

NUMBER SYSTEM

(Remainder Theorem)

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

Totient's Theorem

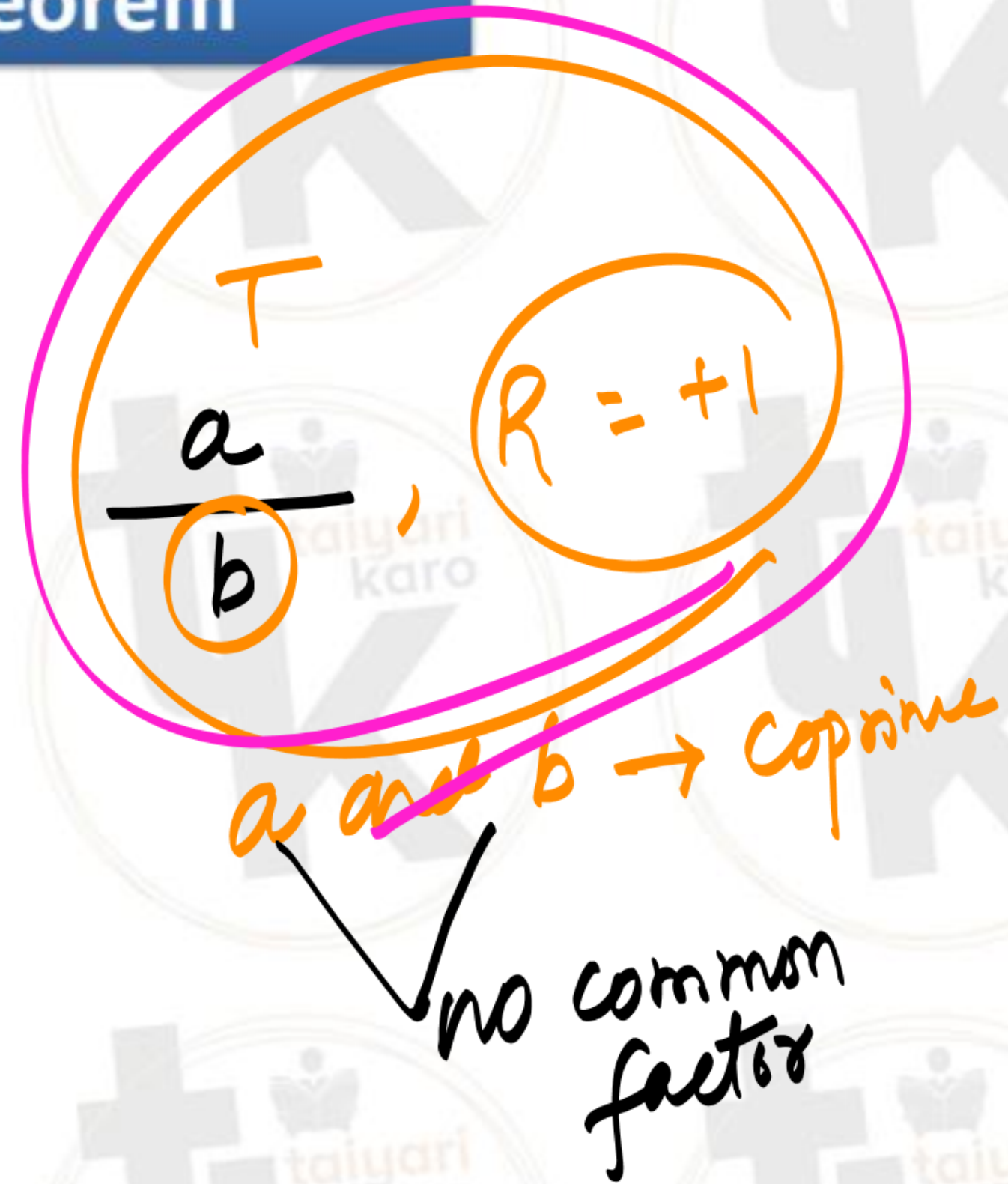
If $\frac{a^T}{b}$ then $R = +1$

where

a & b are co-prime

and, T is the totient of b.

How to find Totient ??



How to find Tient value:-

T(12)

2	12
2	6
3	3
	1

$$12 = 2^2 \times 3$$

$$T(12) = 12 \times \left(1 - \frac{1}{2}\right) \left(1 - \frac{1}{3}\right)$$

$= 12 \times \frac{1}{2} \times \frac{2}{3}$

$= 4$

$T(\Omega)$

$$S_0 = \frac{25 \times 2}{2 \times 5^2}$$

$T(\Omega) = S_0 \times \left(1 - \frac{1}{2}\right) \left(1 - \frac{1}{5}\right)$

$\downarrow$ $\downarrow$ $\downarrow$

$\frac{1}{2}$ $\times$ $\frac{1}{5}$

#

$90 = 2^4$

$80 = 32$

$240 = 64$

$$90 = 9 \times 2 \times 5$$

$$= 3^2 \times 2 \times 5$$

$$T(90) = 90 \times \left(1 - \frac{1}{3}\right) \left(1 - \frac{1}{2}\right) \left(1 - \frac{1}{5}\right)$$

$$3 \times \frac{90 \times 2}{3} \times \frac{1}{2} \times \frac{4}{5}$$

$$= (24)$$

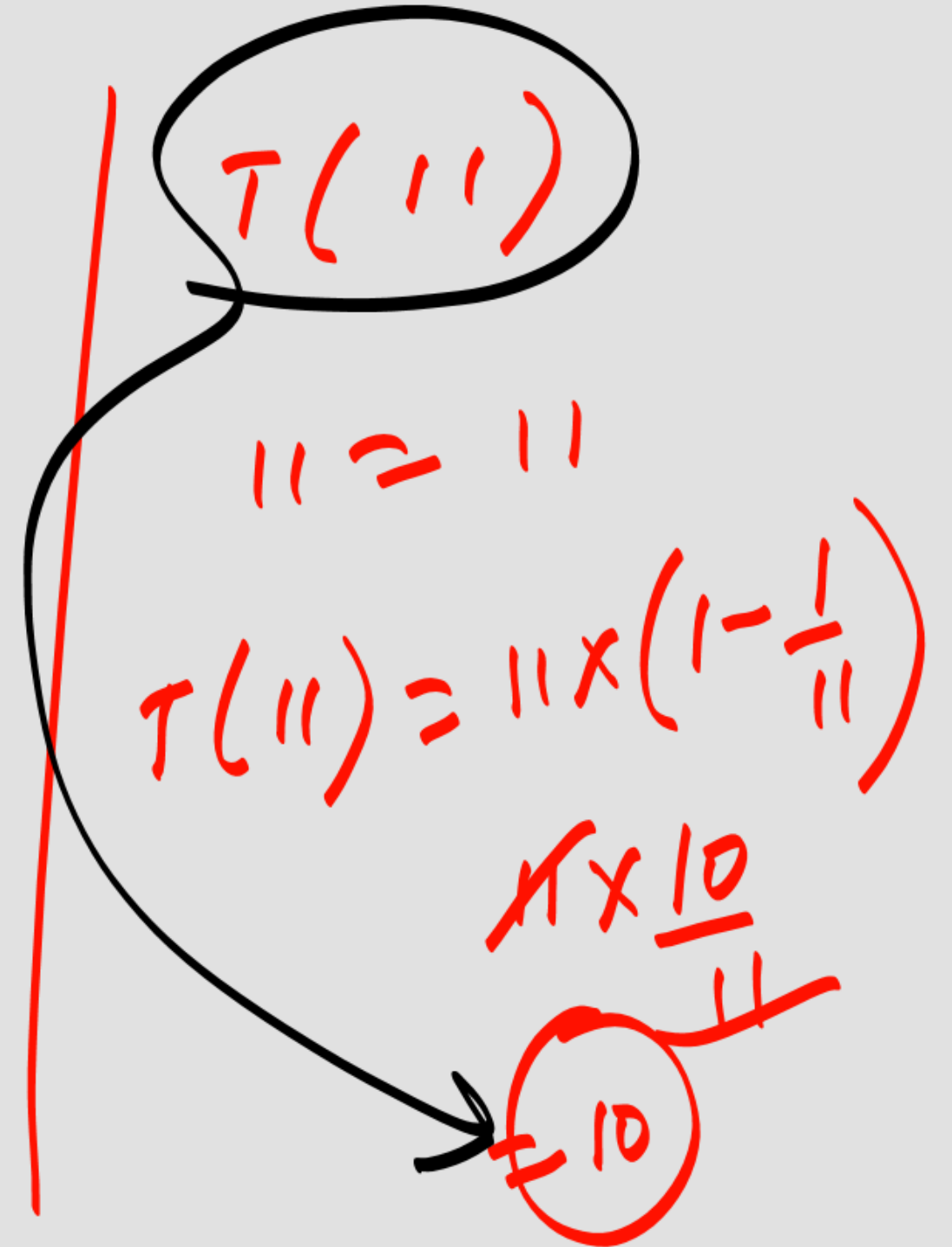
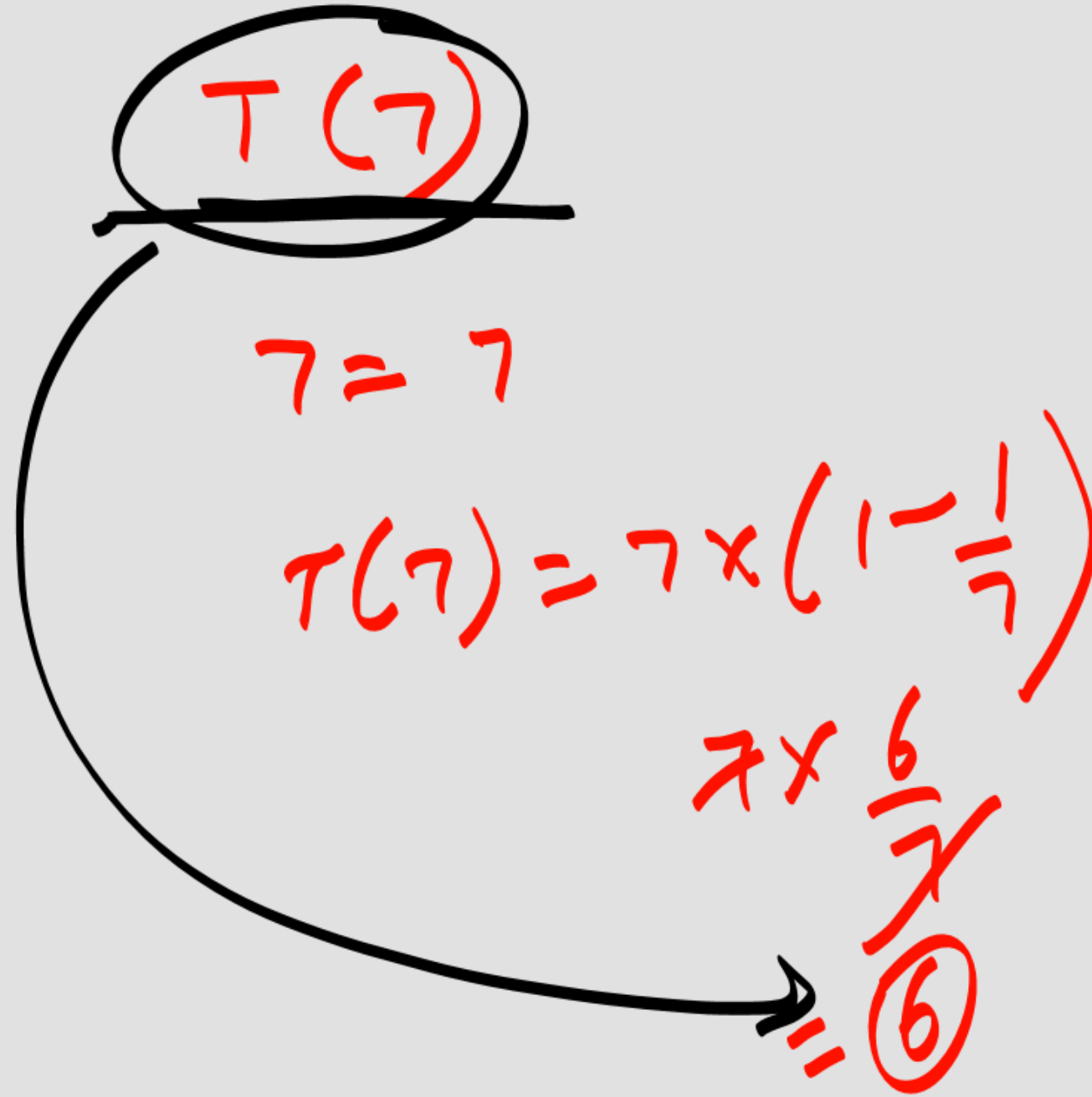
$$80 = \frac{8 \times 2 \times 5}{2^4 \times 5}$$

$$T(80) = 80 \times \left(1 - \frac{1}{2}\right) \left(1 - \frac{1}{5}\right)$$

$$= \frac{8 \times 80 \times 1}{2} \times \frac{4}{5}$$

$$(32)$$

#

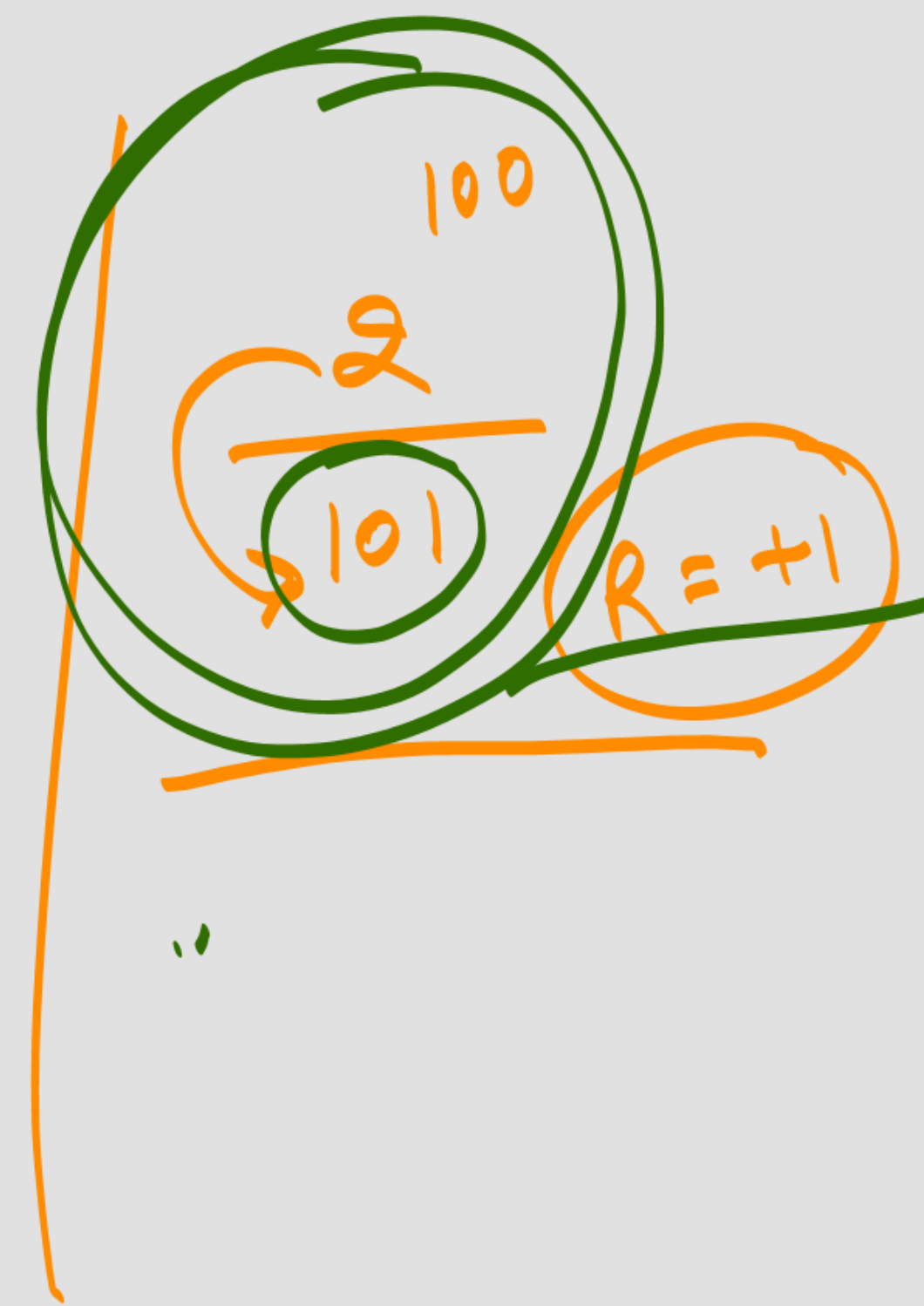
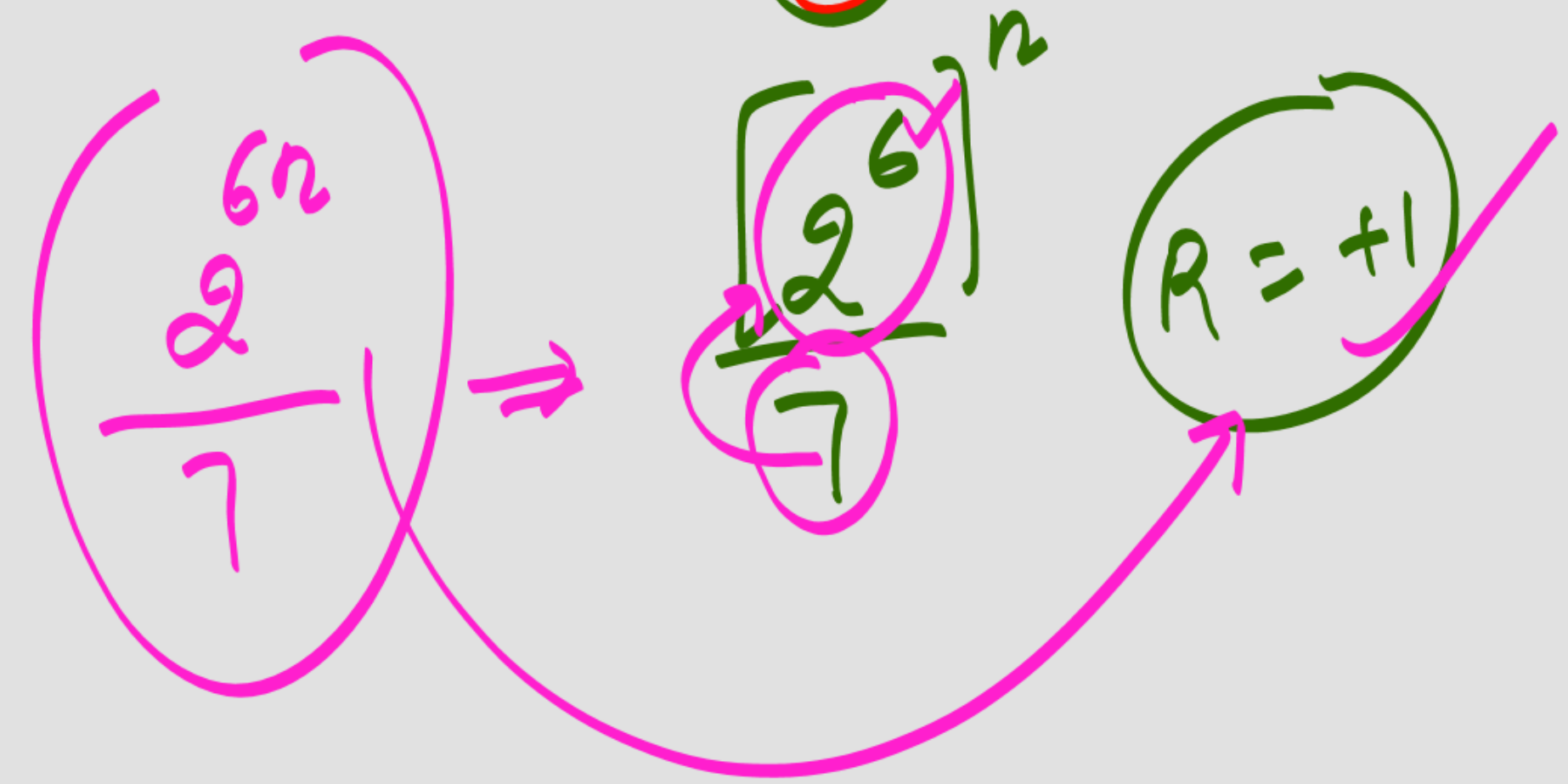
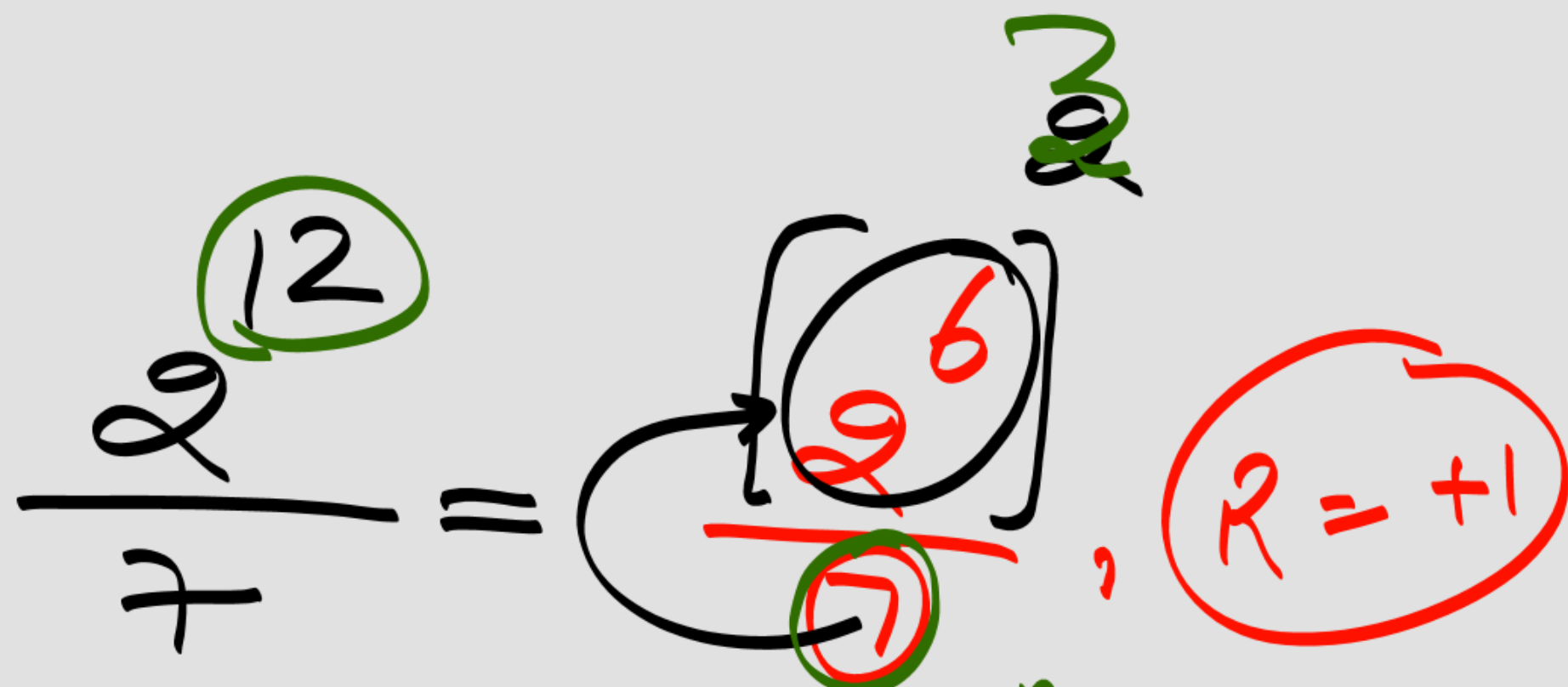


if $n \rightarrow \text{prime}$
 $T(n) = n - 1$

$$\frac{a}{b}^T, R=+1$$

$\Rightarrow a, b \rightarrow \text{coprime}$

$$\Rightarrow T = T(b)$$



$$\frac{2^{10}}{(11)} \quad R = +1$$

$$\frac{17}{(2)} \quad R = +1 \quad \rightarrow 1 \times 12$$

$n \leftarrow \text{even/odd}$

$$\frac{a}{b}^T$$

$$R = +1$$

$$\begin{array}{r} 10^2 \\ \hline 102 \\ \text{---} \\ 11 \end{array}$$

$$\begin{array}{r} R = +1 \\ \hline R \end{array}$$

CLASS EXERCISE

Find the remainder of :

1. $\frac{2^{50}}{7}$ (SSC CHSL 2016)

2. $\frac{3^{102}}{11}$ (SSC 2018)

3. $\frac{19^{561}}{29}$ (SSC CGL Mains 2017)

4. $\frac{19^{402}}{41}$ (CHSL 2016)

5. $\frac{5^{2414}}{13}$ 6. $\frac{6001^{6001} + 6002^{6002}}{7}$ (SSC Mains 2015, 2017, 2018)

$\Rightarrow 9 \times 8 \times 2$

$R = +4$

$R = +1$

$\frac{2}{7}$

50

$\frac{2}{7}$

6

$R = +1$

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Find the remainder of :

1. $\frac{2^{50}}{7}$ (SSC CHSL 2016)

2. $\frac{3^{102}}{11}$ (SSC 2018)

3. $\frac{19^{561}}{29}$ (SSC CGL Mains 2017)

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5. $\frac{5^{2414}}{13}$

6. $\frac{6001^{6001} + 6002^{6002}}{7}$ (SSC Mains 2015, 2017, 2018)

9

33

12

+1

12 x 201
S 12 x 201
x S 2

13

P = 12
Ans

$$\begin{array}{r} 2414 \\ 5 \\ \hline 13 \end{array} \times 201$$

12

$$\frac{5}{13}, R = 1$$

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Find the remainder of :

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5. $\frac{5^{2414}}{13}$

6. $\frac{6001^{6001} + 6002^{6002}}{7}$ (SSC Mains 2015 , 2017 , 2018)

(+1)

40x10

x 19²

19
41

361 -8

R = -8 + 33

41x9
369

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Find the remainder of :

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2. $\frac{3^{102}}{11}$ (SSC 2018)

3. $\frac{19^{561}}{29}$ (SSC CGL Mains 2017)

4. $\frac{19^{402}}{41}$ (CHSL 2016)

5. $\frac{5^{2414}}{13}$

6. $\frac{6001^{6001} + 6002^{6002}}{7}$ (JSC Mains 2015, 2017, 2018)

+2

+2

$R = +4$ Ans

+9

6002

✗ 6002 ✓

(+1)

$$R = \frac{+9}{7}$$

$P = xQ$

Handwritten diagram illustrating the calculation of the number of nodes in a binary tree. The diagram shows a central circle containing the text "6001" and "6 x 1000". An arrow points from "6001" to a circled "7". Another arrow points from "6 x 1000" to a circled "2". A circled "R=2" is at the bottom. The text "6001" is written in red at the top left, and "6001" is written in blue at the top right. A blue line is drawn across the circle.

CLASS EXERCISE

Find the remainder of :

7. $\frac{2^{100}}{101}$ (SSC CGL Mains 2016)

8. $\frac{3^{302}}{101}$ (SSC CGL Mains 2018)

9. $\frac{7^{2426}}{90}$ (SSC CGL Mains 2017)

10. $\frac{5^{74}}{73}$ (SSC CGL Mains 2016)

Handwritten solution for problem 9:

$$\begin{array}{r} 2426 \\ 7 \overline{) 90} \end{array}$$

$+1$

24×101

$7 \overline{) 90}$

2

$+49$

$R = .49$ Ans

→ Lem ①
→ Hcf ①
→ Relation Lem Hcf ①
→ unit digit
Ten's digit ①

Number ①
→ Number ①
→ Divisibility Rule ②
→ Factors Concept ①
→ Remainder Theorem ④
→ ① Trailing Zero ✓
→ ① Division / Successive Division ✓

CLASS EXERCISE

Find the remainder of :

1. $\frac{32^{32^{32}}}{7}$ Ans 4 (SSC MAINS)

2. $\frac{4^{96}}{6}$ Ans 4

3. $\frac{37^{100}}{7}$ (CGL 2019)

4. $\frac{15^{23} + 23^{23}}{19}$ (CGL Mains 2017) Ans 0

5. $\frac{(32^{32})^{32}}{7}$ Ans 4 (CGL Mains 2017)

6. $\frac{13^{22^{42}}}{9}$ Ans 4

CLASS EXERCISE

7. $\frac{25^{26} 27}{11}$ Ans 3 (SSC 2018)

8. $\frac{(25^{26})^{27}}{11}$ (SSC MAINS 2017)

9. $\frac{35^{23} 23}{16}$ Ans 11

10. $\frac{29^{67} 23}{25}$ Ans 14 (SSC MAINS 2019)

11. $\frac{11^{77}}{7}$ Ans 2 (CHSL 2018)

12. $\frac{5^{135}}{7}$ Ans 6

CLASS EXERCISE

Find the remainder of :

13. $\frac{143^{321}}{5}$ Ans 3 (SSC CGL Mains 2016)

CLASS EXERCISE

Find the remainder of :

1.
$$\frac{123456789101112131415}{16}$$

2.
$$\frac{123456 \dots 37 \text{ digits}}{8}$$

3.
$$\frac{123456 \dots 51 \text{ digits}}{16}$$

4.
$$\frac{123456 \dots 24 \text{ digits}}{16}$$

CLASS EXERCISE

Find the remainder of :

1.
$$\frac{10^1 + 10^2 + 10^3 + 10^4 + \dots + 10^{100}}{6}$$

Ans 4

2.
$$\frac{10^1 + 10^2 + 10^3 + 10^4 + \dots + 10^{11}}{6}$$

Ans 2

3.
$$\frac{79^{37} - 3}{80}$$

Ans 76

4. if $(9^6 - 11)$ is divided by 8 then remainder will be ? **Ans 6**

CLASS EXERCISE

Find the remainder of (Based on Divisibility of 3,7,9,11&13):

1. $\frac{222222222222 \dots 33 \text{ times}}{13}$

2. $\frac{55555555 \dots 45 \text{ times}}{7}$

Note : Any digit repeated 6 times always divisible by each of (3,7,9,11 and 13).