MBA

MBA PIONEER 2024

Quantitative Aptitude

DPP: 06

Remainder Theorem II

Q1 Find the remainder when 196^{512} is divided by 13.

(A) 1 (B) 7

(C) 9 (D) 12

Q2 Find the remainder when 31^{82} is divided by 83.

(A) 82 (B) 30

(C) 1 (D) 0

Q3 Find the remainder when $(144)^{1392}$ is divided by 132.

(A) 1 (B) 12

(C) 130 (D) 131

Q4 Find the last two digits of the expression (36 × 41 × 96 × 98 × 7).

(A) 14 (B) 28

(C) 56 (D) 62

Q5 Find the remainder when 16! is divided by 17.

(A) 11 (B) 13

(C) 15 (D) 16

Q6 38! when divided by 41 gives remainder.

(A) 1 (B) 20

(C) 37 (D) 40

Q7 Find the remainder when 57! is divided by 59.

(A) 58 (B) 37

(C) 1 (D) 0

Q8 Find the remainder when 83^{114} is divided by 52.

(A) 1 (B) 3

(C) 13 (D) 81

Q9 What is the difference between remainder when 2^{510} is divided by 33 and 31?

(A) 1 (B) 15

(C) 18 (D) None of these

Q10 Find the remainder when $(12^7 + 1)$ is divided by 11.

(A) 0 (B) 1

(C) 2 (D) 5

Q11 Let N be the least number which leaves remainder 7 when divided by 8, 11 and 12. If N is also divisible by 47, then find the value of N.

Q12 Find the number of numbers between 100 and 500 which when divided by 13 leaves remainder 3 and when divided by 8 leaves remainder 5.

Q13 $(16^3 + 3^2)^{1144}$ when divided by $(9^3 + 15^3)$ leaves remainder.

(A) 27 (B) 256

(C) 729 (D) 1

Q14 $\left[(1324)^{662} + (662)^{322}\right]$ when divided by 100 leaves remainder

(A) 20 (B) 76

(C) 98 (D) 0

Q15 Find the remainder when $\left[(1116)^{1120} + (4449)^{4440}\right]$ is divided by 7.

(A) 3 (B) 4

(C) 5 (D) 0

Q16

What is the remainder when 7^{50} is divided by $\left(14^3 - 7^3 - 1^3\right)$?

Q17 Find the remainder when 149! Is divided by 151?

Q18 Find the remainder when 31! is divided by 3^{14}.

Q19 What is the remainder when $7^{96} - 5^{96}$ is divided by 4?

(A) 0 (B) 1
(C) 2 (D) 3

Q20 Find the remainder when 2^{630} is divided by 61.

(A) 0 (B) 1
(C) 60 (D) 2

Q21 Find the remainder when 16721731592617 is divided by 625.

(A) 617 (B) 117
(C) 100 (D) 93

Q22 What is the remainder when 383^{388} is divided by 389?

(A) 0 (B) 113
(C) 1 (D) 388

Q23 Find the remainder when $\left(1^2 + 2^2 + 3^2 + \ldots\ldots + 97^2\right)$ is divided by 65.

Q24 What is the remainder when $\left(7^{111} + 11^{111}\right)$ is divisible by 18?

(A) 6 (B) 0
(C) 17 (D) 15

Q25 $3^{11} + 3^{12} + 3^{13} + 3^{14}$ when divided by 13, leaves remainder.

(A) 9 (B) 11
(C) 2 (D) 1

Q26 Find the remainder when $3^{10} + 8^{14}$ is divided by 10.

Q27 What is the digit at the hundredths place of the number $(375)^{60}$?

(A) 1 (B) 2
(C) 5 (D) 6

Q28 Find the remainder when $725^{113^{56}}$ is divided by 11

(A) 10 (B) 7
(C) 5 (D) 3

Q29 What is the remainder when 44! is divided by 47?

(A) 0 (B) 13
(C) 23 (D) 46

Q30 17^{130} when divided by 131 gives remainder.

(A) 9 (B) 11
(C) 2 (D) 1

Answer Key

Q1	(A)
Q2	(C)
Q3	(B)
Q4	(C)
Q5	(D)
Q6	(B)
Q7	(C)
Q8	(A)
Q9	(D)
Q10	(C)
Q11	799
Q12	4
Q13	(D)
Q14	(A)
Q15	(C)
Q16	49
Q17	1
Q18	0
Q19	(A)
Q20	(C)
Q21	(B)
Q22	(C)
Q23	0
Q24	(B)
Q25	(A)
Q26	0
Q27	(D)
Q28	(A)
Q29	(C)
Q30	(D)

Hints & Solutions

Q1 Text Solution:

$\frac{196^{512}}{13}$

$= \frac{(14)^{2\times512}}{13}$

$= \frac{(14)^{1024}}{13}$

$= \frac{(13+1)^{1024}}{13}$

$\xrightarrow{R} 1$ ($\xrightarrow{R}$Remainder theorem transformation)

Q2 Text Solution:

We know that,

$\frac{A^{P-1}}{P} \xrightarrow{R} 1$

(P is a prime number, and A should not be a multiple of P)

So, $\frac{31^{82}}{83} = \frac{31^{83-1}}{83} \xrightarrow{R} 1$

Ans. C

Q3 Text Solution:

$\frac{(12\times12)^{1392}}{11\times12} \xrightarrow{R} \frac{(12)^{1392}}{11}$

$\xrightarrow{R} 1$

So, actual remainder = 12

Ans. B

Q4 Text Solution:

We have to actually find the remainder of the given expression when divided by 100

So, $\frac{36\times41\times96\times98\times7}{100}$

$= \frac{9\times41\times96\times98\times7}{25}$

$\xrightarrow{R} \frac{9\times16\times21\times23\times7}{25}$

$= \frac{144\times483\times7}{25}$

$\xrightarrow{R} \frac{19\times8\times7}{25}$

$\xrightarrow{R} \frac{2\times7}{25}$

$\xrightarrow{R} 14$

But the actual remainder = (14 × 4) = 56

Ans. C

Q5 Text Solution:

When p is a prime number, then

$\frac{(p-1)!}{p} \xrightarrow{R} (p-1)$

So, $\frac{16!}{17} = \frac{(17-1)!}{17}$

$\xrightarrow{R} (17-1) = 16$

Ans. D

Q6 Text Solution:

Applying Wilson's Theorem,

$\frac{(p-3)!}{p} \xrightarrow{R} \frac{p-1}{2}$

(Where p is a prime number)

So, $\frac{38!}{41} = \frac{(41-3)!}{41}$

$\xrightarrow{R} \frac{41-1}{2}$

$\xrightarrow{R} 20$

Ans. B

Q7 Text Solution:

Applying Wilson's Theorem,

$\frac{(p-2)!}{p} \xrightarrow{R} 1$(p is a prime number)

Now, $\frac{57!}{59} = \frac{(59-2)!}{59}$

$\xrightarrow{R} 1$

Ans. C

Q8 Text Solution:

52 = 13 × 4 (Co–prime numbers)

Now, $\frac{83^{114}}{13} \xrightarrow{R} \frac{5^{114}}{13} \xrightarrow{R} \frac{5^{6x}}{13} \xrightarrow{R} 1$

and $\frac{83^{114}}{4} \xrightarrow{R} \frac{(-1)^{114}}{4} \xrightarrow{R} 1$

So, actual remainder is 1.

Ans. A

Q9 Text Solution:

$\frac{2^{510}}{33} = \frac{(2^5)^{102}}{33} = \frac{(32)^{102}}{33} \Rightarrow R = 1$

and $\frac{2^{510}}{31} = \frac{(2^5)^{102}}{31} = \frac{(32)^{102}}{31} \Rightarrow R = 1$

So, the difference = 0

Ans. D

Q10 Text Solution:

$\frac{(12^7+1)}{11}$

12^7 when divided by 11 gives remainder 1.

So, actual remainder = 2

Ans. C

Q11 Text Solution:

LCM of (8, 11 and 12) = 264

So, N can be = (264 + 7) = 271

But 271 is not divisible by 47.

Again (264 × 2 + 7) = 535 (Doesn't satisfy)

Then, N = (264 × 3 + 7) = 799

And 799 is divisible by 47. Hence 799 is the answer

Q12 Text Solution:

Number is of type → 13m + 3 = 8n + 5 (m, n ∈ N)

At n = 3, 29 = 13m + 3 or m = an integer.

Least such number = LCM of (13,8) + 29

= 104 + 29

= 133

So all such three digits numbers less than 500 are :

= [(104 × 2) + 29], [(104 × 3) + 29] and [(104 × 4) + 29]

Total numbers = 4

Ans. 4

Q13 Text Solution:

$\frac{(16^3+3^2)^{1144}}{(9^3+15^3)}$

$= \frac{(2^3+16^3+1)^{1144}}{(9^3+15^3)}$

(Because $2^3 + 16^3 = 9^3 + 15^3$)

$\xrightarrow{R}1$

Ans. D

Q14 Text Solution:

$\frac{(1324)^{662}+(662)^{322}}{100} \xrightarrow{R}$

Last two digit of $(1324)^{662}$ is same as $(24)^{662}$ which is equal to 76

Similarly, last two digits of $(662)^{322}$is same as $(12)^{322}$ which is 44

So, $\frac{76+44}{100} \xrightarrow{R} \frac{120}{100} \xrightarrow{R} 20$

Ans. A

Q15 Text Solution:

$\frac{(1116)^{1120}}{7} \rightarrow \frac{(3)^{1120}}{7}$ is same as $\frac{3^4}{7} = \frac{81}{7} \xrightarrow{R} 4$

and $\frac{(4449)^{4440}}{7} \rightarrow \frac{4^{4440}}{7} \xrightarrow{R} 1$

So, required remainder = 5

Ans. C

Q16 Text Solution:

$14^3 - 7^3 - 1^3 = 2400$

So, $\frac{7^{50}}{2400} = \frac{7^{48} \times 7^2}{2400}$

$= \frac{(7^4)^{12} \times 49}{2400}$

$\xrightarrow{R} 1 \times 49$

Or remainder = 49

Ans. 49

Q17 Text Solution:

According to Wilson's theorem,

If p is prime, (p–1)! + 1 must be multiple of p.

So, we know that Rem (150! /151) = –1

Therefore we have,

150! = 151k + 150 where 'k' is an integer

149! × 150 = 151k + 150

Thus we can conclude that 'k' must be a multiple of 150

Dividing both the sides of the equation with 150, we have

149! = 151 (an integer) + 1

Therefore, the remainder when 149! Is divided by 151 is 1.

Q18 Text Solution:

Maximum power of 3 in 31!

$= \left[\frac{31}{3}\right] + \left[\frac{31}{9}\right] + \left[\frac{31}{27}\right]$

= (10 + 3 + 1)

= 14

So, 31! is completely divisible by 3^{14}.

Ans. 0

Q19 Text Solution:

$\frac{7^{96}-5^{96}}{4}$

$=\frac{(7^3)^{32}-(5^3)^{32}}{4}$

$\rightarrow\frac{(-1)^{32}-(1)^{32}}{4}$

$\xrightarrow{R}0$

Ans. A

Q20 Text Solution:

$\frac{2^{630}}{61}=\frac{(2^6)^{105}}{61}\rightarrow\frac{(3)^{105}}{61}$

$=\frac{(243)^{105}}{61}\rightarrow\frac{(-1)^{105}}{61}\xrightarrow{R}60$

Ans. C

Q21 Text Solution:

The remainder of any number divided by 625 is the remainder when last 4 digits is divided by 625.

So, $\frac{2617}{625}\rightarrow117$

Ans. B

Q22 Text Solution:

$\frac{383^{388}}{389}$

$=\frac{383^{389-1}}{389}$

$\xrightarrow{R}1$

$\frac{A^{P-1}}{P}\xrightarrow{R}1$

(P is a prime number and A should not be a multiple of P)

Ans. C

Q23 Text Solution:

$1^2+2^2+\ \ldots\ldots\ +n^2$

$=\frac{n(n+1)(2n+1)}{6}$

Here, n = 97,

So, $Sum=\frac{97\times98\times195}{6}$

Now, $\frac{\frac{97\times98\times195}{6}}{65}$

$\xrightarrow{R}0$

Ans. 0

Q24 Text Solution:

We know that, (a^n+b^n) when divided by (a + b) leaves remainder 0 (Given n is odd)

So, $\frac{7^{111}+11^{111}}{18}\xrightarrow{R}0$

Ans. B

Q25 Text Solution:

$\frac{3^{11}+3^{12}+3^{13}+3^{14}}{13}$

$=\frac{3^{11}(1+3+3^2+3^3)}{13}$

$=\frac{40\times3^{11}}{13}$

$\xrightarrow{R}\frac{1\times9\times27^3}{13}$

$\xrightarrow{R}9$

Ans. A

Q26 Text Solution:

$\frac{3^{10}+81^4}{10}$

$=\frac{3^{10}(1+3^6)}{10}$

$\xrightarrow{R}0$

Ans. 0

Q27 Text Solution:

To get the hundredths place number, we have to divide the given number by 1000.

So, $\frac{(375)^{60}}{1000}=\frac{(125\times3)^{60}}{1000}$

$=\frac{125^{60}\times3^{60}}{1000}$

$=\frac{5^{180}\times3^{60}}{1000}$

$=\frac{125\times5^{177}\times3^{60}}{1000}$

$=\frac{5^{177}\times3^{60}}{8}$

$\rightarrow\frac{5\times(25)^{88}\times9^{30}}{8}$

$\xrightarrow{R}5$

This means last 3 digit number = 5 × 125 = 625

Digit at hundreds place = 6

Ans. D

Q28 Text Solution:

$\frac{725^{113^{56}}}{11} = \frac{(726-1)^{113^{56}}}{11}$

$\rightarrow \frac{(-1)}{11}$

$\xrightarrow{R}$ 10

Ans. A

Q29 Text Solution:

Using Wilson's Theorem,

$\frac{(p-3)!}{p} \xrightarrow{R} \frac{p-1}{2}$ (p is a prime number)

So, $\frac{(47-3)!}{47} \xrightarrow{R} \frac{47-1}{2}$ = 23

Ans. C

Q30 Text Solution:

Using Fermat's little Theorem,

$\frac{a^{p-1}}{p} \xrightarrow{R}$ 1

(p is a prime number and a should not be a multiple of p)

So, $\frac{17^{130}}{131}$

$= \frac{17^{131-1}}{131}$

$\xrightarrow{R}$ 1

Ans. 1