

NUMBER SYSTEM

(Remainder Theorem)

NO. OF QUESTIONS	MAXIMUM DAYS	CLASS DURATION
10 Questions	1 DAY	2 HOURS

find k

$$\begin{array}{r} 2094 \\ 2 \\ \hline 7 \end{array}$$

Handwritten mathematical notes showing calculations for the parity of a permutation.

Top Calculation (Blue and Red):

$$\frac{(2)(3)}{(2 \times 2 \times 2 \times 2 \times 2)} = \frac{(-1)^3}{3}$$

Result: $R = -1$ ✓

Bottom Calculation (Black and Pink):

$$\frac{(4)(2)}{(2 \times 2 \times 2 \times 2)} = \frac{(-1)^4}{2}$$

Result: $R = +1$ ✓

Legend (Bottom Right):

- $(-1)^{\text{even}} = +1$
- $(-1)^{\text{odd}} = -1$

Connections:

- A pink wavy line connects the top calculation to the bottom calculation.
- An orange arrow points from the top calculation to the legend.
- A pink arrow points from the bottom calculation to the legend.

$$\frac{4^4}{2^3} = \frac{\overset{\textcircled{+1}}{4} \times \overset{\textcircled{+1}}{4} \times \overset{\textcircled{+1}}{4} \times \overset{\textcircled{+1}}{4}}{2^3} \Rightarrow \frac{(+1)^4}{2^3} \quad \textcircled{R = +1}$$

OR

$$\frac{4^5}{2^3} = \frac{\overset{\textcircled{+1}}{4} \times \overset{\textcircled{+1}}{4} \times \overset{\textcircled{+1}}{4} \times \overset{\textcircled{+1}}{4} \times \overset{\textcircled{+1}}{4}}{2^3} = \frac{(+1)^5}{2^3} \quad \textcircled{R = +1}$$

$$\frac{p=0}{\infty}$$

$$R = +1$$

$$R = -1$$

$$\text{OR } \frac{N}{D}$$

$$= \frac{35}{9}$$

$$R = -1$$

$$\frac{N}{D}$$

$$= \frac{37}{9}$$

$$R = +1$$

$$\frac{10}{9}$$

When Remainder is 1/-1 ki power form

IF $\frac{a^n}{a+1}$

~~$R = ?$~~

&

$\frac{(a+1)^n}{a}$

$R = ?$

$R = +1$

If n — Even

or

n — odd

$R = 1$

~~$R = -1$~~

If n — even/odd

$R = 1$

CLASS EXERCISE

Find the remainder of :

1. $\frac{3^{2018}}{9}$

2. $\frac{3^{2019}}{9}$

(CSE 2021 Pre)

3. $\frac{35^{21}}{9}$

4. $\frac{64^{41}}{9}$

5. $\frac{9^{64}}{82}$

6. $\frac{8^{32}}{63}$

①

$$\frac{3^{2018}}{9}$$

$$= \frac{\cancel{3} \cdot 3^{2016}}{\cancel{9}}$$

②

$$\frac{3^{2019}}{9}$$

$$= \frac{\cancel{3} \cdot 3^{2017}}{\cancel{9}} \quad R=0$$

$$R=0$$

CLASS EXERCISE

Find the remainder of :

1. $\frac{3^{2018}}{9}$

2. $\frac{3^{2019}}{9}$

(CSE 2021 Pre)

3. $\frac{35^{21}}{9}$

4. $\frac{64^{41}}{9}$

5. $\frac{9^{64}}{82}$

6. $\frac{8^{32}}{63}$

③

$$\frac{35}{9}$$

$$\Rightarrow \frac{(-1)}{9}$$

$$R = -1$$

$$R = +8$$

Ans

②

$$\frac{64}{9}$$

$$= \frac{(+1)}{9}$$

$$R = +1$$

CLASS EXERCISE

Find the remainder of :

1. $\frac{3^{2018}}{9}$

2. $\frac{3^{2019}}{9}$

(CSE 2021 Pre)

3. $\frac{35^{21}}{9}$

4. $\frac{64^{41}}{9}$

5. $\frac{9^{64}}{82}$

6. $\frac{8^{32}}{63}$

5

$$(a^n)^m = a^{n \times m}$$

$$q' = 9$$

$$q^2 = 81$$

$$\frac{9^{64}}{82} \Rightarrow \frac{(9^2)^{32}}{82} = \frac{(-1)^{32}}{82}$$

$$R = +1$$

CLASS EXERCISE

Find the remainder of :

1. $\frac{2^{72}}{9}$

Ans 1

(SSC CGL Pre 2019)

2. $\frac{2^{73}}{9}$

Ans 2

(SSC CHSL Pre 2016)

3. $\frac{2^{63}}{9}$

Ans 8

(SSC CGL Pre 2016)

4. $\frac{3^{68}}{82}$

Ans 81

(UP SI, CHSL 2018)

$$\frac{2^{72}}{9}$$

$$= \frac{2^4}{9} = \frac{16}{9}$$

$$R = +1$$

$$\begin{aligned} 2^1 &= 2 \\ 2^2 &= 4 \\ 2^3 &= 8 \end{aligned}$$

CLASS EXERCISE

Find the remainder of :

1. $\frac{2^{72}}{9}$

Ans 1

(SSC CGL Pre 2019)

2. $\frac{2^{73}}{9}$

Ans 2

(SSC CHSL Pre 2016)

3. $\frac{2^{63}}{9}$

Ans 8

(SSC CGL Pre 2016)

4. $\frac{3^{68}}{82}$

Ans 81

(UP SI, CHSL 2018)

$$\frac{2^{73}}{9}$$

Handwritten notes for problem 2:

- Remainder of $2^1 \div 9$ is 2.
- Remainder of $2^2 \div 9$ is 4.
- Remainder of $2^3 \div 9$ is 8.
- Remainder of $2^4 \div 9$ is 7.
- Remainder of $2^5 \div 9$ is 5.
- Remainder of $2^6 \div 9$ is 3.
- Remainder of $2^7 \div 9$ is 6.
- Remainder of $2^8 \div 9$ is 4.
- Remainder of $2^9 \div 9$ is 2.
- Remainder of $2^{10} \div 9$ is 5.
- Remainder of $2^{11} \div 9$ is 7.
- Remainder of $2^{12} \div 9$ is 8.
- Remainder of $2^{13} \div 9$ is 1.
- Remainder of $2^{14} \div 9$ is 2.
- Remainder of $2^{15} \div 9$ is 4.
- Remainder of $2^{16} \div 9$ is 7.
- Remainder of $2^{17} \div 9$ is 5.
- Remainder of $2^{18} \div 9$ is 3.
- Remainder of $2^{19} \div 9$ is 6.
- Remainder of $2^{20} \div 9$ is 4.
- Remainder of $2^{21} \div 9$ is 2.
- Remainder of $2^{22} \div 9$ is 5.
- Remainder of $2^{23} \div 9$ is 7.
- Remainder of $2^{24} \div 9$ is 8.
- Remainder of $2^{25} \div 9$ is 1.
- Remainder of $2^{26} \div 9$ is 2.
- Remainder of $2^{27} \div 9$ is 4.
- Remainder of $2^{28} \div 9$ is 7.
- Remainder of $2^{29} \div 9$ is 5.
- Remainder of $2^{30} \div 9$ is 3.
- Remainder of $2^{31} \div 9$ is 6.
- Remainder of $2^{32} \div 9$ is 4.
- Remainder of $2^{33} \div 9$ is 2.
- Remainder of $2^{34} \div 9$ is 5.
- Remainder of $2^{35} \div 9$ is 7.
- Remainder of $2^{36} \div 9$ is 8.
- Remainder of $2^{37} \div 9$ is 1.
- Remainder of $2^{38} \div 9$ is 2.
- Remainder of $2^{39} \div 9$ is 4.
- Remainder of $2^{40} \div 9$ is 7.
- Remainder of $2^{41} \div 9$ is 5.
- Remainder of $2^{42} \div 9$ is 3.
- Remainder of $2^{43} \div 9$ is 6.
- Remainder of $2^{44} \div 9$ is 4.
- Remainder of $2^{45} \div 9$ is 2.
- Remainder of $2^{46} \div 9$ is 5.
- Remainder of $2^{47} \div 9$ is 7.
- Remainder of $2^{48} \div 9$ is 8.
- Remainder of $2^{49} \div 9$ is 1.
- Remainder of $2^{50} \div 9$ is 2.
- Remainder of $2^{51} \div 9$ is 4.
- Remainder of $2^{52} \div 9$ is 7.
- Remainder of $2^{53} \div 9$ is 5.
- Remainder of $2^{54} \div 9$ is 3.
- Remainder of $2^{55} \div 9$ is 6.
- Remainder of $2^{56} \div 9$ is 4.
- Remainder of $2^{57} \div 9$ is 2.
- Remainder of $2^{58} \div 9$ is 5.
- Remainder of $2^{59} \div 9$ is 7.
- Remainder of $2^{60} \div 9$ is 8.
- Remainder of $2^{61} \div 9$ is 1.
- Remainder of $2^{62} \div 9$ is 2.
- Remainder of $2^{63} \div 9$ is 4.
- Remainder of $2^{64} \div 9$ is 7.
- Remainder of $2^{65} \div 9$ is 5.
- Remainder of $2^{66} \div 9$ is 3.
- Remainder of $2^{67} \div 9$ is 6.
- Remainder of $2^{68} \div 9$ is 4.
- Remainder of $2^{69} \div 9$ is 2.
- Remainder of $2^{70} \div 9$ is 5.
- Remainder of $2^{71} \div 9$ is 7.
- Remainder of $2^{72} \div 9$ is 8.
- Remainder of $2^{73} \div 9$ is 1.

Handwritten note for problem 4:

$$R = 1 \times 2$$

CLASS EXERCISE

Find the remainder of :

1. $\frac{2^{72}}{9}$

Ans 1

(SSC CGL Pre 2019)

2. $\frac{2^{73}}{9}$

Ans 2

(SSC CHSL Pre 2016)

3. $\frac{2^{63}}{9}$

Ans 8

(SSC CGL Pre 2016)

4. $\frac{3^{68}}{82}$

Ans 81

(UP SI, CHSL 2018)

2^3

$\frac{2^{63}}{9}$

$R = -1$
 $(+8)$

$(-1)^{21}$
 $\frac{2^3}{9}$

CLASS EXERCISE

Find the remainder of :

1. $\frac{2^{72}}{9}$

Ans 1

(SSC CGL Pre 2019)

2. $\frac{2^{73}}{9}$

Ans 2

(SSC CHSL Pre 2016)

3. $\frac{2^{63}}{9}$

Ans 8

(SSC CGL Pre 2016)

4. $\frac{3^{68}}{82}$

Ans 81

(UP SI, CHSL 2018)

$$\begin{array}{l} 3^1 = 3 \\ 3^2 = 9 \\ 3^3 = 27 \\ 3^4 = 81 \end{array}$$

$$\frac{3^{68}}{82}$$

$$\begin{array}{r} 17 \\ 82 \overline{) 1414} \\ \underline{1414} \\ 0 \end{array}$$
$$R = \frac{-1}{+81}$$

CLASS EXERCISE

5. $\frac{3^{4321}}{80}$

Ans 3

(SSC CGL Mains 2015)

6. $\frac{7^{400}}{400}$

Ans 1

(SSC CGL Pre 2019)

7. $\frac{4^{48}}{33}$

Ans 31

(SSC CGL Pre 2018)

8. $\frac{2^{99}}{16}$

Ans 0

$3^1 = 3$

$3^2 = 9$

$3^3 = 27$

$3^4 = 81$

⑤

①

$\frac{4321}{3}$
80

$\frac{1080}{4321}$
4

$(+1)$
 1080
 $(3^4) \times 3^1$
80

$R = 1 \times 3$

CLASS EXERCISE

5. $\frac{3^{4321}}{80}$

Ans 3

(SSC CGL Mains 2015)

6. $\frac{7^{400}}{400}$

Ans 1

(SSC CGL Pre 2019)

7. $\frac{4^{48}}{33}$

Ans 31

(SSC CGL Pre 2018)

8. $\frac{2^{99}}{16}$

Ans 0

$7^1 = 7$
 $7^2 = 49$
 $7^3 = 343$

$7^4 = 2401$

7
 $\frac{7}{400}$

$\frac{[7^4]^{100}}{400}$
 $R \approx +1$

CLASS EXERCISE

5. $\frac{3^{4321}}{80}$

Ans 3

(SSC CGL Mains 2015)

6. $\frac{7^{400}}{400}$

Ans 1

(SSC CGL Pre 2019)

7. $\frac{4^{48}}{33}$

Ans 31

(SSC CGL Pre 2018)

8. $\frac{2^{99}}{16}$

Ans 0

$2^5 = 32$

$$\frac{4^{48}}{33} = \frac{2^{96}}{33} = \frac{2^{19} \cdot 2^1}{33} = \frac{2^{19} \cdot 2}{33} = \frac{2^{20}}{33}$$

$\Rightarrow$

$R = -2 \text{ or } 31$

CLASS EXERCISE

5. $\frac{3^{4321}}{80}$

Ans 3

(SSC CGL Mains 2015)

6. $\frac{7^{400}}{400}$

Ans 1

(SSC CGL Pre 2019)

7. $\frac{4^{48}}{33}$

Ans 31

(SSC CGL Pre 2018)

8. $\frac{2^{99}}{16}$

Ans 0

$$2^1 = 2$$

$$2^2 = 4$$

$$2^3 = 8$$

$$2^4 = 16$$

$$\frac{2^{99}}{16} =$$

$$\frac{2^4 \times 2^{95}}{16}$$

$$R=0$$

CLASS EXERCISE

9. $\frac{2^{99}}{10}$

Ans 8

(SSC CGL Mains 2016)

10. $\frac{5^{500}}{500}$

Ans 125

(SSC CGL Mains 2015)

H.W

11. $\frac{35^{40}}{100}$

Ans 25

(SSC CGL Mains 2014)

12. $\frac{17^{200}}{18}$

Ans 1

(SSC CGL 2016 , CHSL , MTS 2018)

CLASS EXERCISE

13. $\frac{3^{21}}{5}$

Ans 3

(SSC CHSL 2016)

14. $\frac{2^{31}}{5}$

Ans 3

μ.ω