TESTS OF DIVISIBILITY

1. Divisibility of numbers by 2:

► A number that has 0, 2, 4, 6 or 8 in its ones place is divisible by 2.

2. Divisibility of numbers by 3

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

3. Divisibility of numbers by 4

► A number is divisible by 4 if the number formed by its last two digits (i.e. ones and tens) is divisible by 4.

4. Divisibility of numbers by 5

► A number that has either 0 or 5 in its ones place is divisible by 5.

5. Divisibility of numbers by 6:

► A number is divisible by 6 if that number is divisible by both 2 and 3.

6. Divisibility of numbers by 7:

► A number is divisible by 7, if the difference b/w twice the last digit and the no. formed by the other digits is either 0 or a multiple of 7. eg. 2975, it is observed that the last digit of 2975 is '5', so, 297 --(5x2) = 297 - 10 =287, which is a multiple of 7 hence, it is divisible by 7

7. Divisibility of numbers by 8:

► A number is divisible by 8 if the number formed by its last three digits is divisible by 8.

8. Divisibility of numbers by 9:

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

9. Divisibility of numbers by 10:

► A number that has 0 in its ones place is divisible by 10.

10. Divisibility of numbers by 11:

► If the difference between the sum of the digits at the odd and even places in a given number is either 0 or a multiple of 11, then the given number is divisible by 11.

11. Divisibility of number by 12.

► Any number which is divisible by both 4 and 3, is also divisible by 12. To check the divisibility by 12, we i. First divide the last two-digit number by 4. If it is not divisible by 4, it is divisible by 4 is not divisible by 12. If it is divisible by 4 them. ii. Check whether the number is divisible by 3 or not.

Ex: 135792 : 92 is divisible by 4 and also (1 + 3 + 5 + 7 + 9 +2 =) 27 is divisible by 3 ; hence the number is divisible by 12.

12. Divisibility by 13

Oscillator for 13 is 4. But this time, our oscillator is not negative (as in case of 7) It is 'one-more' Oscillator. So, the working Principle will be different now.

Eg: Is 143 divisible by 13 ? Sol: 14 3 : 14 + 3 x 4 = 26 Since 26 is divisible by 13, the number 143 is also divisible by 13. Eg 2 : Check the divisibility by 13. 2 416 7 26/6/20/34 [4 x 7 (from 24167) + 6 (from 24 167) = 34] [4 x 4 (from 3 4) + 3 (from 3 4) + 1 (from 24167)] =20 [4 x 0 (from 2 0) + 2 (from 20) + 4 (from 24 167)= 6] [4 x 6 (from 6) + 2 (from 24 167)= 26] Since 26 is divisible by 13 the number is also divisible by 13.

13. Divisibility by 14

► Any Number which is divisible by both 2 and 7, in also divisible by 14. That is, the number's last digit should be even and at the same time the number should be divisible by 7.

14. Divisibility by 15

► Any number which is divisible by both 3 and 5 is also divisible by 15.

15. Divisibility by 16

► Any number whose last 4 digit number is divisible by 16 is also divisible by 16.

16. Divisibility by 17

► Negative Oscillator for 17 is 5. The working for this is the same as in the case 7. Eg: check the divisibility of 1904 by 17

Sol: 1904 : 190 - 5 x 4 = 170 Since 170 is divisible by 17, the given number is also divisible by 17.

E.g 2: 957508 by 17

So1: 95750 8: 95750 - 5 x 8 = 95710 9571 0 : 9571 - 5 x 0

= 9571 957 1 : 957 - 5 x 1 = 952 952 : 95 - 5x2 =85

Since 85 is divisible by 17, the given number is divisible by 17.

17. Divisibility by 18

► Any number which is a divisible by 9 has its last digit (unit-digit) even or zero, is divisible by 18. Eg. 926568: Digit - Sum is a multiple of nine (i.e., divisible by 9) and unit digit (8) is even, hence the number is divisible by 18.

18. Divisibility by 19

► If recall, the 'one-more' osculator for 19 is 2. The method is similar to that of 13, which is well known to us. Eg. 1 4 9 2 6 4 19/9/12/11/14

General rules of divisibility for all numbers:

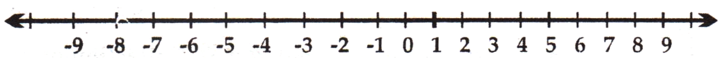
♦ If a number is divisible by another number, then it is also divisible by all the factors of the other number.

♦ If two numbers are divisible by another number, then their sum and difference is also divisible by the other number.

♦ If a number is divisible by two co-prime numbers, then it is also divisible by the product of the two co-prime numbers.

INTEGERS

• Whole numbers are represented on the number line as shown here:



-9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9

• If you move towards the right from the zero mark on the number line, the value of the numbers increases.

▪ If you move towards the left from the zero mark on the number line, the value of the numbers decreases.

i. Integers: The collection of the numbers, that is, ... -3, -2, -1, 0, 1, 2, 3, ..., is called integers.

ii. Negative integers: The numbers -1, -2, -3, -4... which are called negative numbers.

iii. Positive integers: The number 1, 2, 3, 4 ...s, which are called positive

• Euclid's division lemma can be used to: a = b × q + r

• Find the highest common factor of any two positive integers and to show the common properties of numbers.

• Finding H.C.F using Euclid's division lemma.

• Suppose, we have two positive integers 'a' and 'b' such that 'a' is greater than 'b'. Apply Euclid's division lemma to the given integers 'a' and 'b' to find two whole numbers 'q' and 'r' such that, 'a' is equal to 'b' multiplied by 'q' plus 'r'.

• Check the value of 'r':

If 'r' is equal to zero then 'b' is the **HCF** of the given numbers.

If 'r' is not equal to zero, apply **Euclid's division lemma** to the new divisor 'b' and remainder 'r'. Continue this process till the remainder 'r' becomes zero. The value of the divisor 'b' in that case is the **HCF** of the two given numbers.

• Euclid's division algorithm can also be used to find some common properties of numbers.

Some Rules on Counting Numbers

i. Sum of all the first n natural numbers = $\frac{n\,(n+1)}{2}$

For eg.: 1 + 2 + 3 +....+ 105 = $\frac{105\,(105+1)}{2}$ =5565

ii. Sum of first n odd numbers = n^2

Eg: 1 + 3 + 5 + 7 = 4^2 = 16 (as there are four odd numbers)

Eg: 1 + 3 +5 + +20th odd numbers

(ie. 20 × 2 - 1 = 39) = 20^2 = 400

iii. Sum, of first n even numbers = n(n + 1)

Eg: 2 + 4 +6 +8 + +100 (or 50th Even number)

= 50 x (50 + 1) = 2550

iv. Sum of Squares of first n natural numbers = $\frac{n\,(n+1)(2n+1)}{6}$

For eg : $1^2 + 2^2 + 3^2 + \ldots\ldots\ldots 10^2$

$= \frac{10\,(10+1)(2\times10+1)}{6} = \frac{10\times11\times21}{6} = 385$

v. Sum of cubes of first n Natural numbers

$= \left[\frac{n\,(n+1)}{2}\right]^2$

For eg : $1^3 + 2^3 + + \ldots\ldots\ldots\ 6^3$

$= \left[\frac{3\,(6+1)}{2}\right]^2 = (21)^2 = 441$