# NUMBER SYSTEM

# **DIVISIBILITY RULES**

**Divisibility by 2:** When the last digit in a number is 0, 2, 4, 6, or 8, the number is divisible by 2.

**Divisibility by 3**: A number is divisible by 3 if the sum of its digits is divisible by 3.

Example: Consider the number 64275

Sum of the digits = 6 + 4 + 2 + 7 + 5 = 24, Which is divisible by 3. ( $24 \div 3 = 8$ ). Therefore, 64275 is divisible by 3.

**Divisibility by 4:** If the number formed by the last two digits in a number is divisible by 4, the original number is divisible by 4. **Divisibility by 5:** A number is divisible by five if the last digit of that number is either 0 or 5.

**Divisibility by 6:** A number is divisible by 6 if it is divisible by both 2 and 3.

<u>Example</u>: 10008, have 8 at one's place so is divisible by 2 and the sum of 1, 0, 0, 0 and 8 gives the total 9 which is divisible by 3. Therefore, 10008 is divisible by 6.

**Divisibility by 7:** Following are the steps to check the divisibility rule for 7,

- Take the last digit and then double the last digit.
- Subtract the result from the remaining number.
- If the number is 0 or a multiple of 7, then the original number is divisible by 7. Else, it is not divisible by 7.

**Divisibility by 8:** if a number is divisible by 8 its last three digits should be divisible by 8.

**Divisibility by 9:** A number is divisible by 9 if the sum of its digits is divisible by 9. Example: Consider the number 65403. Sum of the digits = 6 + 5 + 4 + 0 + 3 = 18, Which is divisible by 9. ( $18 \div 9 = 2$ ) Therefore, 65403 is divisible by 9. **Divisibility by 11:** Here, we will subtract sum of digits placed

at odd places with sum of digits placed at even places, if the result is divisible by 11, the number will be divisible by 11.

**Divisibility by 13**: The four times of the last digit, when added to the rest of the number, the result obtained should be divisible by 13.

**Divisibility by 17:** The five times of the last digit, when subtracted by the rest of the number, the difference obtained should be divisible by 17.

**Divisibility by 19:** The double of the last digit, when added to the rest of the number, the result obtained should be divisible by 19.

# **ALL ABOUT NUMBERS**

#### The Natural and Whole Numbers

We start with the natural numbers. These are the numbers 1, 2, 3, ... (The ... symbol means that the sequence goes on forever.) They are used for counting. If we include zero then we get the whole numbers, 0, 1, 2, 3, ....

#### Integers

The set of numbers  $\dots$ , -3, -2, -1, 0, 1, 2, 3,  $\dots$  (the whole numbers and their opposites) is called the integers.

## **Rational Number**

A rational number is defined to be any number that can be expressed as the quotient or ratio of two integers. We use the same fraction notation to express rational numbers:



Integer a is called the numerator and integer b is called the denominator. The denominator is not allowed to be zero.

#### Irrational Number

The irrational numbers are those that cannot be expressed as a ratio of two integers. Examples are  $\sqrt{3}$  as well as the square roots of many other numbers, and special numbers like e and  $\pi$ . It turns out that there are as many irrational numbers as rational. Irrational numbers have no exact decimal equivalents.

#### Prime and Composite number

A prime number is a positive whole number greater than 1 and is only divisible by 1 or itself, without a remainder. In other words, a prime number is a positive integer that has two positive factors, including 1 and itself. For example, 5 can only be divided by 1 and 5.

#### Facts

- 2 is the only even prime number. All other even numbers are divisible by 2.
- All the prime numbers, except 2, are odd and called odd prime.
- No prime number beyond 5 has the last digit ending with a 5. All numbers greater than 5 which ends with a 5 are divisible by 5.
- 0 and 1 are not prime numbers.

#### Perfect number

A positive integer that is equal to the sum of its proper divisors. The smallest perfect number is 6, which is the sum of 1, 2, and 3. Other perfect numbers are 28, 496, and 8,128.

#### Even Odd number formula

Odd \* Odd = Odd Even \* Even = Even Odd \* Even = Even

#### **Real Number**

The rational numbers and the irrational numbers together make up the real numbers.

#### Number of factors

If we have to find the number of factors of any number say N, then we should follow below steps: Step 1: Prime factorize  $N=p^a \times q^b \times r^c \times ...$ 



Step 2: The number of factors of N = (a+1)(b+1)(c+1)...

#### HCF AND LCM

(LCM of two numbers)  $\times$  (HCF of two numbers) = Product of two numbers Mathematically this can be written as: LCM(a, b)  $\times$  HCF(a, b) = a  $\times$  b

#### HCF by Prime Factorization

Finding HCF by Prime Factorization can be done by following the given steps:

Step 1: Find out the prime factors of the given number.

Step 2: Check the occurrence of a particular factor. Find out the common factors and choose them in HCF.

Step 3: Multiply the occurrence of common factors. And this will be the HCF Of the given numbers.

Example: Find out the HCF of 18 and 90.

Prime factors of  $18 = 2 \times 3 \times 3$ 

Prime factors of  $90 = 2 \times 3 \times 3 \times 5$ 

Now, HCF =  $2 \times 3 \times 3 = 18$ 

#### LCM by Prime Factorization

Finding LCM by Prime Factorization is done by following the given steps:

Step 1: Find out the prime factors of the given number.

Step 2: Check the occurrence of a particular factor. If a particular factor has occurred multiple times in the given number, then choose the maximum occurrence of the factor in LCM. It can also be found out by checking the powers of the factors. The factor having greater power will be chosen between the numbers.

Step 3: Multiply all the maximum occurrences of a particular factor. And this will be the LCM Of the given numbers. Example: Find out the LCM of 18 and 90.

Solution:

Prime factors of  $18 = 2 \times 3 \times 3$ Prime factors of  $90 = 2 \times 3 \times 3 \times 5$ Now, LCM =  $2 \times 3 \times 3 \times 5 = 90$ 

## **CONCEPT OF REMAINDER**

The remainder of multiplication of a numbers by a value is same as multiplication of remainder of individual terms. Example:  $1421 \times 1423 \times 1425 / 12$  same as R (1421/12)  $\times$  R(1423/12)  $\times$  R(1425/12) where R(p/q) is remainder of p/q. Therefore we get  $5 \times 7 \times 9 / 12 = 35 \times 9 / 12 = 99 / 12 = 3$ .

#### Formulas Based Concepts for Remainder:

 $(a^n + b^n)$  is divisible by (a + b), when n is odd.  $(a^n - b^n)$  is divisible by (a + b) and (a - b), when n is even.  $(a^n - b^n)$  is always divisible by (a - b), for every n

# To find unit's digit

Cyclicity implies when the unit digit of a number raised to some power 'n' repeats after an interval.

Example: Unit digit of  $2^1 = 2$ ,  $2^2 = 4$ ,  $2^3 = 8$ ,  $2^4 = 16$ ,  $2^5 = 2$ , hence, cyclicity here will be 4.

Number	Cyclicity
1	1
2	4
3	4
4	2
5	1
6	1
7	4
8	4
9	2
10	1

#### To find the number of zeros at the end of a product

If an integer can be expressed as  $2^a \times 5^b \times k$ , where k is an integer such that  $2\frac{1}{k}$  and  $5\frac{1}{k}$ , then the number of trailing zeros that integer has is min(a,b).

Example  $- 8 \ge 25 \ge 35 \ge 40$  can be expressed as  $2^3 \ge 5^2 \ge 5 \ge 7$  $\ge 5 \ge 2^6 \ge 5^4 \ge 7$ ; here minimum of (6,4) is 4. Hence, the expression will have 4 zeros.

#### **Solved Problems**

Q 1.	Which one of the following can't be the square o	f
	natural number?	

- (a). 30976
- (b). 75625
- (c). 28561
- (d). 143642

#### Answer: d

The square of a natural number never ends with 2 and 7. ∴ 143642 is not the square of natural number.

- Q2. A number when divided successively by 4 and 5 leaves remainders 1 and 4 respectively. When it is successively divided by 5 and 4, then the respective remainders will be?
  - (a). 1, 2
  - (b). 2, 3
  - (c). 3, 2
  - (d). 4, 1

#### Answer: b

Let the number be X.

When you divide X by 4, it gives the remainder 1. Let the dividend here be  ${\rm Y}$ 

 $\Rightarrow$  X = 4Y+1 ...(1)

Now, when we divide Y by 5, we get remainder 4. We take quotient as 1, as 5 divides Y completely.

 $\Rightarrow$  Y=1×5+4=9

 $\Rightarrow$  Y = 9

Putting Y = 9 in equation (1), we get

$$\Rightarrow X = 4 \times 9 + 1 = 37$$
$$\Rightarrow X = 37$$

Now, 37 divided by 5 and 4 respectively will give 2 and 3.

- (a). 2
- (b). 3
- (c). 4
- (d). 6

### Answer: c

#### 90 = 10 x 9

Clearly, 653xy is divisible by 10, so y = 0Now, 653x0 is divisible by 9. So, (6 + 5 + 3 + x + 0) = (14 + x) is divisible by 9. So, x = 4. Hence, (x + y) = (4 + 0) = 4.

#### Q 4. If x is positive, what is x?

- 1. x is even.
- 2. x is prime.
- (a). Statement 1 is sufficient to answer the question.
- (b). Statement 2 is sufficient to answer the question.
- (c). Both the Statements together are sufficient to answer the question.
- (d). None of the statement is sufficient to answer the question.

#### Answer: c

X is even, implies X can be 2, 4, 6....

X is prime, implies X can be 2, 3, 5.....

Hence, X can be 2 only.

Hence, the statements together are sufficient.

# Q 5. The digit in unit's place of the product $49237 \times 3995 \times 738 \times 83 \times 9$ is

- (a). 6
- (b). 0
- (c). 5
- (d). 7

#### Answer: (b)

Required unit's digit = Unit's digit in the product of  $7 \times 5 \times 8 \times 3 \times 9 = 0$ 

# **Q 6.** The digit in unit's place of the product $81 \times 82 \times 83 \times ... \times 89$ is

- (a). a) 8
- (b). b) 0
- (c). c) 6
- (d). d) 2

#### Answer: (b)

The digit in unit's place = unit's digit in the product  $1 \times 2 \times 3 \times \dots \times 9 = 0$ .

#### Q 7. Is a whole number a perfect square integer?

- 1. Statement 1: It falls between 110 and 120 inclusive.
- 2. Statement 2: Its last digit is a 7.
- (a). EITHER statement ALONE is sufficient to answer the question.
- (b). BOTH statements TOGETHER are sufficient to answer the question, but NEITHER statement ALONE is sufficient to answer the question.

- (c). Statement 1 ALONE is sufficient to answer the question, but Statement 2 ALONE is NOT sufficient to answer the question.
- (d). Statement 2 ALONE is sufficient to answer the question, but Statement 1 ALONE is NOT sufficient to answer the question.

#### Answer: a

There are no perfect square integers between 110 and 120 inclusive:

102=100<110<120<121=112

Also, all perfect squares end in 0, 1, 4, 5, 6, or 9, depending on the last digit of the number being squared.

From either statement alone, it therefore follows that the number is not a perfect square integer.

#### **Q 8.** Is the product of three positive integers divisible by 4?

- 1. Statement 1: The three integers are consecutive.
- 2. Statement 2: Two of the integers are even.
- (a). BOTH statements TOGETHER are sufficient to answer the question, but NEITHER statement ALONE is sufficient to answer the question.
- (b). EITHER statement ALONE is sufficient to answer the question.
- (c). Statement 1 ALONE is sufficient to answer the question, but Statement 2 ALONE is NOT sufficient to answer the question.
- (d). Statement 2 ALONE is sufficient to answer the question, but Statement 1 ALONE is NOT sufficient to answer the question.

#### Answer: d

Statement 1 is not enough to answer the question. For example, the integers can be 3, 4, and 5, the product of which is 60, which is divisible by 4; or, the integers can be 5, 6, and 7, the product of which is 210, which is not divisible by 4.

From Statement 2, however, it can be inferred that the product is divisible by 4. If two of the integers are even, the two can be written as 2A and 2B for some integers A,B. If we call the third integer N, the product is 2A·2B·N=4(ABN), and the product must be divisible by 4.

#### **Q 9.** Is the product of three integers divisible by 6?

- 1. Statement 1: The three integers are consecutive.
- 2. Statement 2: One integer is even and two are odd.
- (a). BOTH statements TOGETHER are sufficient to answer the question, but NEITHER statement ALONE is sufficient to answer the question.
- (b). EITHER statement ALONE is sufficient to answer the question.
- (c). Statement 1 ALONE is sufficient to answer the question, but Statement 2 ALONE is NOT sufficient to answer the question.
- (d). Statement 2 ALONE is sufficient to answer the question, but Statement 1 ALONE is NOT sufficient to answer the question.



#### Answer: c

Any group of three consecutive integers must include at least one multiple of 3 and at least one even number (multiple of 2). Therefore, if Statement 1 is assumed, 2 and 3 both divide the product of the integers and, subsequently, so does 6.

Statement 2 is not enough, however - for example, the product of 3, 4, and 5 is 60, a multiple of 3, but the product of 4, 5, and 7 is 140, not a multiple of 3.

#### **Q 10.** What will be the product of a and b (a, b > 0)?

- (i). 'a' is the remainder when  $53^7$  is divided by 17.
- (ii). 'b' is the remainder when  $(7a + 1)^4$  is divided by 11.
- (iii). HCF of  $3a^2$  and  $4b^2$  is 12 which is 24 less than their LCM.
- (a). Statement I is sufficient to answer the question.
- (b). Statement II is sufficient to answer the question.
- (c). Statement III is sufficient to answer the question.
- (d). None of the statement is sufficient to answer the question.

#### Answer: c

(i). Remainder =  $\frac{53^7}{17} = \frac{2^7}{17} = \frac{128}{17} = 9$ 

Hence, 
$$a = 9$$

(ii). 
$$b = b = \frac{(7x9+1)^4}{11} = \frac{(64)^4}{11} = \frac{(-2)^4}{11} = 5$$

(iii).  $3a^2 \times 4b^2 = 12 \times 36$  $\Rightarrow a^2 \times b^2 = 4 \times 9$  $\Rightarrow$  ab = 6

Hence, Statement III alone gives the result.

#### Q11. What is the total weight of 6 boxes. Each of them is equal in weight.

- (A). One-third of each boxes weight 2kg.
- (B). The total weight of four boxes is 12 kg more than weight of 2 boxes.
- (a). Both the statements can alone answer the question.
- (b). Statement I is sufficient to answer the question.
- (c). Statement II is sufficient to answer the question.
- (d). None of the statement is sufficient to answer the question.

#### Answer: a

 $1 \times = 2$  (Where x is the weight of Individual box) 3

#### X = 6

∴ Total Weight = 36 kg.

 $B_0 4x - 2x = 12 \text{ kg}$ 

 $\Rightarrow$ X = 6 kg

:. Total Weight = 36 kg.

Hence, both the Statements can alone answer the question.

#### Q 12. The remainder when $2^{39}$ is divided by 39 is:

- (a). 0
- (b). 2
- (c). 8
- (d). 1

#### Answer: c



Thus, the remainder is 8.

(Since the final remainder can be obtained by dividing the factors of the given number).

**Q 13.** Halfway through the journey from Delhi to Lahore a person to look out of the window of the train and continues looking out until the distance which is yet to be covered becomes half of the distance that he has already covered. At this point of time how much distance is he yet to cover?

(a).	$\frac{2}{4}$
(b).	$\frac{1}{4}$
(c).	$\frac{1}{3}$
(d).	1

6

#### Answer: c

Since he has covered twice the distance which he is yet to cover. It means he has covered  $\frac{2}{2}$  of the whole journey

and remaining journey is  $\overline{3}$  .

- Q 14. At the end of 1996, I found that the height of my son was 90 cm. But, at the end of 2003, I found that the height of my son was 1/9th more than it was at the end of 2002. However, over the years I have observed that every year his height is increasing by equal amount and it is expected to increase at the same way. Can you find the height of my son at the end of 2008?
  - (a). 360 cm
  - (b). 450 cm
  - (c). 250 cm
  - (d). 270 cm

#### Answer: b

Let the height of my son increase cm per year then the height at the end of 2002 = 6x+90And the height at the end of 2003 = 7x+90But 7x+90=(6x+90)+(6x+90) 1

 $\Rightarrow (7x+90)=(6x+90)\times \frac{10}{9}$ 

 $\Rightarrow$  63x+810=60x+900

$$\Rightarrow$$
 3x=90

 $\Rightarrow$  x = 30 cm

Thus, the height at the end of 2008 = 90+12x⇒ 90 + 12 x 30 = 450 cm

$$\Rightarrow$$
 90 + 12 X 50 -

KGS

- Q 15. Chris widener had a servant who was determined to be paid \$ 250, a wrist watch and a ration for whole year? But after 9 months Widener migrated to India and he had just paid him \$ 270 and the ration for the 9 months. What is the cost of the wrist watch?
  - (a). \$20
  - (b). \$120
  - (c). \$110
  - (d). data insufficient

#### Answer: c

Let the cost of watch Rs.x Then the total amount for 12 months except ration = 250 + xTherefore, the amount for 9 months =  $(250+x) \times 3$ 

Thus 
$$(250+x)\frac{3}{4}=270$$

 $\Rightarrow 750+3x=10/0$  $\Rightarrow 3x=330$ 

 $\Rightarrow$  3x=330  $\Rightarrow$  x=110

Therefore, the cost of wrist watch = 110 (It can also be solved using options.)

- **Q 16.** The sum of the squares of a two-digit number is 10. If we add 18 to this number, we get another number consisting of the same digits written in reverse order. The original number is:
  - (a). 10
  - (b). 46
  - (c). 13
  - (d). none of the above

#### Answer: c

 $1^2 + 3^2 = 10$ 13 + 18 = 31

- **Q 17.** A two-digit number ab is added to another number ba, which is obtained by reversing the digits then we get a three-digit number. Thus a + b equals to:
  - (a). at least 18
  - (b). 2ab
  - (c). 2(a+b)
  - (d). (a+b) ≥ 10

#### Answer: d

When two "two digit" numbers are added and the resultant value is a 'three digit number", it means there must be a carry over (i.e. the sum of the unit digits be greater than 9. Similarly the sum of the tens digit is also greater than 9.)

Hence (d) is correct as 72+ 27 = 99 is inadmissible, but 64+ 46=110 is an admissible value.

**Q 18.** In the examination of CBSE, a candidate must get 2/5th marks to pass, out of total marks. Vinod appeared in the same exam and got 210 marks and

still failed it by 40 marks. The maximum marks which a candidate can get is:

- (a). 500
- (b). 625
- (c). 390
- (d). can't be determined

#### Answer: b

Vinod gets 210 marks and failed by 40 marks It means the min. marks required = 250 = 2/5th of total. Therefore maximum (or total) marks =  ${}_{250}\times{}^{5}={}_{625}$ 

- **Q 19.** I know a two-digit number, but when its digits swap their places, we get another two-digit number. But, when these two-digit numbers are added, it amounts to 99. Further if I just consider the difference between these numbers, it comes out to be 45. What is the number which I know?
  - (a). 27

4

- (b). 38
- (c). 72
- (d). Both a and c is a possibility

#### Answer(c):-

the two digits number is :- 10a + b the number if we swap their places :- 10b + a the sum of these numbers -10a + b + 10b + a 11a + 11b According to guestion 11a + 11b = 99 a + b = 9the difference between the numbers is – 10a + b - (10b + a)9a – 9b According to the question 9a - 9b = 45a - b = 5from 1 and 2 a = 7b = 2then, the original number is = 72

- Q 20. In a mobile shop 7/12 mobiles are imported and rest are manufactured in India. Further 1/5<sup>th</sup> Indian mobiles are coloured while 5/7<sup>th</sup> imported mobiles are black and white. If there are total 150 coloured mobiles in his shop, then total number of mobile phones in his shop is:
  - (a). 500
  - (b). 600
  - (c). 800
  - (d). data insufficient

#### Answer: b

Go through alternatives. Consider option (b) Total mobiles = 600 Indian mobiles = 600 × 5/12=250

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and imported mobiles =  $600 \times 7/12=350$ The coloured mobiles of Indian origin =  $_{250 \times \frac{1}{5}=50}$ 

The coloured mobiles which are imported =  ${}_{350} \times \frac{2}{7} = 100$ 

Thus, total-coloured mobiles = 50+100=150, which is same as given in the problem. Hence the presumed option is correct.

- **Q 21.** In a call centre at New Delhi, it is observed that it gets a call at an interval of every 10 minutes from California, at every 12 minutes from Texas, at the interval of 20 minutes from Washington DC and after every 25 minutes it gets the call from London. If in the early morning at 5:00 a.m. it has received the calls simultaneously from all the four destinations, then at what time will it receive the calls simultaneously from all the places on the same day?
  - (a). 10:00 a.m.
  - (b). 3:00 a.m.
  - (c). 5:00 p.m.
  - (d). both (a) and (b)

#### Answer: d

The minimum time internal when the call centre receives the calls from all the destinations at the same time

- = the L.C.M. of 10, 12, 20 and 25
- = 300 minutes = 5 hours
- Thus 5+5=10A.M. and 10+5 = 15 =3:00 P.M. Hence (d).

## **Practice Questions**

- **Q 1.** Let  $N = 55^3 + 17^3 72^3 N$  is divisible by
  - (a). both 7 and 13
  - (b). both 3 and 13
  - (c). both 17 and 7
  - (d). both 3 and 17
- **Q 2.** A string of length 221 metre is cut into two parts such that one part is  $9/4^{th}$  as long as the rest of the string, then the difference between the larger piece and the shorter piece is
  - (a). 58 m
  - (b). 53 m
  - (c). 85 m
  - (d). none of these
- **Q 3.** abcde is a five-digit number when multiplied by 13 it gives a number, which is purely formed by the digit 9. Then the value of a + b + c + d + e is:
  - (a). divisible by 8
  - (b). equal to 27
  - (c). divisible by 11
  - (d). all of these
- Q 4. Kavita was supposed to multiply a natural number by 23. Instead, she multiplied that natural number by 32 and thus her result got increased by 315. The original product was:

- (a). 135
- (b). 805
- (c). 775
- (d). data insufficient
- **Q 5.** A fraction in its lowest form is such that when it is squared and then its numerator is reduced by 1/3<sup>rd</sup> and denominator is reduced to 1/5<sup>th</sup>, the resultant fraction becomes twice of the original fraction. The sum of numerator and denominator could be:
  - (a). 7
  - (b). 8
  - (c). 9
  - (d). 17
- Q 6. If a five-digit number 'm21n2" is divisible by 24 then the maximum number of possible combinations of m and n:
  - (a). 4
  - (b). 9
  - (c). 16
  - (d). 10
- **Q7.** If a fraction is divided by its reciprocal and then multiplied by itself then the fraction becomes 512/125. The difference between the actual fraction and its reciprocal fraction is:
  - (a). 29
    - 30 、39
  - (b).  $\frac{37}{40}$ 
    - 40
  - (c). data insufficient
  - (d). none of these
- **Q8.** A perfect square less than 500 is such that when a prime number  $P_1$  is subtracted or another prime number  $P_2$  is added to it in both cases it becomes the perfect square when  $P_2 = 2 + P_1$ . Then the  $P_1 + P_2$  is necessarily divisible by:
  - (a). 8
  - (b). 11
  - (c). 4
  - (d). all of these
- Q 9. A two-digit number is such that it is the product of the two distinct perfect squares. The tens digit, unit digit and the sum of these two digits are in A.P. Further if we reverse the digits mutually, the new number increases by 27. The original number is:
  - (a). 72
  - (b). 19
  - (c). 36
  - (d). none of these
- Q 10. In an opera house, there are 7777 chairs to be placed, but the organiser of the event arranged all the chairs in such a way that there were as many columns as there were rows. So, he had to remove minimum 'n' chairs from the total 7777 chairs. The minimum value of n is:

- (a). 121
- (b). 44
- (c). 33
- (d). 25
- Q 11. If a, b are two perfect square digits and ab is a two-digit perfect square number, such that (a × b) + (a + b) = ab, then the value of [ba (b + a)] is:
  - (a). 27
  - (b). b<sup>2</sup>
  - (c). 81
  - (d). either of b and c
- **Q 12.** The least possible divisor of 25930800, by which we divide this number, we get the quotient as a perfect square:
  - (a). 2
  - (b). 3
  - (c). 5
  - (d). can't be determined
- **Q 13.** Arun and Prabhat have some books with them. Once Prabhat said to Arun that if Arun gives 3 books to Prabhat then Arun will have only 1/2 of the books that Prabhat will have with him. Then Arun asked Prabhat that if Prabhat gives only two books to Arun, then Prabhat will have as many books as Arun will have. The total number of books that Arun and Prabhat have with them is:
  - (a). 25
  - (b). 56
  - (c). 30
  - (d). can't be determined
- **Q 14.** A lad was asked his age by his friend. The lad said, "The number you get when you subtract 25 times my age from twice the square of my age will be thrice your age". If the friend's age is 14, then the age of the lad is:
  - (a). 21
  - (b). 28
  - (c). 14
  - (d). 25
- Q 15. If the sum of two numbers added to the sum of their squares is 42 and the product of these numbers is 15, then the numbers are:
  - (a). 15, 1
  - (b).  $\frac{15}{6}$ , 6
  - (c).  $_{2\frac{1}{2}}, 6$
  - (d). 5, 3
- **Q 16.** A page contains 60 lines. A chapter contains 125 pages. A book contains 5 chapters. 20 such books form a bound. If there are total 30 lakh lines in an x number of bounds then the value of is:
  - (a). 4
  - (b). 2
  - (c). 5
  - (d). 6

- **Q 17.** x is a five-digit number. The digit in ten thousand place is 1. The number formed by its digits in units and tens places is divisible by 4. The sum of all the digits is divisible by 3. If 5 and 7 also divide, then will be:
  - (a). 14020
  - (b). 12060
  - (c). 100203
  - (d). 10080
- **Q 18.** The least number which when divided by 2, 3, 4, 5 and 6 leaves the remainder 1 in each case. If the same number is divided by 7 it leaves no remainder. The number is:
  - (a). 231
  - (b). 301
  - (c). 371
  - (d). 441
- **Q 19.** Three bells, toll at interval of 36 sec, 40 sec and 48 sec respectively. They start ringing together at particular time. They will toll together next time after:
  - (a). 6 minutes
  - (b). 12 minutes
  - (c). 18 minutes
  - (d). 24 minutes
- Q 20. Mohan gets 3 marks for each correct sum and loses 2 marks for each wrong sum. He attempts 30 sums and obtains 40 marks. The number of sums solved correctly is:
  - (a). 10
  - (b). 15
  - (c). 20
  - (d). 25
- Q 21. It costs ₹10 a kilometre to fly and ₹2 a km to drive. If one travels 200 km covering km of the distance by flying and the rest by driving, then the cost of the trip is:
  - (a). ₹2000
  - (b). ₹24000
  - (c). ₹(8 + 400)
  - (d). ₹(12 + 400)
- Q 22. For a journey the cost of a child ticket is 1/3rd of the cost of an adult ticket. If the cost of the tickets for 4 adults and 5 children is ₹85, the cost of a child ticket is
  - (a). ₹5
  - (b). ₹6
  - (c). ₹10
  - (d). ₹15

Q 23. Tanya gives away to each of four girls  $\frac{1}{12}$ ,  $\frac{5}{18}$ ,  $\frac{7}{30}$ ,  $\frac{7}{48}$ 

of the apples in a basket and has only just enough apples to be able to do so without dividing an apple. The minimum number of apples she has in her basket:

- (a). 250
- (b). 720
- (c). 750
- (d). none



**Q 24.** Abhishek, Bobby and Charlie start from the same point and travel in the same direction around an island 6 km in circumference. Abhishek travels at the rate of 3, Bobby at the rate of  $2\frac{1}{2}$  and Charlie at

the rate of  $\frac{1}{4}$  km/hr. In how many hours will they

come together again?

- (a). 6 hrs
- (b). 12 hrs
- (c). 24 hrs
- (d). 15 hrs

# **Solutions**

- 1. Here, the equation is of form  $a^3+b^3+c^3$  where a + b + c = 0, hence, the equation will be equal to 3abc i.e.  $3 \ge 55 \ge 17 \ge 72$ ; which is divisible by 17 and 3.
- 2.  $x + \frac{9x}{4} = 221 \Longrightarrow x = 68$  metre and  $\frac{9}{4}x = 153$  metre

Thus, the difference between two parts =153-68=85 metre



Thus abcde=7692 a+b+c+d+e=7+6+9+2+3=27

4. 32k-23k = 315  $\Rightarrow 9k = 315 \Rightarrow k = 35$ The original product =  $23 \times 35 = 805$ 

5. Let the fraction be 
$$\frac{x}{2}$$
, then  $\left(\frac{x}{2}\right)^2 = \frac{x^2}{2}$  then,

$$\Longrightarrow \frac{\frac{2}{3}x^2}{\frac{1}{5}y^2} = \frac{10x^2}{3y^2}$$

Thus  $\frac{10x^2}{3y^2} = 2\frac{x}{y}$  $\Rightarrow \frac{x}{y} = \frac{3}{5}$ 

Hence x+y = 3+5 = 8

6.  $24 = 8 \times 3$ , so the given number must be divisible by both 8 & 3.

Now for 8, n = 1, 5, 9

Again for 3, when n=1 then m = 3, 6, 9 and when n = 5 then m = 2, 5, 8 and when n = 9 then m=1, 4, 7Thus, there are total 9 combinations of m and n. 7. Let the fraction be x/y, then its reciprocal be y/x,  $\underline{x / y} = x^2/y^2$ 

y / x

Now 
$$\frac{x^2}{y^2} \times \frac{x}{y} = \frac{x^3}{y^3} = \frac{512}{125} = \frac{8^3}{5^{.3}}$$

$$\Rightarrow \frac{x}{y=8/5}$$
  
$$\Rightarrow \frac{y}{x=5/8}$$
  
$$\therefore \frac{x}{y} = \frac{y}{x} = \frac{8}{5} - \frac{5}{8} = \frac{64 - 25}{40} = \frac{39}{40}$$

8. Consider the values as 441 - 41 = 400And, 441 + 43 = 484So, 41 + 43 = 84, which is divisible by 4.

9. Go through options
36 = 4 x 9 = (2)<sup>2</sup> x (3)<sup>2</sup>
3, 6, 9 are in G.P.; 9 = (3 + 6)
36 + 27 = 63

**10.** Go through options and subtract the reasonable value from 7777 and see that whether the resultant number is a perfect square.

Alternatively,  $n^2 \le 777 n^2 = 7744$ Hence 33 (=7777 - 7744) chairs are required to remove from that place.

**11.** The perfect square digits are 1, 4 and 9. So, the number formed by using any of these two digits which is also a perfect square is 49. where  $(4 \times 9) + (4+9) = 49$ 36 + 13 = 49So, 94 - (9 + 4) = 81

**12.**  $25930800 = 2^4 x 3^3 x 5^2 x 7^2$ So, if this number is divided by 3, then we get the quotient as a perfect square.

**13.** Let the Arun has x books and Prabhat has y books with them, then  $2(x-3) = (y+3) \Rightarrow 2x-6 = y+3 \Rightarrow 2x - y = 9$  ... (i)

And (x + 2) = (y - 2)  $\Rightarrow x - y = -4$  ... (ii) Solving eqs. (i) and (ii), we get x = 13 and y = 17 thus x + y = 30.

14. Go through options Then consider option (c). As,  $2x (14)^2 - 25 \times 14 = 3 \times 14$ Alternatively Let the age of the lad be x then  $2x^2 - 25x = 42$   $= 2x^2 - 25x - 42 = 0$ Now, either solve this quadratic equation to get the ans

Now, either solve this quadratic equation to get the answer or put the appropriate value from the option to get the required answer.



**15.** Check through options: As,  $(5+3) + (5^2 + 3^2) = 42$ and  $5 \ge 3 = 15$ 

**16.** Total number of lines (in one bound)

= [Number of lines per page x Number of page per chapter × Number of chapters per book × Number of books per bound] = 60 x 125 x 5 x 20 = 750000 Number of bounds = 3000000 = 4

750000

Hence, there are total 4 bounds.

**17.** Check the options for the given condition. 10080 fulfils all the requirements.

**18.** The required number = (LCM of 2, 3, 4, 5, 6) k + 1 = 71= 60k + 1 = 71  $\Rightarrow$  60k + 1

Now put the least possible value of k such that l must be a positive integer. Hence at k = 5, l is an integer. Thus, the required value is  $60 \times 5 + 1 = 301$ .

**19.** The required time = LCM of 36, 40 and 48 = 720 second = 12 minutes

Hence, (b) is the right choice.

**20.** Best way is to go through options. Consider option (c) Correct answer = 20, marks for correct answer = 60So wrong answer = 10, marks for wrong answer = -20Net marks = 60 - 20 = 40Hence, presumed option is correct. Alternatively,  $30 \ge 3 - \ge 5 = 40$  $90 - 5 \ge 40$ X = 10Hence, the wrong answer = 10 Thus, the correct answer = 20

**21.** Total cost = Distance covered x Rate (or charge/km) = × 10 + (200 - x) x 2 = 10x + 400 - 2x = 8x + 400 Hence, (c).

22. 
$$4A + \frac{5A}{3} = 85$$
  
 $A = 15 = \frac{A}{3} = 5$ 

Hence, the cost of child ticket = Rs.5. Thus (a) is the correct option.

**23.** The required value = LCM of 12, 30, 18, 48 = 720 Hence, (b).

- 24. Time taken for each of three persons A, B and C is respectively  $\frac{6}{3}, \frac{6}{1}$  and  $\frac{6}{1}$  hrs i.e.  $\frac{2}{1}, \frac{12}{5}$  and  $\frac{24}{5}$  hrs.
- So, it is required to find the LCM of  $\frac{2}{1}, \frac{12}{5}, \frac{24}{5} = \frac{24}{1} = 24$ hr

Hence, (c).

# 3 KHAN SIR ≫