

Date: TBA Time: TBA Duration: 1.5 H	Class: 10 Prepared by Md Imanul Huq
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Today's Topics Theme:

Today Topics to be Covered:

1. Final Terms Topics	2. Number Theory
3. Parity	4. Divisibility: Introduction
5. Divisibility Rules	6.

1. Final Terms

Topics Core Topics:

a) Number Theory

Parity

[**Divisibility**: Rules, Euclidean Division Theorem, **GCD**, **LCM**, Bezout's Identity, Perfect Number, Practical Number, Amicable Number, Fibonacci Sequence, Tribonacci Sequence, Golden Ratio] [1H 15 M]

[**Prime: Fundamental Theorem of Arithmetic**, Almost Prime, Prime Powers, **Factorial Prime**, Euclid's Theorem, Prime Number Theorem, Number Empire] [0 H 57 M]

[Modular Arithmetic: **Congruence**, Congruence Class, Residue System, Quadratic Residues, Modular Operation, Inverse, Modular Exponentiation, Wilson's Theorem, **Chinese Remainder Theorem**, Fermat's Totient Theorem, Euler-Fermat Theorem] [1 H 35 M]

b) Mathematical Reasoning

Proof: Terminologies, Direct Proofs, Proof of Composition, Proofs, by Contradiction, Exhaustion Proofs, Existence & Uniqueness Proofs, Proofs, by Induction, Mathematical Induction [1 H 51 M]

c) Counting

Factorials, Fundamental Counting principle, Permutations, Combinations, Pigeonhole Principle, Pascal's Triangle [1 H 4 M]

Inclusion-Exclusion principle, Application of Sum rule and Product rule, Binomial coefficients, Recurrence relations [1 H 0 M]

d) Graph

Graphs, Subgraphs, Degree, Sum of Degrees of Vertices Theorem, Adjacency and Incidence, Adjacency Matrix, Incidence Matrix, Isomorphism, [Walks, Trails, Paths & Circuits], [Eccentricity, Diameter, Radius], Connectedness, Euler Trails & Circuits, Fleury's Algorithm, Hamiltonian Paths & Circuits, Ore's Theorem, The Shortest Path Problem [3 H 36 M]

Planner Graphs, Graph coloring [0 H 15 M]

e) Tree

Trees, Cayley's Theorem, Rooted Trees, Binary Tree, Binary Search Trees, Spanning Trees, Forest [1 H 46 M]

2. Topic: Number Theory

Deals with properties of number

03. Parity

Basic: if an integer is even or odd

Even: $2k$

Odd: $2k+1$

Zero: is even integer

Negative number: -10 is even? -11?

Only integer can be either even or odd

Even and odd calculation

Even + Even = Even

Even + Odd = Odd

Odd + Odd = Even

Even x Even = Even

Even x Odd = Even

Odd x Odd = Odd

Quiz:

- If both a & b are integers, then $8a + 4b$ is an _____ integer.
- The square of any integer on the form of $2k + 1$ such that k is an integer is:
- Any integer multiplied by an odd and then an even integer is_____.

4. Divisibility: Intro

Rules for integer division

Integer has to be whole number after division

An integer N is divisible by another integer M if there exists an integer K such that $K.M = N$

Divisor		Dividend
3		6

Example: $N=10, M=2$

Property 1: If $a|b$ and $b|c \rightarrow a|c$
 $a|b=2|4$ and $b|c=4|16$ then $a|c=1|16$

Property 2: If $a|b$ and $b|a \rightarrow a=b$ or $a=-b$
 $a=3$ and $b=-3$

Property 3: If $a|b \rightarrow a|bc$
 $a=3$ $b=6$
 $a|b=3|6=2$ $a|bc=3|18=6$

05. Divisibility Rules

Divisible by	Condition	Example
1	No conditions. All integers are divisible by 1	$1 45=45$ $1 22=22$
2	If the last digit of the integer is even	$2 56=28$ $2 102 = 51$
3	If the sum of the digit's numbers are divisible by 3	$207 (2+0+7 = 9) \rightarrow$ $3 207 = 69$
4	If the last 2 digits are divisible by 4	$1244 (44/4 = 11)$ $\rightarrow 4 1244 = 311$
5	If the last digit is either 0 or 5	$5 100 = 20$ 901 is not divisible by 5
6	If it is divisible by both 2 and 3. (For divisibility by 2 and 3, check rule 2 and 3)	$6 3312$ since: $2 3114$ (4 is even) $3 3114$ ($3+1+1+4 = 9$ and 9 is divisible by 3)
7	If you double the last digit and subtract it from the rest of the number and the answer is: - 0, or - divisible by 7	532 (Double 2 is 4, $53-4=49$, and $49 \div 7=7$)
8	If the last three digits are divisible by 8.	9816
9	If the sum of the digits are divisible by 9	$5661 (5+6+6+1 = 18$ and 18 is divisible by 9)
10	If the number ends in 0.	1000, 5000
11	Add and subtract digits in an alternating pattern (add first, subtract second, add third, etc). Then the answer must be: - 0, or - divisible by 11	$1364 (1-3+6-4 = 0)$ $913 (9-1+3 = 11)$
12	If the number is both divisible by 3 and 4. (check divisibility rules for 3 and 4)	$12 1116 = 93$ for divisibility by 3 ($1+1+1+6 = 9$ is divisible by 3) for divisibility by 4, the last two digits 16 is divisible by 4)