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GATE & PSU's

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Published by

Engineers Institute of India

www.engineersinstitute.com

Engineers Institute of India

28-B/7, Jia Sarai, Near IIT Hauz Khas New Delhi-110016

Tel: 011-26514888

Publication Link: www.engineersinstitute.com/publication

ISBN: 978-93-5137-755-9

Price: Rs. 350.00

A word to the students

Er. R.K. Rajesh
(DIRECTOR)

Knowledge of Reasoning & General Aptitude is very important to score good marks into examinations like GATE, SSC, Public sector undertakings & many promising and prestigious competitions. Preparation for Reasoning & General Aptitude can't be underestimate as it is compulsory to qualify for many exams; this may contribute your score upto top ranks with final selections. You need to plan your study as per recent examination pattern, which help you to understand the core area to focus in more details. This book will definitely help an average student to understand the basic fundamentals and improve their strategies to attempt questions related to Reasoning & General Aptitude section.

In my opinion, syllabus is quite large in Reasoning & General Aptitude, so selective preparations with thorough understanding of concepts are very important. Practice of quality questions is best way to deal & qualify such exams. Competitive examinations rigorously tests candidates' overall knowledge & understanding of concepts, ability to apply their knowledge and personality level by screening them through various stages. A candidate is supposed to smartly deal with the syllabus not just mugging up concepts. Thorough understanding with critical analysis of topics and ability to express clearly are some of the pre-requisites to crack this exam. The syllabus and questioning pattern has remained pretty much the same over the years.

We at **Engineers Institute of India-E.i.i** have consistently provided rigorous classes and quality contents to students over the nation in successfully accomplishing their dreams. We believe in providing exam-oriented contents with regular updates, so that our students stay ahead in the competition. The faculties at EII are team of experienced professionals who have guided thousands of aspirants over the years. Many current and previous year toppers associate with us for contributing towards our goal of providing quality education and share their success with the future aspirants. Our results speak for themselves. Past students of EII are currently working in various reputed departments and PSU's and pursuing higher specializations.

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UNIT-I

NUMBER & FRACTIONS

Numeral: In Hindu numeral Arabic system, we can use ten symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 called Digits to represent any number

A group of digits, denoting A number is called A numeral

Place Value

Place value of 2 is (2 × 1) = 2

Place value of 3 is (3 × 10) = 30

Place value of 1 is (1 × 100) = 100 and so on

Place value of 6 is $(6 \times 10^8) = 6000\,00000$

Face Value: The face value of a digit in a numeral is the value of the digit. Itself at whatever place. It may be in the above numeral the face value of 2 is 2. The face value of 3 is 3 and so on.

Types of Numbers

1. Natural Numbers

Counting numbers 1, 2, 3, 4, 5 ………. Are called natural number.

2. Whole Number

All counting number together with zero from the set of whole numbers. Thus

(*i*) 0 is the only whole number which is not A natural number

(*ii*) Every natural number is a whole number

3. Integers: All natural numbers, 0 and negatives of counting numbers (–3, –2, –1, 0, 1, 2, 3 ……..) together from the set of integers

1. Positive integers 2. Negative integers

3. Non positive and non positive integers

4. Even Numbers

A number divisible by 2 is called an even numbers

5. Odd Number

A number not divisible by 1 is called an odd number 1, 3, 5, 7, 9.

6. Prime Number

A number greater than 1 is called an odd number 1, 3, 5, 7, 9, 11 etc.

Prime number up to 100 are 2, 3, 5, 11, 13, 17, 19, 23, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

(*ii*) Prime numbers greater than : Let *p* be given number greater than 100. To find out whether it is prime or not we use the following method.

(*iii*) Find a whole number nearly greater than the square root of *p*.

(*iv*) Prime numbers less than 14 are 2, 3, 5, 7, 11, 13

(*v*) 191 is not divisible by any of them. So, 191 is a prime number.

Composite Number

Numbers greater than 1 which are not prime are known as composite no., e.g. 4, 6, 8, 9, 10, 12.

(*i*) 1 is neither prime nor composite

(*ii*) 2 is the only even number which is prime

(*iii*) There are 25 prime numbers between 1 and 100

Test of Divisibility

1. Divisibility by 2

A number is divisible by 2. If its unit's digit is any of 0, 2, 4, 6, 8.

2. Divisibility by 3

A number is divisible by 3. If the sum of its digits is divisible by 3.

3. Divisibility by 4

A number is divisible by 4. If the number formed by the last two digits is divisible by 4.

4. Divisibility by 5

A number is divisible by 5. If its unit's digit is either 0 or 5. Thus, 20820 and 50345 are divisible by 5. While 30934 and 40946 are not.

Divisibility by 6

A number is divisible by 6. If its is divisible by both 2 and 3.

Divisibility by 8

A number is divisible by 8. If the number formed by the last three digits of the given number is divisible by 8.

Divisibility by 9

A number is divisible by 9. If the sum of its digits is divisible by 9.

(A) Multiplication by short cut methods

(*i*) $a * (b + c) = a \times b + a \times c$ (*ii*) $a(b - c) = ab - ac$

(B) Multiplication of a number by 5^n

Put *n* zeroes to the right of the multiplicand and divide. The no. so formed by 2^n

Division Algorithm or Euclidean Algorithm

If we divide A given number by another number. Then dividend = (Divisors × Quotient) + Remainder

Progression

Arithmetic Progression

*N*th term of this A.P.

$$T_n = a + (n-1)\,d$$

$$S_n = \frac{n}{2}[2a + (n-1)d] = \frac{n}{2}\text{[first term + last term]}$$

(A) $(1 + 2 + 3 + \ldots\ldots + n) = \frac{n(n+1)}{2}$ (B) $(1^2 + 2^2 + 3^2 + \ldots\ldots + n^2) = \frac{n(n+1)\,(2n+1)}{6}$

(C) $(1^3 + 2^3 + \ldots\ldots + n^3) = n^2\,\frac{(n+1)^2}{4}$

Geometrical Progression

In this G.P. = $T_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{(1-r)} \text{ when } r<1$$

$$S_n = \frac{a(r^n-1)}{r-1} \text{ when } r>1$$

Decimal Fractions

Fractions in which denominator are powers of 10 are known as decimal fractions

$$\frac{1}{100} = 1 \text{ hundredth} = .01$$

Conversion of a Decimal into Vulgar fractions

Put 1 in the denominator under the decimal point and annex with it as many zeroes as is the number of digits. After the decimal point. Now remove the decimal point and reduce the fraction to its lowest terms

Thus $0.25 = \frac{25}{100} = \frac{1}{4}$

Recurring Decimal

If in a decimal fraction, A figure or a set of figures is repeated continuously. Then such A number is called A recurring decimal. In a recurring decimal. If a single figure is repeated. Then it is expressed by putting A dot on it. If a set of figures is repeated it is expressed by putting A bar on the set

$$\frac{1}{3} = 0.3333 = 0.\dot{3}$$

$$\frac{22}{7} = 3.142857142857 \ldots\ldots\ldots$$

Types of Recurring Decimal

(1) Pure Recurring Decimal (2) Mixed Recurring Decimal

(1) Pure Recurring Decimal

A decimal fraction in which all the figures after the decimal point are repeated , is called.

A pure recessing decimal.

Example: $0.\overline{5} = \frac{5}{9};\ 0.\overline{53} = \frac{53}{99},\ 0.\overline{067} = \frac{67}{999}\ etc.$

(2) Mixed Recurring Decimal

A decimal fraction in which some figures do not repeat and some of them are replacted is called a mixed recessing decimal.

Example: $0.17\overline{33} = \frac{1733-17}{9900} = 1716/9900$

Some Examples:

1. If a $\dfrac{1}{1+\dfrac{1}{3\frac{1}{4}}}$, then a=?

Solution:

$$a=\frac{1}{1+\dfrac{1}{3+\dfrac{1}{4}}}\Rightarrow a+\frac{1}{1+\dfrac{1}{(13/4)}}=2 \quad \Rightarrow a+\frac{1}{1+\dfrac{4}{13}}=2 \quad \Rightarrow a+\frac{1}{17/13}=2$$

$$\Rightarrow a+\frac{13}{17}=2 \quad \Rightarrow a=2-\frac{13}{17} \quad \Rightarrow a=\frac{34-13}{17}=\frac{21}{17}=1\frac{4}{17}$$

2. On children's day sweets were to be equally distributed amongst 540 children. But on that particular day, 120 children were absent. Thus, each child got 4 sweets extra. How many sweets was each originally supposed to get?

Solution: Suppose, each child was supported to get *x* sweets. Then we have,

$$540\times x=(540-120)(x+4)$$

$$\Rightarrow 120x=420\times 4 \qquad \Rightarrow x=\frac{420\times 4}{120}=14$$

Therefore, x =14 sweets.

3. The difference between the squares of two consecutive odd integers is always divisible by which digits or numbers?

Solution: Let the two consecutive odd numbers be (2n +1) and (2n +3) respectively.

Then, $(2n+3)^2-(2n+1)^2=(2n+3+2n+1)(2n+3-2n-1)$

$=(4n+4)\times 2=8(n+1,$ which is divisible by 8.

4. In an entrance examination of GATE, there are two sections of Biological science students and the two sections are Life sciences and Biotechnology. If 10 students of Biotechnology shift over to Life science, the strength of appearing students in Life science becomes three times the strength of Biotechnology. But, if 10 students shift over from Life science to Biotechnology, both Life science and Biotechnology students becomes equal. How many students there in Life Science and Biotechnology?

(a) 50 and 30 (b) 45 and 15 (c) 90 and 40 (d) 30 and 50

ANS: a

5. Simplify the given fraction: $12\div\dfrac{1}{7-\dfrac{1}{1-\dfrac{1}{1+\dfrac{1}{2}}}}$ of $19\dfrac{1}{5}$

(a) 2/5 (b) 3/4 (c) 5/2 (d) 4/3

ANS: c

6. "October2, 2001" in MMDDYYYY format is a palindrome (a strength that reads the same forwards as it does backwards example, 10/02/2001…..10022001). When was the latest century before October 2, 2001 that is also a palindrome?

(a) 13^{th} century (b) 14^{th} century (c) 17^{th} century (d) 20^{th} century

ANS: b

7. Find the largest natural number which exactly divides the product of any 4 consecutive natural numbers.

Solution: Required number $=1\times 2\times 3\times 4 = 24$

Therefore, required number =24 [it is applicable for all 4 consecutive natural numbers]

8. Murari, Arun and Nitin start at the same time in the same direction to run around a circular stadium. Murari completes a round in 126 seconds, Arun in 154 seconds and Nitin in 99 seconds, all starting at the same point. After what time they meet again at the starting point?

Solution: Required time = L.C. M. of 126 sec, 154 sec and 99 sec.

$$\begin{array}{r|l} 2 & 126,154,99 \\ \hline 11 & 63,77,99 \\ \hline 9 & 63,7,9 \\ \hline 7 & 7,7,1 \\ \hline & 1,1,1 \end{array}$$

Therefore, required time $=2\times 110\times 9\times 7=1386$ sec=23 min. 10 sec.

9. Amit, Bijender and Chandu go walking round a circle 1 km in circumference at the rates of 10 m/min, 20 m/min and 40m/min respectively, if they all start together and walk in the same direction, when will they be together at the same place?

(a) After 50 minute (b) after 100 minute

(c) after 240 minute (d) after 800 minute

ANS: b

10. In an examination, a student average marks were 63 per paper. If he had obtained 20 more marks for his Biochemistry paper and 2 more marks for his Microbiology paper, his average per paper would have been 65. How many papers were there in the examinations?

Solution: Assume there by x all papers.

Total marks of all papers= 62x

From question

65x –63x= 20+2

$\Rightarrow 2x = 22 \quad \therefore x = 11$

11. The work done by a child in one third that by a man and half that by a women. If one man, one woman and one child together can complete a work in 2 days, in how many days can 4 children together complete the same work?

Solution: We have, 1M =3C and 1W =2C (where, M =male work, C= child work, W = woman work)

Therefore, 1M+1W+1C =6C

Hence, the required number of days $=\dfrac{6\times 2}{4}=3 days$

12. In a central government office, there are 5 working days and for each day, the working hours are 8. A employee gets Rs. 2.40 per hour for regular work and Rs. 3.20 per hour for overtime. If he earns Rs. 432 in 4 weeks, how many hours he work for?

(a) 195 (b) 160 (c) 175 (d) 180

ANS: c

13. Nitin and Pradip solved a quadratic equation. In solving it, Nitin made a mistake in the constant tern and got the roots as 6 and 2, while Pradip made a mistake in the coefficient of x only and obtained the roots as –7 and –1. Find the correct roots of equation

Solution: For Nitin, we have $\alpha + \beta = 8 \text{ and } \alpha\beta = 12$

The equation is x^2– (sum of roots)x+ product of roots =0

$\therefore x^2 - 8x + 12 = 0$

For Pradip, we have $\alpha + \beta = -8 \text{ and } \alpha\beta = 7$

Therefore, the equations is $x^2 + 8x + 7 = 0$

When there is no mistake in a and b, the sum of roots must be correct.

Therefore, sum of roots= 6+2= 8 and product of roots=(–7)×(–1)=7

So, the correct equation is $x^2 - 8x + 7 = 0$

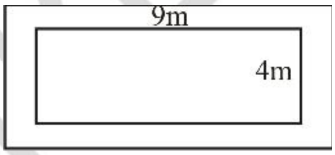
$\Rightarrow x^2 - 7x - x + 7 = 0$

$\Rightarrow (x-7)(x-1) = 0$

$\Rightarrow x = 7 \text{ or } x = 1$

Therefore, the roots are 7, 1.

14. Pradeep wishes to make a gravel path around his rectangular pond. The path must be the same width all the way round, as shown in the diagram. The pond measures 4m by 9m and he has enough gravel to cover an area of $48m^2$. How wide around the path be?



(a) 2 meter (b) 3 meter (c) 1.5 meter (d) 8 meter

ANS: c

15. A man arranges to pay off a debt of Rs. 3600 by 40 annual installments which are in A.P. when 30 of the installments are paid, the dies leaving one third of the debt unpaid. Find the value of 8^{th} instilment.

Solution: Let the first installment be a and common difference of A.P be d.

Given, 3600 =sum of 40 terms $= \frac{40}{2}\{2a + (40-1)d\}$

$\Rightarrow 3600 = 20\{2a + 39d\}$

$\Rightarrow 2a + 39d = 180 \qquad ....(i)$

After 30 installments, one third of the debt is unpaid

Hence, $\frac{3600}{3} = 1200$ is unpaired and 2400 is paid.

Now, $2400 = \frac{30}{2}\{2a + (30-1)d\}$

$\Rightarrow 2400 = 15\{2a + 29d\}$

$\Rightarrow 2a + 29d = 160$ ...(ii)

Subtracting (ii) from (i), we get

$\Rightarrow 10d = 20 \quad \therefore d = 2$

From (i), 2a =180–39d =180–39×2=180–78=102

Therefore, a=51

Now value of the 8th installment = $a + (8-1)d = 51 + 7 \times 2 = 65$

16. The population of bacteria culture doubles every 2 minutes. How many minutes will it takes for the population grow from 1000 to 512000 bacteria?

Solution: Let the growth be 2000, 4000,…….512000

This is the G.P in which a =2000, r =2 and t_n=512000

Since, $t_n = ar^{n-1}$

$\Rightarrow 512000 = 2000 \times 2^{n-1}$

$\Rightarrow 512 = 2^{n-1} \times 2^1$

$\Rightarrow 2^n = 2^9$

$\Rightarrow n = 9$

Therefore, time taken = $2 \times 9 = 18$ minutes.

17. If $\log_{\sqrt{8}} \times 3\frac{1}{3}$,find x

Solution: $\log_{\sqrt{8}} \times = 3\frac{1}{3} = \frac{10}{3}$

$\Rightarrow x = (\sqrt{8})^{\frac{10}{3}} = (2^{3/2})^{\frac{10}{3}} = 2^{\left(\frac{3}{2}\times\frac{10}{3}\right)} = 2^5 = 32 \qquad \therefore x = 32$

18. If $\log_{10}$ 2=0.3010 and $\log_{10}$ 3=0.4714, find the value of $\log_{10}$ 25 and $\log_{10}$ 4.5.

Solution: $\log_{10} 25 = \log_{10}\left(\frac{100}{4}\right) = \log_{10} 100 - \log_{10} 4 = \log_{10} 10^2 - \log_{10} 2^2$

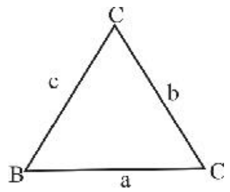
$= 2 - 2\log_{10} 2 - 2 \times 2.3010 = 1.398$

$$\log_{10} 4.5 = \log_{10}\left(\frac{9}{2}\right) = \log_{10} 9 - \log_{10} 2 = \log_{10} 3^2 - \log_{10} 2$$

$$= 2\log_{10} 3 - \log_{10} 2 = 2\times 0.4771 - 0.3010 = 0.6532$$

19. What is the minimum value of the perimeter of a triangle, if two of its sides are 5 cm and 7 cm respectively? (the sides have integer volumes)

Solution: In a triangle , c>b–a

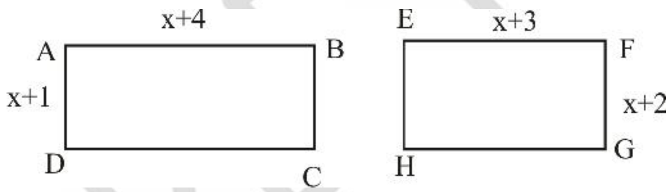


Therefore, c>7–5 or c>2

The minimum length of the third side is 3 cm

Hence, the minimum value of the perimeter =5+7+3=15cm

20. What is the area of rectangle EFGH given figure, if the area of rectangle ABCD is 100?



Solution. Area of rectangle ABCD = $(x+1)\times(x+4) = x^2 + 5x + 4$

Area of rectangular EFGH = $(x+2)\times(x+3) = x^2 + 5x + 6$

If we compare the area of rectangle ABCD and EFGH, the area of rectangle EFGH is 2 more than the area of rectangle ABCD.

Therefore, area of rectangle EFGH =100+2 =102

LEVEL-1

1. Which of the following are prime number (*i*) 241 (*ii*) 337 (*iii*) 391
(*a*) 241, 337 (*b*) 337, 391 (*c*) All the above (*d*) None of these

2. Find the unit's digit in $(264)^{102} + (264)^{103}$
(*a*) 0 (*b*) 2 (*c*) 4 (*d*) 20

3. Find the total number of prime factors in the expression $(4)^{11} \times (7)^5 \times (11)^2$
(*a*) 1 (*b*) 2 (*c*) 3 (*d*) 4

4. Simplify (*i*) 896 × 896 – 204 × 204 (*ii*) 387 × 387 + 114 × 114 + 2 × 387 × 114
(*a*) 761000, 251000 (*b*) 761200, 251001 (*c*) 761200, 251000 (*d*) 76100, 25100

5. Which of the following numbers is divisible by 3 (*i*) 541326 (*ii*) 5967013
(*a*) (*i*) and (*ii*) (*b*) only (*ii*) (*c*) only (*d*) None of these

6. Which one of the following is not A prime number
(*a*) 31 (*b*) 61 (*c*) 71 (*d*) 91

7. $(112 * 5^4) = ?$
(*a*) 67000 (*b*) 50055 (*c*) 70000 (*d*) 75000

8. What least value must be assigned * so that the number 54623*7 is exactly divisible by 9
(*a*) 1 (*b*) 0 (*c*) 2 (*d*) 3

9. Which of the following numbers is divisible by 4
(*i*) 6792059 (*ii*) 618703572
(*a*) (*i*) and (*ii*) (*b*) only (*ii*) (*c*) only (*i*) (*d*) None of theses

10. Which digits should came in place of * and $. If the number 62684 * $ is divisible by both 8 and 5.
(*a*) 4, 0 (*b*) 0, 4 (*c*) 4, 4 (*d*) none of these

11. Is 4832718 is divisible by 11
(*a*) Yes (*b*) No (*c*) Data inadequate (*d*) None of these

12. A number when divided by 342 gives a remainder 47. When the same number is divided by 19, what would be the remainder
(*a*) 5 (*b*) 9 (*c*) 4 (*d*) 0

13. Find the remainder when 2^{31} is divided by 5
(*a*) 4 (*b*) 5 (*c*) 3 (*d*) 7

14. Find the sum of all odd numbers up to 100
(*a*) 2000 (*b*) 2500 (*c*) 2800 (*d*) 3000

15. Find the sum of all 2 digit numbers divisible by 3
(*a*) 1700 (*b*) 1665 (*c*) 1600 (*d*) 1605

16. It is being given that $(2^{32} + 1)$ is completely divisible by a whole number which of the following numbers is completely divisible by this number.
(*a*) $(2^{16} + 1)$ (*b*) $(2^{16} - 1)$ (*c*) $7 * 2^{23}$ (*d*) $2^{96} + 1$

17. How many prime numbers are less than 50?
(*a*) 16 (*b*) 15 (*c*) 14 (*d*) 18

BRIEF SOLUTIONS

1. 391 is not prime number , 337 is a prime number, 241 is a prime number

2. Required unit's digit = unit digit in $(4)^{102}+(4)^{103}$

Now 4^2 gives unit digit 6

$\therefore$ $(4)^{102}$ gives unit digit 6

$\therefore$ $(4)^{103}$ gives unit digit of the product (6 × 4) = 4

Hence unit's digit in $(264)m+(264)103$ = unit digit in (6 + 4) = 0

3. Total no. of prime factors = number of bases = 3

4. $(896)^2-(204)^2$

= (896 + 204) (896 – 204) = 1100 × 692 = 761200

(*ii*) Given expression

$=(387)^2+(114)^2+(2\times387\times114)=a^2+b^2+2ab$

where a = 387 b = 114 $=(501)^2=251001$

5. Sum of digits in 541326 = 21
Which is divisible by 3 hence 541326 is divisible by 3.
Sum of digits in 5967013 = 31
Which is not divisible by 3, hence 5967013 is not divisible by 3.

6. 91 is divisible by 7, so it is a prime number.

7. 70000

8. **Ans. (b)**

9. Which is not divisible by 4

10. (4, 0)

11. (Sum of digits at odd places) – (Sum of digits at even places)
= (8 + 7 + 3 + 4) – (1 + 2 + 8) = 11
Which is divisible by 11. Hence 4832718 is divisible by 11.

12. On dividing the given number by 342, Let k be the quotient and 47 as remainder.
Then number = 342 k + 47 = 19(18k + 2) + 9
$\therefore$ The given no when divided by 19 gives (18 k + 2) as quotient and 9 as remainder

13. $2^{10}=1024$ unit digit of $2^{10}\times2^{10}\times2^{10}$ is 4
as 4 × 4 × 4 gives unit digit 4
$\therefore$ Unit digit of 231 is 8. Now 8 when dividend by 5, gives 3 as remainder.
Hence 231 when dividend by 3, gives as remainder.

14. The given numbers are 1, 3, 5, 7, ……… 99
This is an A.P. with a = 1 and d = 2
Let it contains n terms
= Then 1 + (n – 1) × 2 = 99 or n = 50

$\therefore$ Required sum = n(first term + last term) $=\dfrac{50}{2}(1+99)=2500$

15. Required sum $=\dfrac{30}{2}(12+99)=1665$

16. Let

$$2^{32} = x$$

Then $(2^{32} + 1) = (x + 1)$

Let (x + 1) be completely divisible by the natural number N. Then $(2^{96} + 1) = [(2^{32})^3 + 1]$

$$= (x^3 + 1) = (x + 1)\,(x^2 - x + 1)$$

Which is completely divisible by N.
Since (x + 1) is divisible by N.

17. Prime numbers less than 50 are
2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 47 their no. is 15.