728 = (12)^3 = 2^6 \times 3^3$

From $(4!)^4$ onwards, each term are divisible

So, remainder $= (1!)^4 + (2!)^4 + (3!)^4$

$= 1 + 16 + 1296$

$= 1313$

Q16 Text Solution:

$\frac{19^{25}+27^{25}}{23} \xrightarrow{R} \frac{(-4)^{25}+(4)^{25}}{23}$

And we know that

$(-4)^{25} + (4)^{25} = 0$

So, remainder = 0

Ans. D

Q17 Text Solution:

$\frac{2^{612}}{15}$

$= \frac{(2^4)^{153}}{15}$

$= \frac{(15+1)^{153}}{15}$

$\xrightarrow{R} 1$

Ans. B

Q18 Text Solution:

Given expression 13(5!) + 13(8!)

= 13 (5! + 8!)

The above expression can be rewritten as

13(119 + 40321)

Therefore the required remainder

$\text{Rem.} \frac{13(119)}{40321} + \text{Rem.} \frac{13(40321)}{40321}$

= 1547 + 0

= 1547.

Q19 Text Solution:

From $5!^3$ onwards each term is divisible by 1000.

So, only terms we have to consider are

$1!^3, 2!^3, 3!^3, 4!^3$

or $\frac{1!^3+2!^3+3!^3+4!^3}{1000}$

$= \frac{1+8+216+13824}{1000}$

$= \frac{14049}{1000}$

$\xrightarrow{R} 49$

Ans. C

Q20 Text Solution:

Using remainder theorem,

$a^3 - 3a^2 + 5a + 7 = 13$

At a = 2, we get

8 – 12 + 10 + 7 = 13

Ans. B

Q21 Text Solution:

Remember

When $\frac{x^n-1}{(x-1)} \xrightarrow{R} 1$ (n ∈ odd, even)

So, $\frac{x^{73}-1}{x-1} \xrightarrow{R} 0$

Ans. 0

Q22 Text Solution:

LCM of 4, 6 and 9 = 36

Least three digit number divisible by 36 = 108

And 108 + n = 110

So, n = 2

Ans. C

Q23 Text Solution:

Let the number be of type 6m + 4 (m ∈ N)

Again, when divided by 9 leaves remainder 1

So, 6m + 4 – 1 will be divisible by 9.

or 6m + 3 is divisible by 9.

At m = 13, we get

(6 ´ 13 + 4) = (78 + 4)

= 82

82 satisfy the given condition.

Ans. D

Q24 Text Solution:

Checking option,

Option A - 1000 when divided by 8 gives the remainder as 0 so it can't be the sanswer.

Similarly 1002 when divided by 6 gives the remainder as 0 so it can't be the sanswer.

also checking C and D, we can see that only D satisfies the given condition.

So, Ans. D

Q25 Text Solution:

For N! to be completely divisible by 13^{29}, N should be less than (13 ´ 29) = 377.

Now, highest power of 13 in 377

$= \left[\frac{377}{13}\right] + \left[\frac{377}{169}\right] = (29 + 2) = 31$

Now, 377 – 13 = 364

Highest power of 13

$= \left[\frac{364}{13}\right] + \left[\frac{364}{169}\right]$

= 28 + 2 = 30

This means, (364 – 1) is the largest such number.

Thus, (3 + 6 + 3) = 12

Ans. A

Q26 Text Solution:

When $9^x + 11^x$ is divided by 10, then remainder we get = 0 or 2

o when x is odd and 2 when x is even.

So, t = 2

Ans. B

Q27 Text Solution:

When the given expression is divided by 10, we have to find the last digit of it.

When, m is even

last digit → (6 + 1 + 1 + 1)

= 9

So, remainder = 9

This means m is an even number.

Ans. A

Q28 Text Solution:

$\frac{121 \times 123 \times 126 \times 127}{10}$

$\xrightarrow{R} \frac{1 \times 3 \times 6 \times 7}{10}$

$\xrightarrow{R} \frac{126}{10}$

$\xrightarrow{R} 6$

Now, 6 × 2 gives 12.

or remainder = 2

Thus, b = 2

Ans. 2

Q29 Text Solution:

Using –1 remainder rule, we get

$\frac{21^{21^{32}}}{11}$

$\xrightarrow{R} \frac{(-1)^{21^{32}}}{11}$

$\xrightarrow{R} \frac{(-1)^{oddpower}}{11}$

$\xrightarrow{R}$ -1

or $\xrightarrow{R} 10$

Ans. C

Q30 Text Solution:

Let us calculate the unit's digits of the each of the terms first

222^{555} = 8, 555^{222} = 5, 444^{999} = 4, 999^{444} = 1

Thus, the last digit of the above expression will be

= 8 + 5 + 4 + 1

= 18

Therefore, the required unit's digit is 8.