

Note: X axis: 1 to 10 marked in Chapter-wise analysis refers to years starting from 2010 ranging till 2019 where 1 stands for 2010, 2 stands for 2011 ... and 10 stands for 2019. Y axis: No. of Questions

Maths

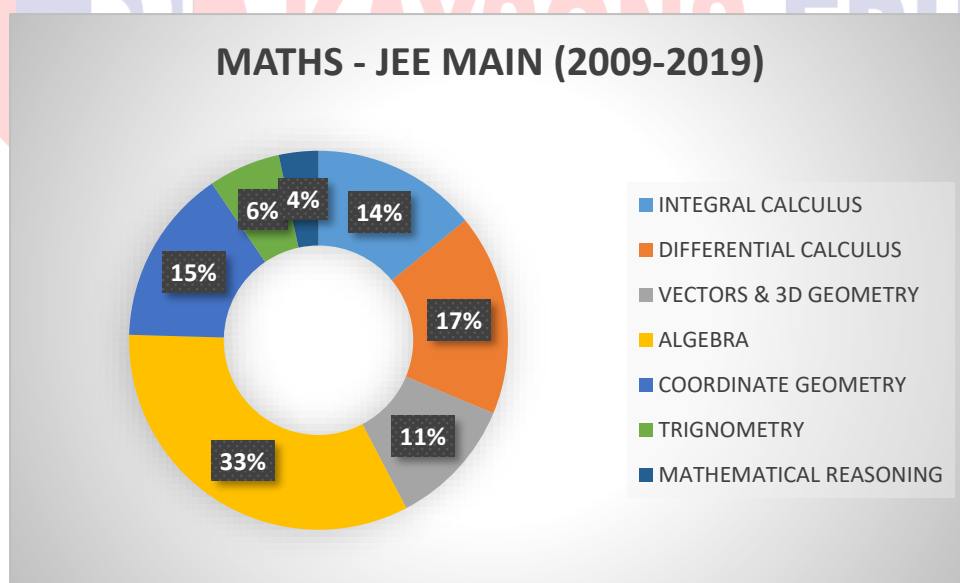
Maths is a subject that requires a lot of practice owing to various formulas and questions that can be made out of its variations and derivations. A certain sense of trend needs to be established before going into the examination to be able to swiftly solve the questions within the limited time frame. Among all its units, Algebra takes up a huge 33% followed by Calculus with 31%. Vectors, 3D Geometry and Coordinate Geometry further contribute 26% together.

Some of the most important chapters are: Definite Integration, Differential Equation, Application of Derivatives, Vectors, 3D Coordinate Geometry, Sequence & Series, Matrices & Determinants, Probability, and Straight Line.

The 7 units of Mathematics are:

1. Integral Calculus
2. Differential Calculus
3. Vectors & 3D Geometry
4. Algebra
5. Coordinate Geometry
6. Trigonometry
7. Mathematical Reasoning

The graph below shows the mark distribution of the subjects



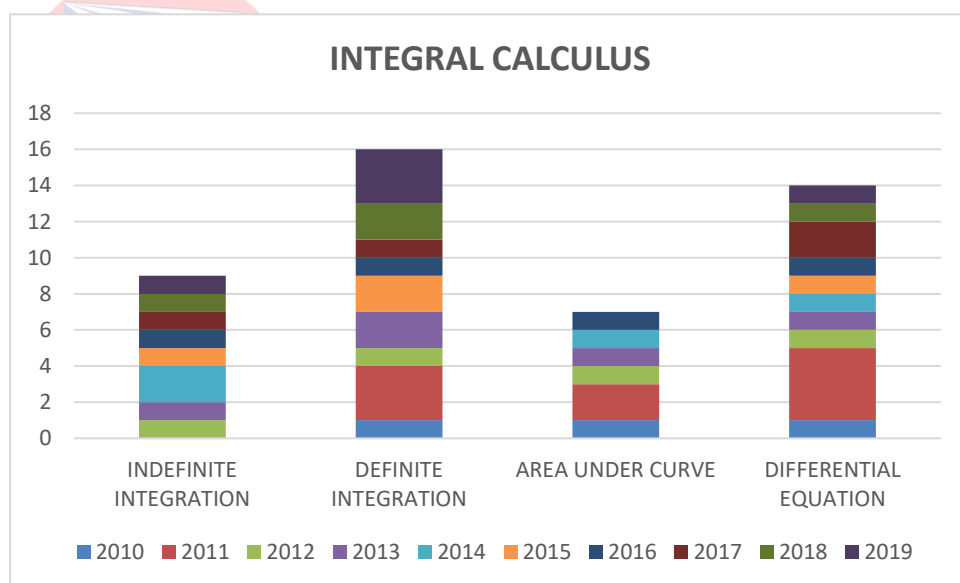
The chart below shows the mark distribution of the subjects across the years:

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
	30	60	30	30	30	30	30	30	30	28	328
INTEGRAL CALCULUS											46
INDEFINITE INTEGRATION	0	0	1	1	2	1	1	1	1	1	9
DEFINITE INTEGRATION	1	3	1	2	0	2	1	1	2	3	16
AREA UNDER CURVE	1	2	1	1	1	0	1	0	0	0	7
DIFFERENTIAL EQUATION	1	4	1	1	1	1	1	2	1	1	14
DIFFERENTIAL CALCULUS											56
SETS & RELATION	1	2	1	1	1	1	0	0	1	0	8
FUNCTIONS	0	2	0	0	1	0	1	1	0	1	6
LIMIT OF FUNCTION	1	2	0	1	1	1	0	0	1	0	7
CONTINUITY & DERIVABILITY	0	3	1	0	0	1	1	1	1	0	8
DIFFERENTIATION (MOD)	1	1	0	1	0	0	1	1	0	1	6
APPLICATION OF DERIVATIVES (AOD)	3	2	3	1	2	1	2	3	2	2	21
VECTORS & 3D GEOMETRY											36
VECTOR	2	4	2	1	1	1	1	3	1	2	18
CO-ORDINATE GEOMETRY (3-D)	2	4	2	2	2	2	2	0	2	0	18
ALGEBRA											108
COMPLEX NUMBER	2	2	1	1	1	1	1	1	1	1	12
BINOMIAL THEOREM	1	1	1	1	1	1	1	1	1	1	10
SEQUENCE & SERIES	1	2	2	1	2	1	2	3	2	1	17
PERMUTATION & COMBINATION	1	2	1	1	0	2	1	1	1	1	11
QUADRATIC EQUATION	0	2	0	1	2	1	1	0	1	1	9
MATRICES & DETERMINANTS	3	5	2	2	2	2	2	2	2	1	23
PROBABILITY	2	3	1	1	1	1	1	3	1	2	16
STATISTICS	1	2	1	1	1	1	1	0	1	1	10
COORDINATE GEOMETRY											49
STRAIGHT LINE	1	3	2	2	2	1	1	1	1	1	15
CIRCLE	1	2	1	1	1	2	2	0	1	1	12
PARABOLA	1	0	1	1	1	2	1	0	1	0	8
ELLIPSE	0	1	2	1	1	1	0	1	1	1	9
HYPERBOLA	0	1	0	0	0	0	1	1	1	1	5
TRIGNOMETRY											20
TRIGO. RATIO & IDENTITIES	2	1	1	1	0	0	1	2	1	0	9
TRIGONOMETRIC EQUATION	0	1	0	1	1	0	1	0	1	1	6

INVERSE TRIGONOMETRIC FUNCTION	0	0	0	1	0	1	0	0	0	1	3
HEIGHT & DISTANCE	0	0	0	0	1	1	0	0	0	0	2
MATHEMATICAL REASONING											11
MATHEMATICAL REASONING	1	2	1	1	1	1	1	1	1	1	11
Mathematical Induction 1 question	2011										
Fundamental of Mathematics 1 q	2019										

UNIT 1 - INTEGRAL CALCULUS

Integral Calculus takes up as much as 14% of the entire Maths. 4 to 5 questions are asked every year from this unit. Definite Integration and Differential Equation are the two most important chapters in this unit. Integral Calculus is very closely tied with Differential Calculus and is usually prepared alongside and thus is a very important unit.



SYLLABUS

PART 1: INTEGRAL CALCULUS

- Integral as an anti-derivative, Fundamental Integrals involving algebraic, trigonometric, exponential and logarithms functions.
- Integrations by substitution, by parts and by partial functions.
- Integration using trigonometric identities.
- Evaluation of simple integrals of the type

$$\int \frac{dx}{x^2+a^2}, \quad \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \quad \int \frac{dx}{a^2-x^2},$$

$$\int \frac{dx}{\sqrt{a^2-x^2}}, \quad \int \frac{dx}{ax^2+bx+c}, \quad \int \frac{dx}{\sqrt{ax^2+bx+c}},$$

$$\int \frac{(px+q)dx}{ax^2+bx+c},$$

$$\int \frac{(px+q)dx}{\sqrt{ax^2+bx+c}}, \quad \int \sqrt{a^2 \pm x^2} dx,$$

$$\int \sqrt{x^2 - a^2} dx$$

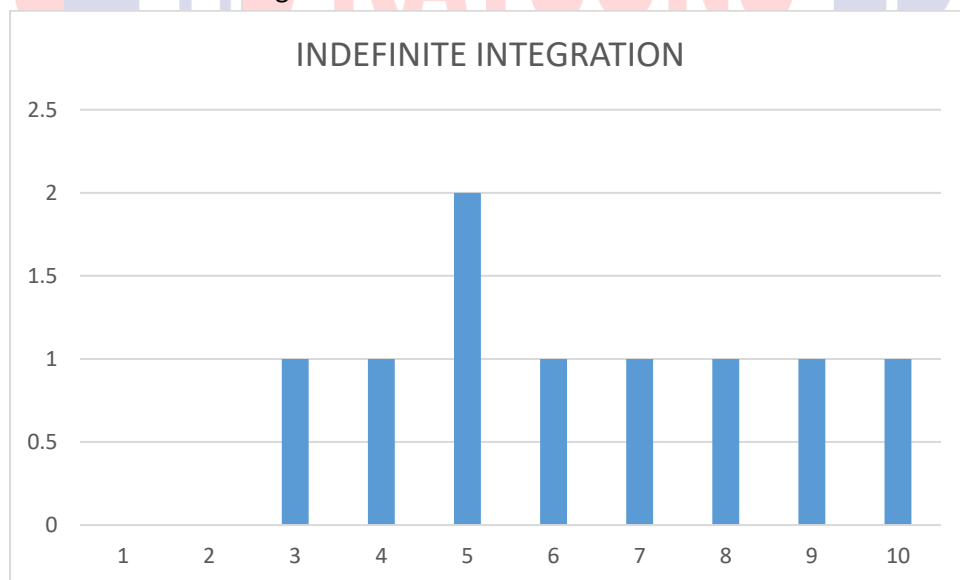
- Integral as limit of a sum.
- The fundamental theorem of calculus, properties of definite integrals.
- Evaluation of definite integrals, determining areas of the regions bounded by simple curves in standard form.

PART 2: DIFFERENTIAL EQUATIONS

- Ordinary differential equations, their order and degree, the formation of differential equations, solution of differential equation by the method of separation of variables, solution of a homogeneous and linear differential equation of the type $dy/dx + p(x)y = q(x)$

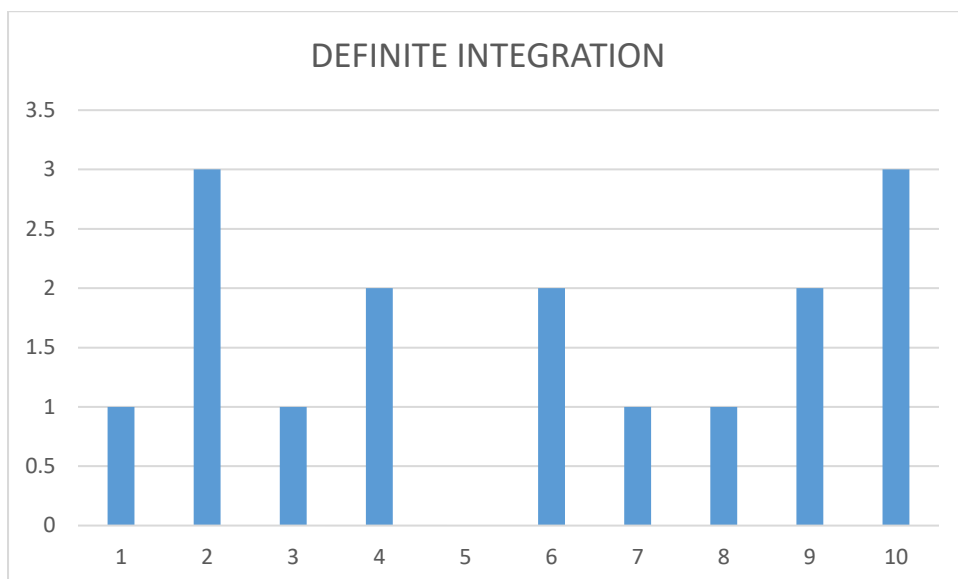
CHAPTERWISE ANALYSIS

1. Indefinite Integration



With at least 1 question asked in the previous 8 years, it is important to complete this chapter. It is important to know integration methods such as substitution, by parts, partial fraction and by use of trigonometric identities. Knowing the types is important to see the patterns and solve problems quickly.

2. Definite Integration

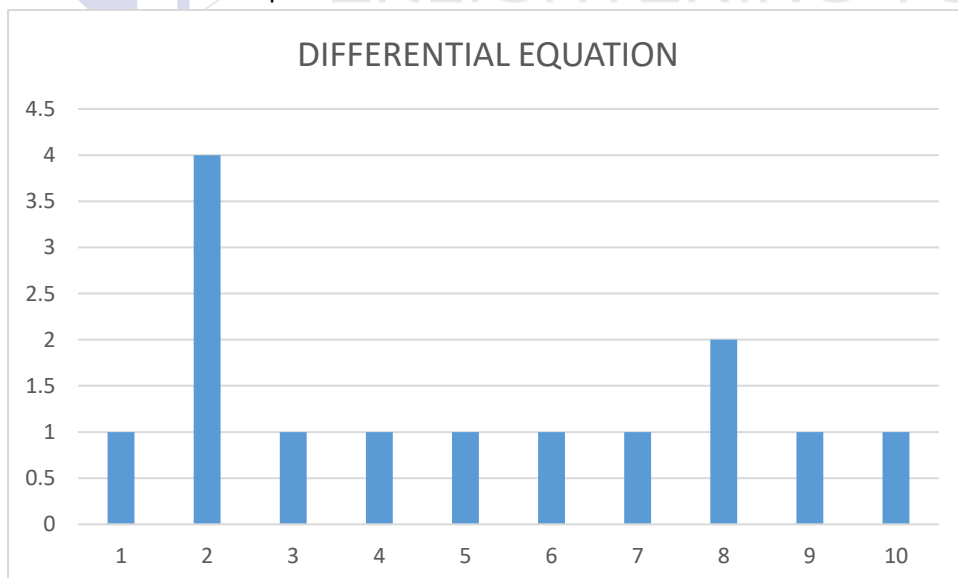


Definite Integration has as much as twice the weightage of indefinite integration and hence is naturally more important. It is similar to indefinite integration except for the limits are well defined.

3. Area under Curve

This chapter follows from the previous chapters of integration. However, only 1 question has been asked from this subject in the past 5 years.

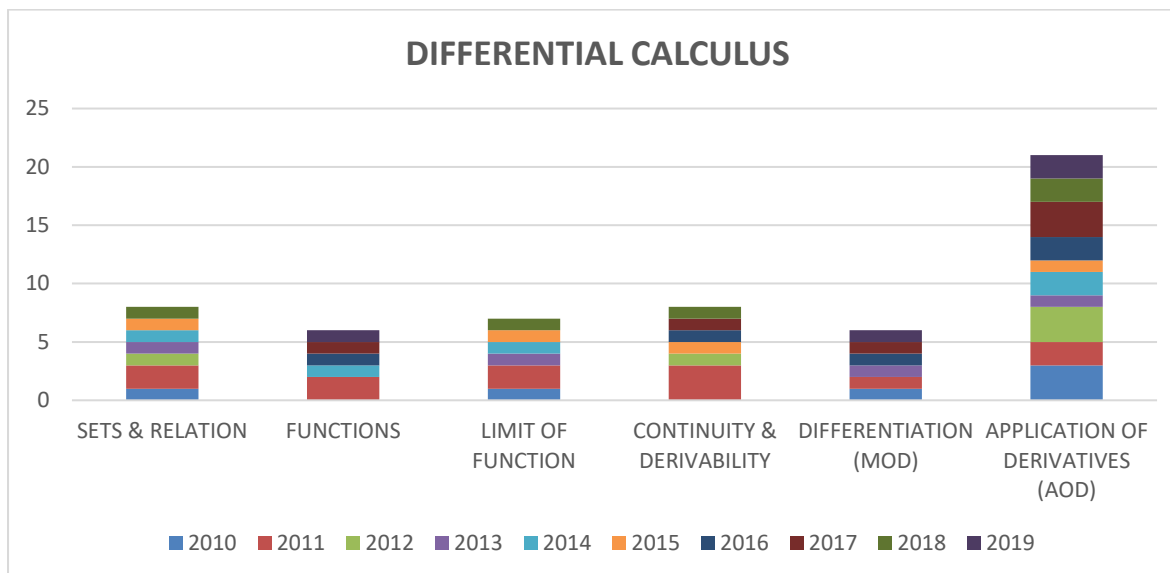
4. Differential Equation



It is a very important chapter which sees at least one question every year. With 14 questions asked in the previous years, all the orders of DE in various forms and other topics are important. It is a small chapter and should be covered to score good marks.

UNIT 2 - DIFFERENTIAL CALCULUS

Prepared alongside Integral Calculus, it has a lot higher weightage i.e., 17% with 56 questions asked in the previous 10 years. While most questions can be seen to be from the chapter Application of Derivatives, it is to be understood that all the chapters preceding it are its pre-requisites and this can't be left unprepared. It is thus very important to take the whole unit and prepare everything.



SYLLABUS

PART 1: SETS, RELATIONS AND FUNCTIONS

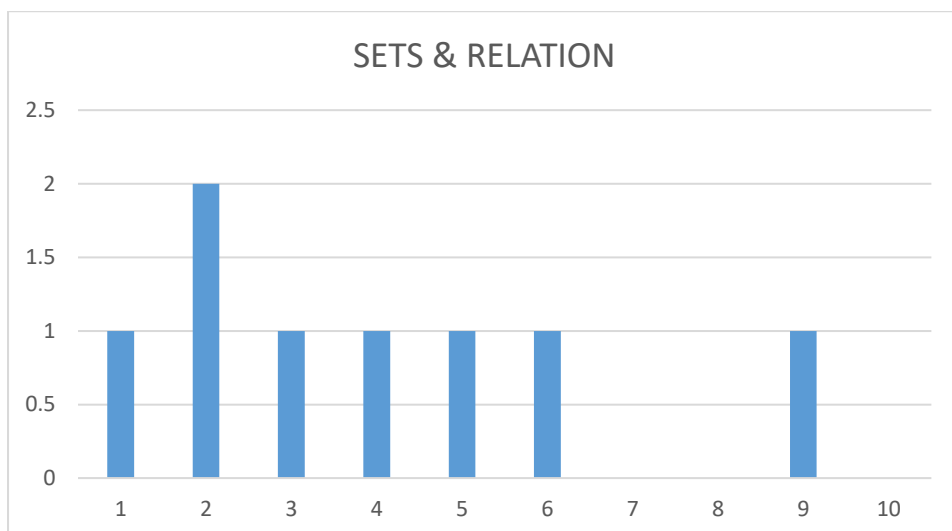
- Sets and their representation: Union, intersection and complement of sets and their algebraic properties; Power set;
- Relation, Type of relations, equivalence relations
- Functions; one-one, into and onto functions, the composition of functions.

PART 2: LIMIT, CONTINUITY AND DIFFERENTIABILITY

- Real – valued functions, algebra of functions, polynomials, rational, trigonometric, logarithmic and exponential functions, inverse function.
- Graphs of simple functions. Limits, continuity and differentiability.
- Differentiation of the sum, difference, product and quotient of two functions.
- Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions
- Derivatives of order up to two, Rolle's and Lagrange's Mean value Theorems
- Applications of derivatives: Rate of change of quantities, monotonic- Increasing and decreasing functions, Maxima and minima of functions of one variable, tangents and normal.

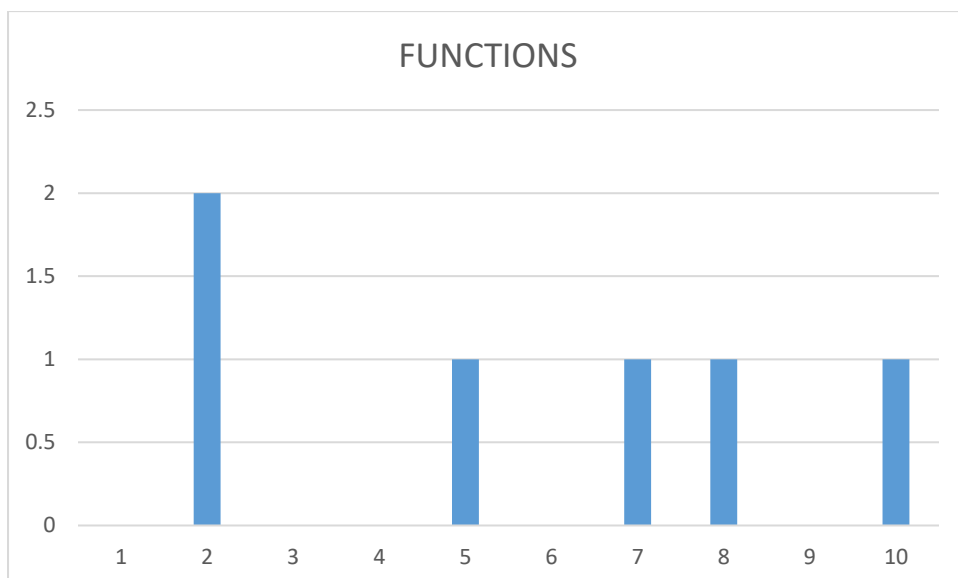
CHAPTERWISE ANALYSIS

1. Sets & Relation



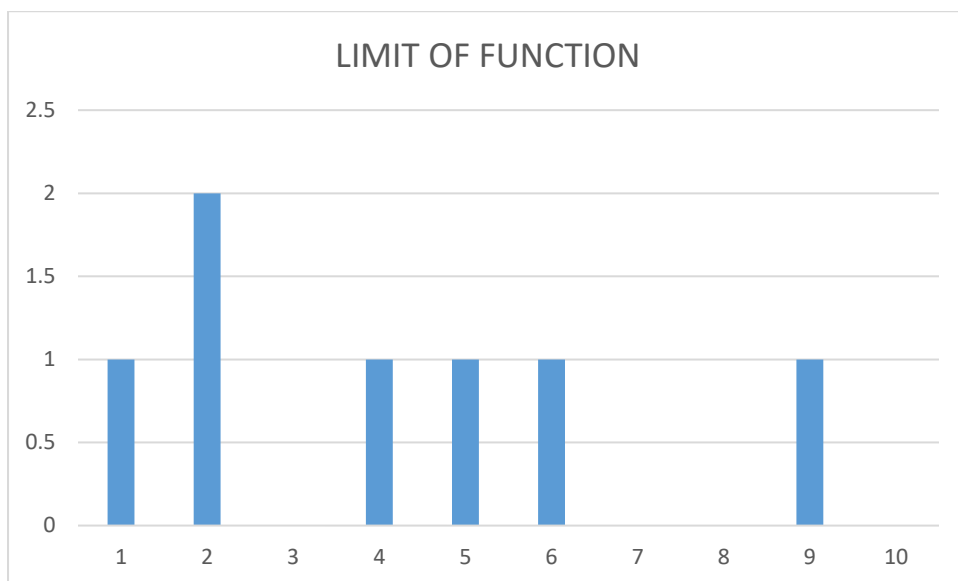
Even though 8 questions have been asked in 10 years, recent 4 years has seen only 1 question. However, understanding relations is important to understand functions. So, a basic understanding is both easy and important.

2. Functions



Even though only 6 questions have been asked from the chapters, it is a very important fundamental for the rest of the chapters and should be completed without fail.

3. Limits of Function

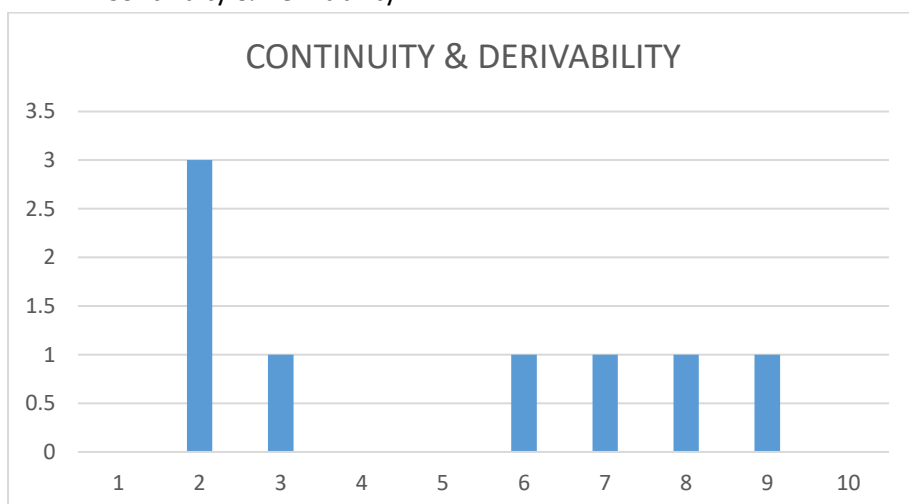


Much like functions, even though there are no direct questions, it serves as a fundamental chapter. 7 questions in the past 10 years.



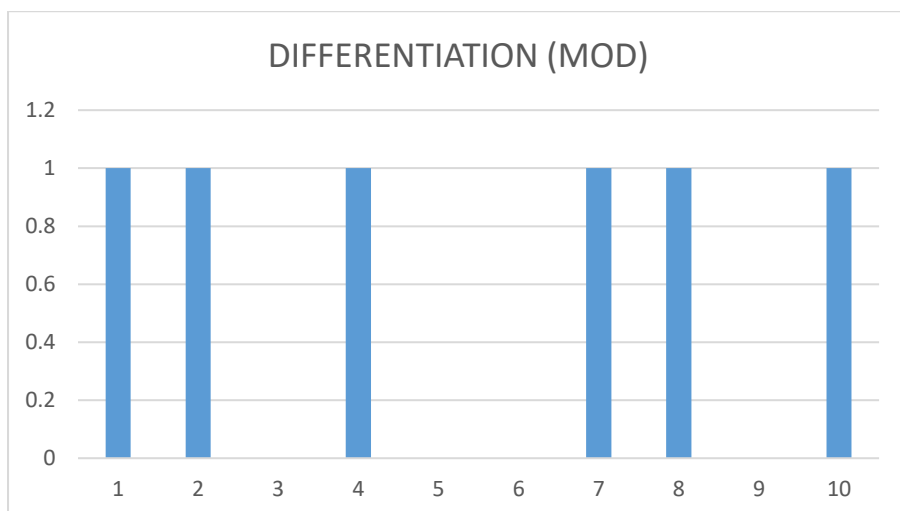
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4. Continuity & Derivability



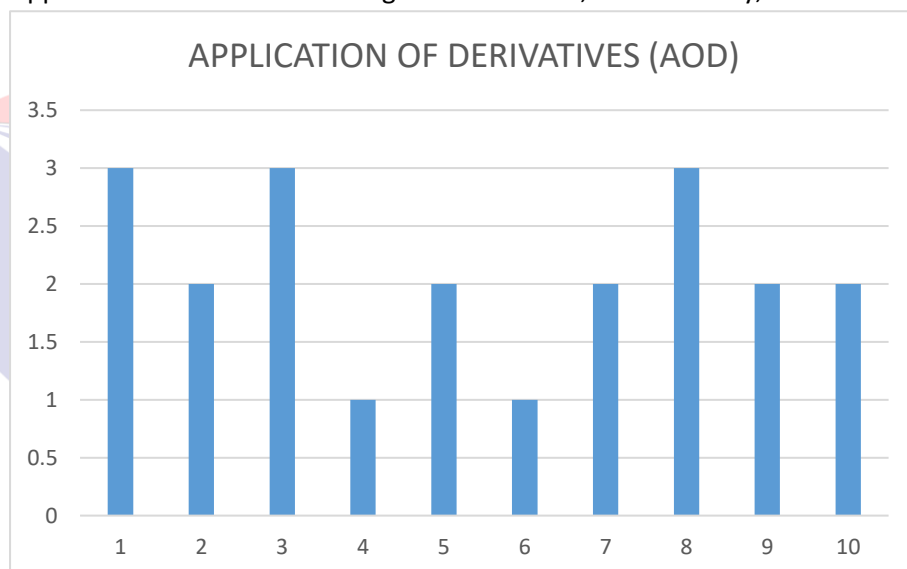
This chapter follows the same fundamental aspect like the preceding chapters. 8 questions from 10 years.

5. Differentiation



This chapter introduces the methods which are further used during application. 1 or 0 direct questions are asked every year. However, all these chapters are a set up for the final chapter that brings with it a huge scoring opportunity.

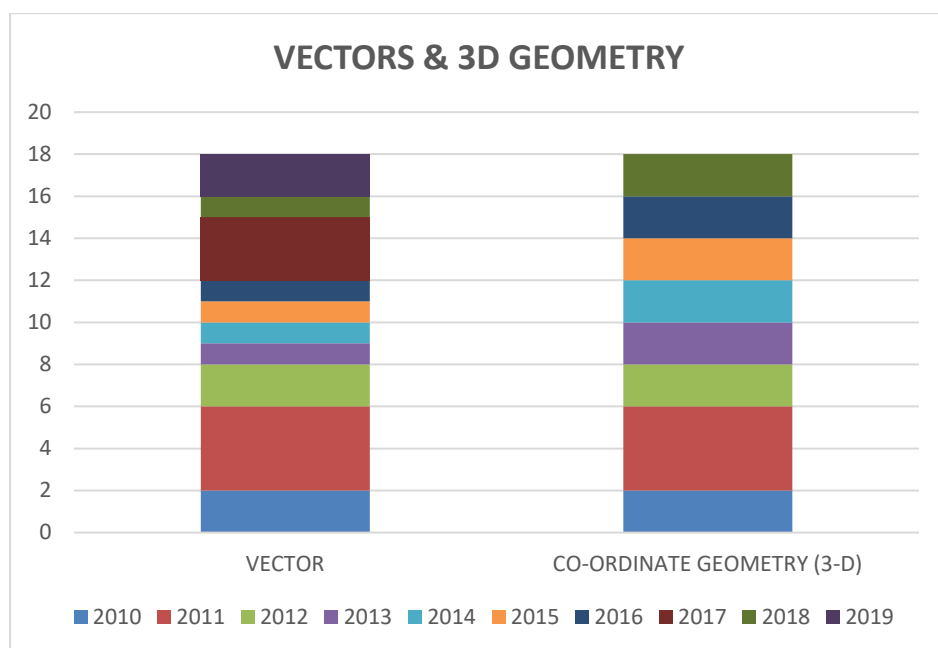
6. Application of Derivatives - Tangents & Normals, Monotonicity, Maxima & Minima, Graphical Transformation



This is the giant we have been talking about all this time in this unit. With as many as 21 questions in the 10 years, it is important to not leave out on the applications based on the differential calculus you have studied so far. This whole unit if done properly will make sure you get 5 to 6 questions under control.

UNIT 3 - VECTORS & 3D GEOMETRY

Both the chapters have equal weightage to the unit. 3 to 4 questions are asked every year from this unit and it is important to not let the chapter go unprepared. There are a lot of cases in these chapters and making a good note will prove to be useful. Vectors might take some time to build intuition in but once that is done working with 3D geometry is going to be easier as well.



SYLLABUS

PART 1: THREE DIMENSIONAL GEOMETRY

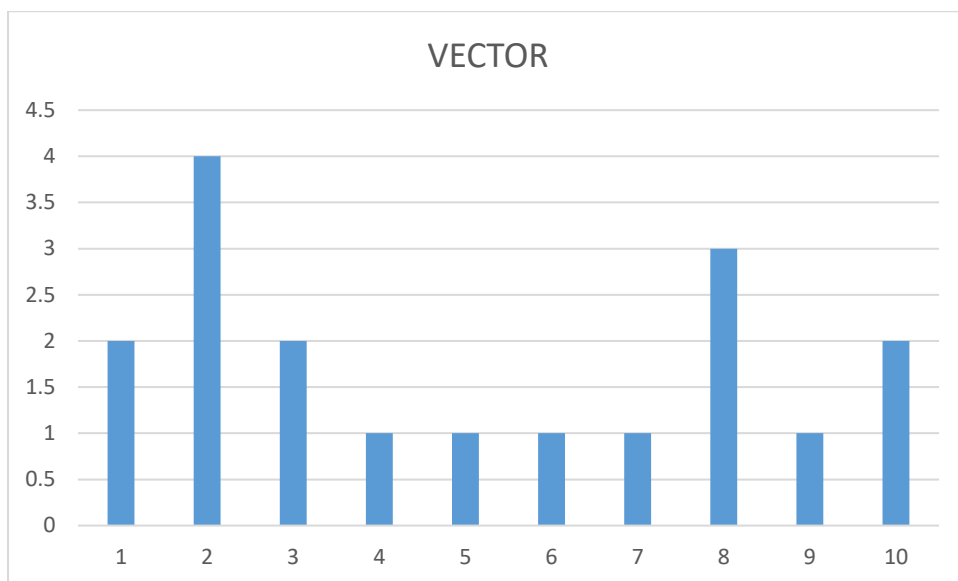
- Coordinates of a point in space, the distance between two points, section formula, directions ratios and direction cosines, the angle between two intersecting lines.
- Skew lines, the shortest distance between them and its equation.
- Equations of a line and a plane in different forms, the intersection of a line and a plane, coplanar lines.

PART 2: VECTOR ALGEBRA

- Vectors and scalars, the addition of vectors, components of a vector in two dimensions and three-dimensional space, scalar and vector products, scalar and vector triple products.

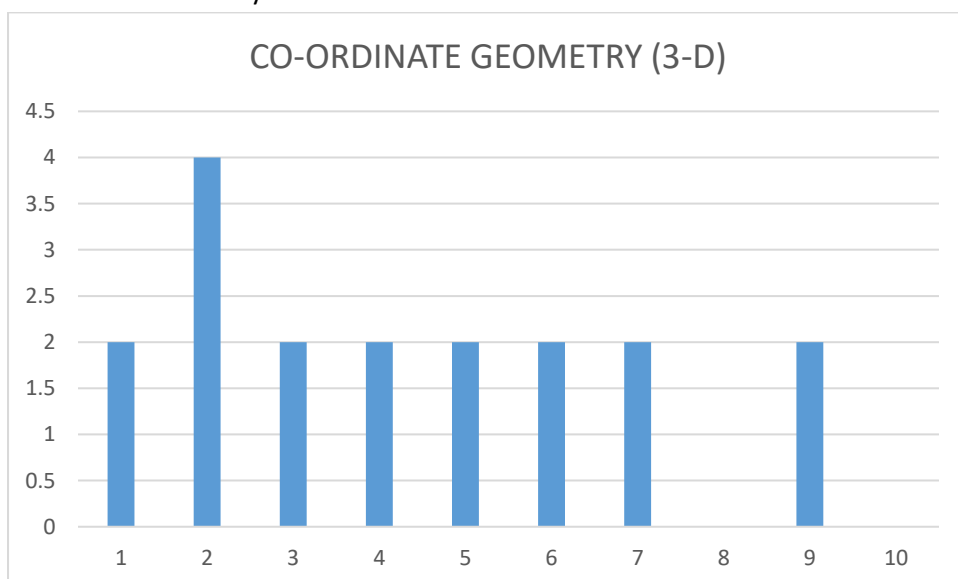
CHPATERWISE ANALYSIS

1. Vectors



With 18 questions under its hood, knowing various products will be important to score well in vectors.

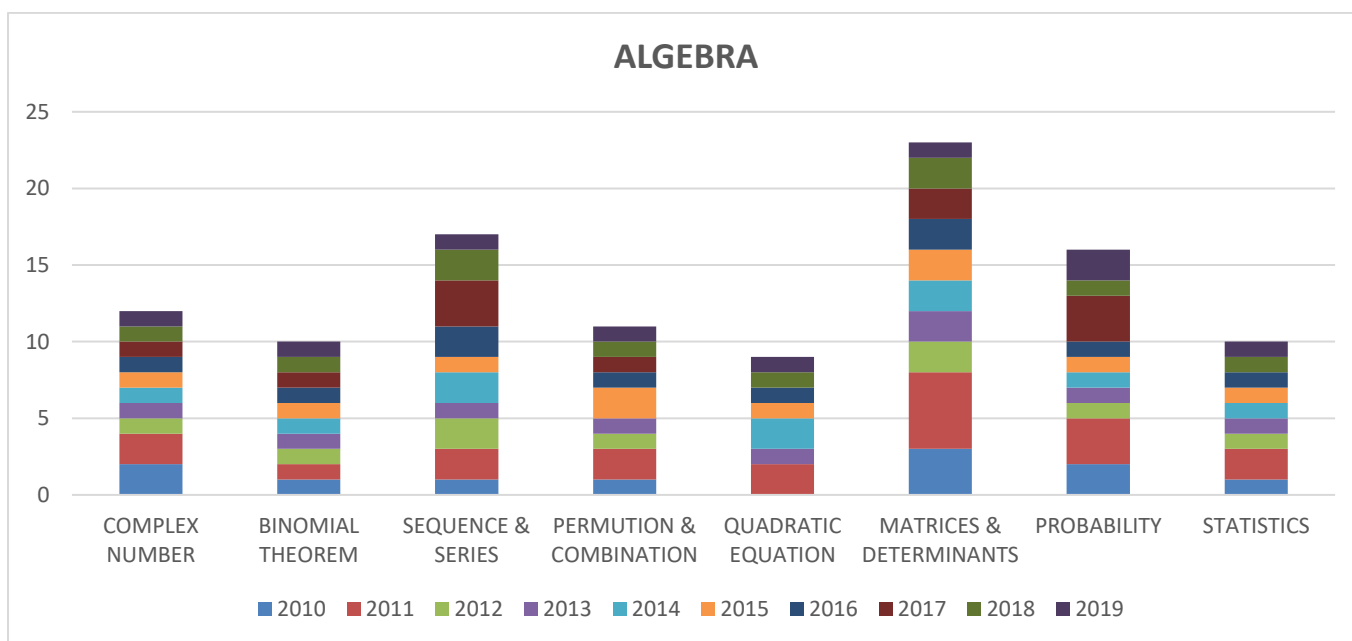
2. 3D Geometry



3D Geometry is knowing all about the cases and the formulas associated with it. From the pattern itself, either 2 questions are straight out of the chapter or none. So, it become very important to not miss out on 2 questions.

UNIT 4 - ALGEBRA

Algebra is vast and evidently constitutes one-third of the entire subject. 10 to 11 questions are asked every year from this unit. Sequence & Series, Matrices & Determinants and Probability together cover more than half the weightage of the unit and should not be missed at any cost. Rest of the chapters have more or less equal weightage adding 1 question every year. Complex Number and Binomial Theorem can be kept as the last subjects to prepare from.

**SYLLABUS****PART 1: COMPLEX NUMBERS AND QUADRATIC EQUATIONS:**

- Complex numbers as ordered pairs of reals, Representation of complex numbers in the form $a + ib$ and their representation in a plane, Argand diagram, algebra of complex number, modulus and argument (or amplitude) of a complex number, square root of a complex number, triangle inequality
- Quadratic equations in real and complex number systems and their solutions Relations between roots and co- efficient, nature of roots, the formation of quadratic equations with given roots.

PART 2: MATRICES AND DETERMINANTS:

- Matrices, algebra of matrices, type of matrices, determinants and matrices of order two and three, properties of determinants, evaluation of determinants, area of triangles using determinants, Adjoint and evaluation of inverse of a square matrix using determinants and elementary transformations, Test of consistency and solution of simultaneous linear equations in two or three variables using determinants and matrices.

PART 3: PERMUTATIONS AND COMBINATIONS:

- The fundamental principle of counting, permutation as an arrangement and combination as section, Meaning of $P(n,r)$ and $C(n,r)$, simple applications.

PART 4: BINOMIAL THEOREM AND ITS SIMPLE APPLICATIONS:

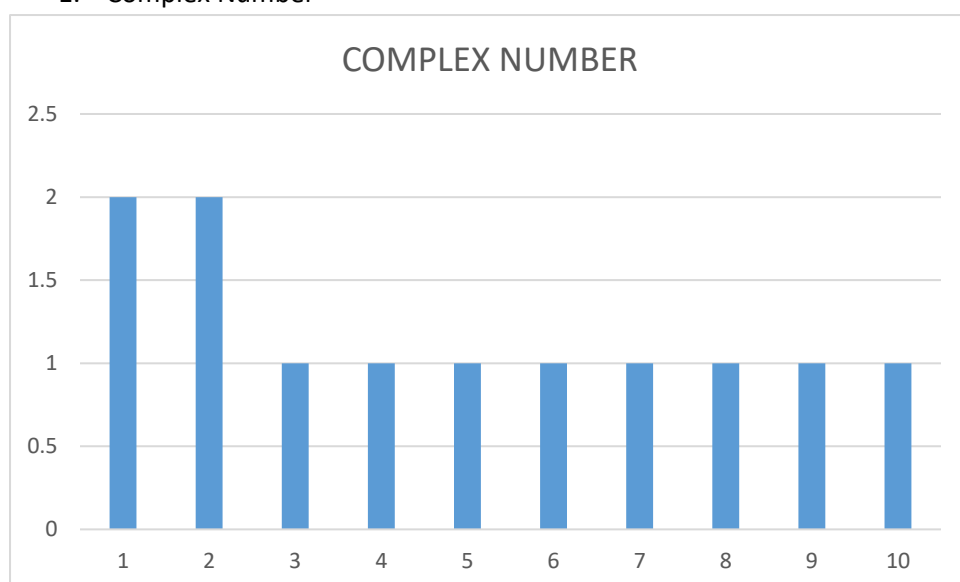
- Binomial theorem for a positive integral index, general term and middle term, properties of Binomial coefficients and simple applications.

PART 5: SEQUENCE AND SERIES:

- Arithmetic and Geometric progressions, insertion of arithmetic, geometric means between two given numbers, Relation between A.M and G.M sum up to n terms of special series; S_n , S_{n^2} , S_{n^3} . Arithmetico-Geometric progression.

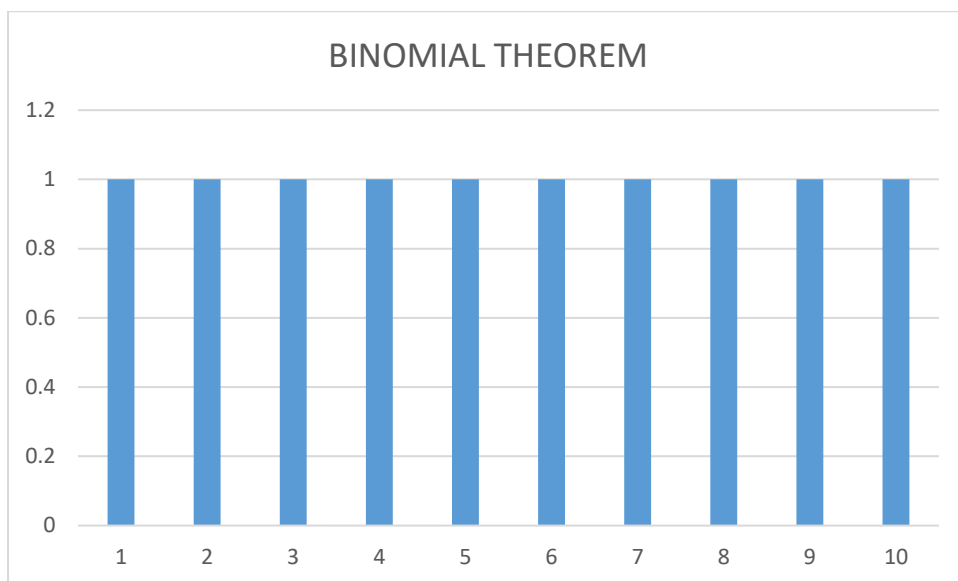
PART 6: STATISTICS AND PROBABILITY

- Measures of discretion; calculation of mean, median, mode of grouped and ungrouped data calculation of standard deviation, variance and mean deviation for grouped and ungrouped data.
- Probability: Probability of an event, addition and multiplication theorems of probability, Baye's theorem, probability distribution of a random variate, Bernoulli trials and binomial distribution.

CHAPTERWISE ANALYSIS**1. Complex Number**

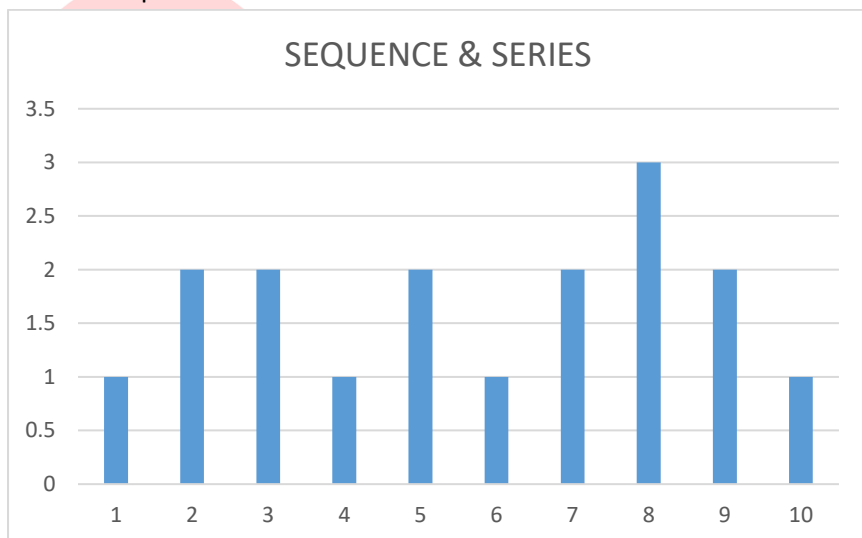
With 12 questions, studying complex number will be rewarding but it can get a little confusing at times and keeping in view the rest of the important chapters in algebra, it is best studied at the end.

2. Binomial Theorem



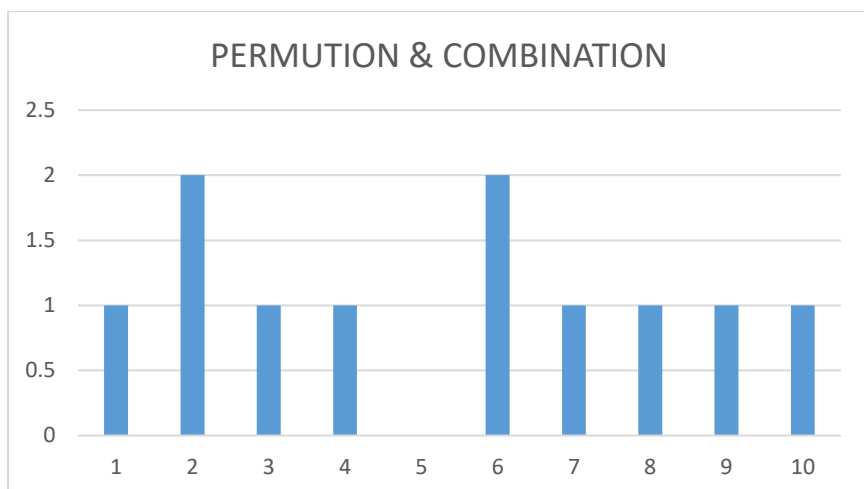
1 question every year for 10 years in a row makes this a very consistent chapter. There are going to be multiple formulas and make sure to know to find the number of terms to score well.

3. Sequence & Series



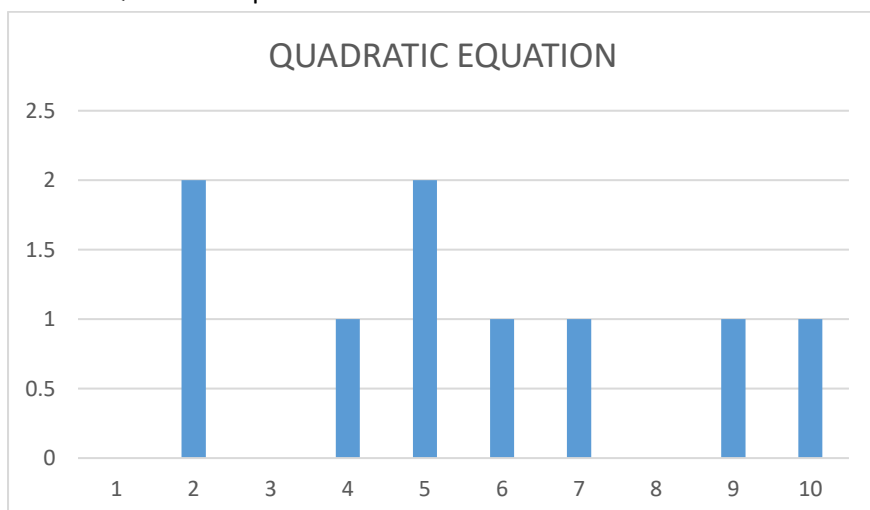
With at least 1 question every year, this is a very important chapter to study. Formulas for general form, nth term, sum of n terms, important summations for both arithmetic and geometric progression is important.

4. Permutation & Combination



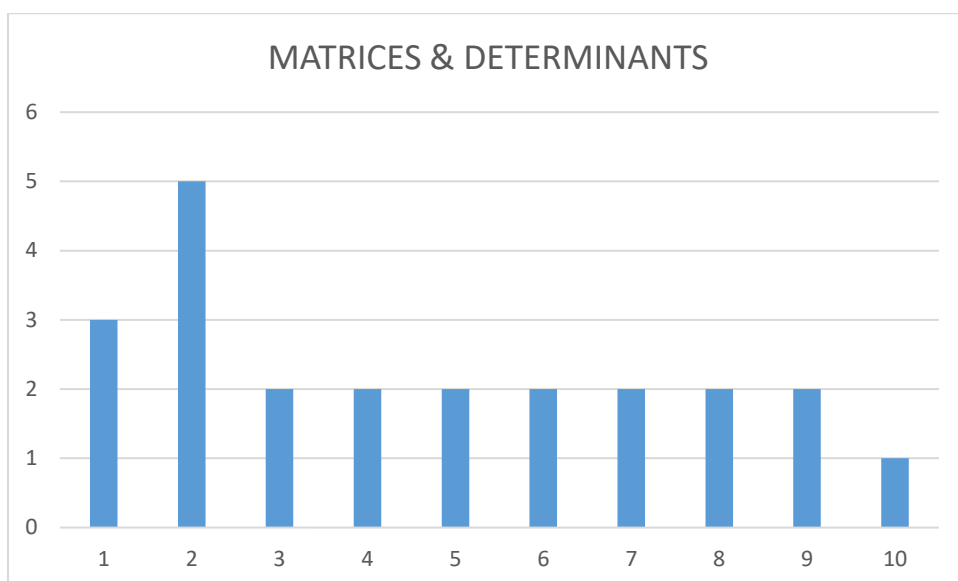
This is another important chapter keeping in mind the fact that it's very useful in probability. With 11 questions in the previous year, this has direct questions as well. It is very important to know the intuition behind solving any problem otherwise it becomes very confusing. Practice a good amount of questions to be well acquainted.

5. Quadratic Equation



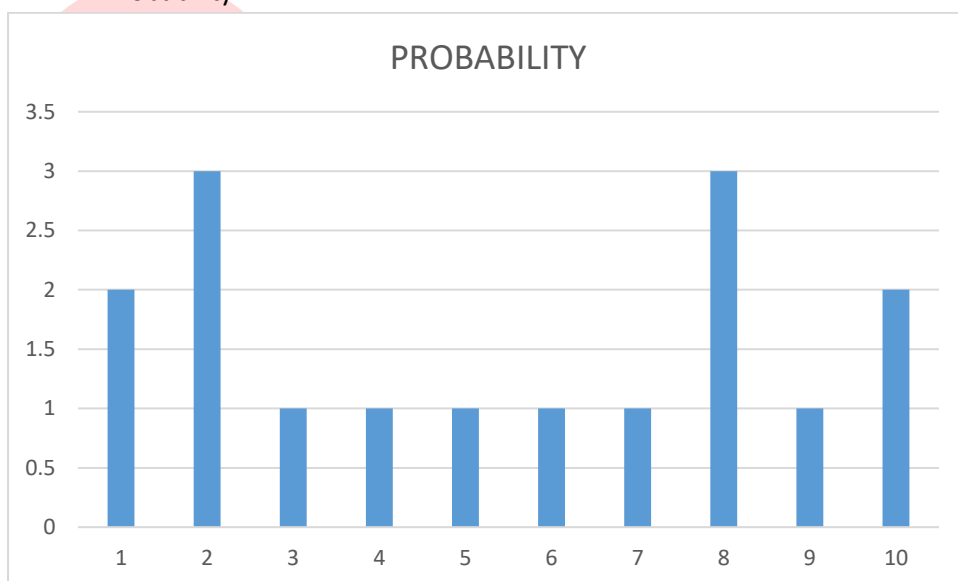
Know the formulas, relationships between coefficients and roots, discriminant and both the algebraic and graphical methods. With 9 questions in past years, it might not have a lot of direct questions but it forms the base of mathematics in a lot of ways.

6. Matrices & Determinants



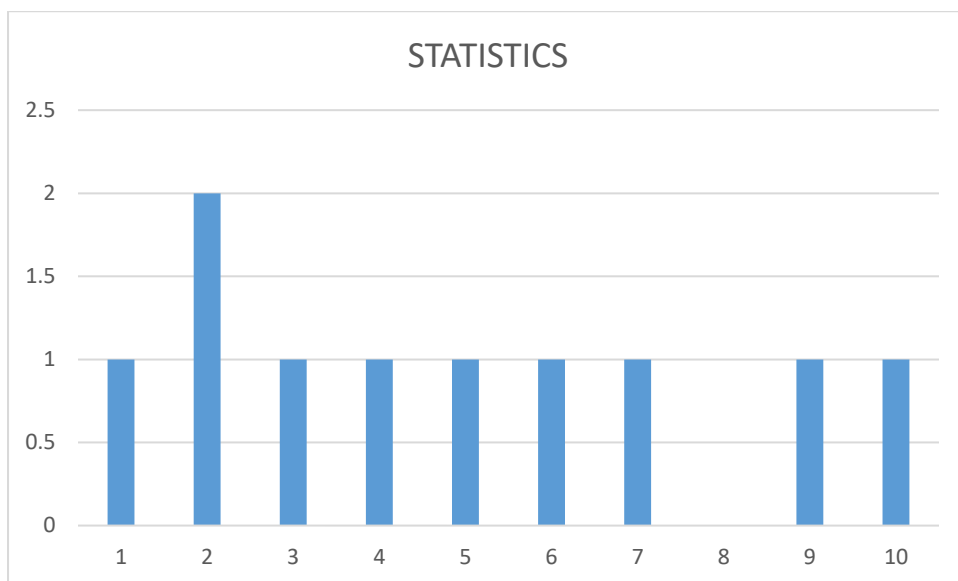
It is the most important chapter in all of algebra with as many as 23 questions averaging 2 questions a year. Study minors, cofactors, operations, elementary operations, properties of determinants, cramer's rule, classification of matrices, and inverse as these are the most important topics.

7. Probability



The second most important chapter with 16 questions in 10 years. It is important to study types of events, probability distribution i.e., conditional probability, bayes theorem and binomial distribution for successive events.

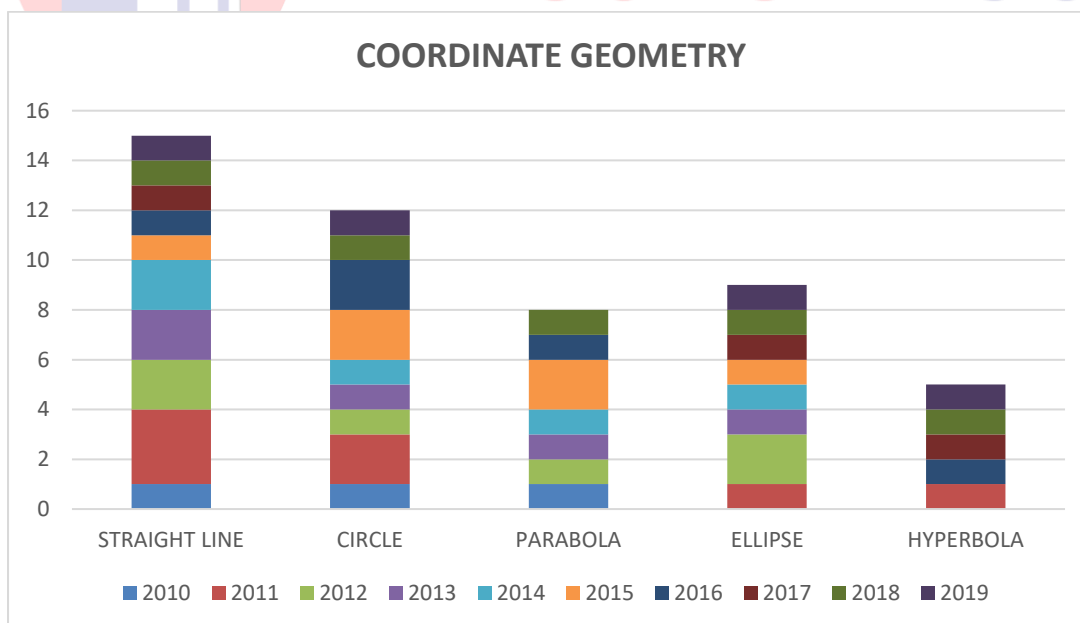
8. Statistics



With 1 question every year, this chapter should be completed alongside Probability for it is a collection of simple formulas. Mean, Median, range, mean deviation, variance, standard deviation and its relative counterparts are the important topics in this chapter.

UNIT 5 - COORDINATE GEOMETRY

5 questions are asked every year from this unit. However it is easy to direct the preparation keeping in mind the weightage of various chapters. Straight Line, Circle are the most important chapters in this unit and should be must prepared. Hyperbola can be prepared at last.

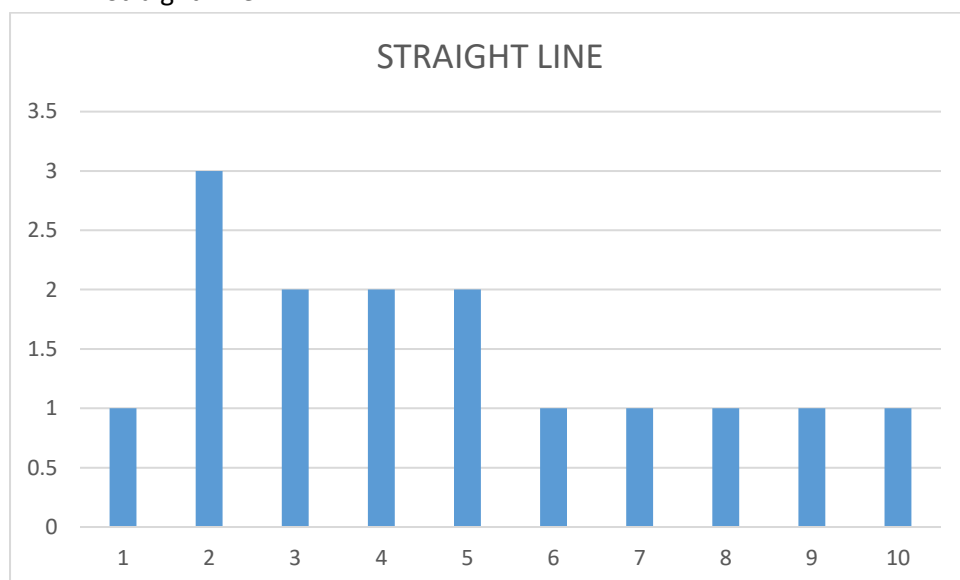


SYLLABUS

- Cartesian system of rectangular co-ordinates in a plane, distance formula, sections formula, locus and its equation, translation of axes, the slope of a line, parallel and perpendicular lines, intercepts of a line on the co-ordinate axis.
- Straight line: Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, the distance of a point from a line, equations of internal and external bisectors of angles between two lines co-ordinate of the centroid, orthocentre and circumcentre of a triangle, equation of the family of lines passing through the point of intersection of two lines.
- Circle, conic sections: A standard form of equations of a circle, the general form of the equation of a circle, its radius and central, equation of a circle when the endpoints of a diameter are given, points of intersection of a line and a circle with the centre at the origin and condition for a line to be tangent to a circle, equation of the tangent, sections of conics, equations of conic sections (parabola, ellipse and hyperbola) in standard forms, condition for $Y = mx + c$ to be a tangent and point (s) of tangency.

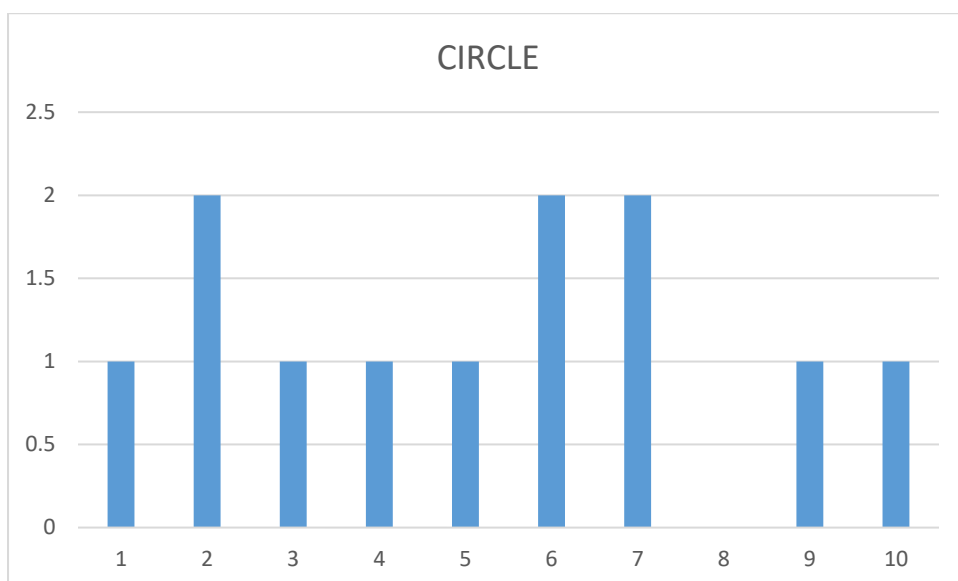
CHAPTERWISE ANALYSIS

1. Straight Line



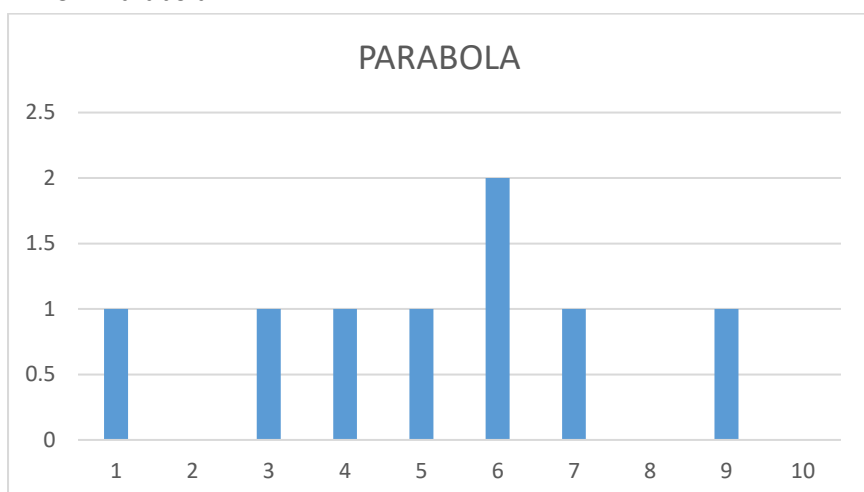
With 15 questions, this is the most important chapter of the unit. Important topics for the chapter are formula for distance, section, centroid, incenter, area of triangle and equation of straight lines in various forms, condition of parallel and perpendicular line, reflection of a point about line, bisector of angle, family of straight line, pair of straight lines etc.

2. Circle



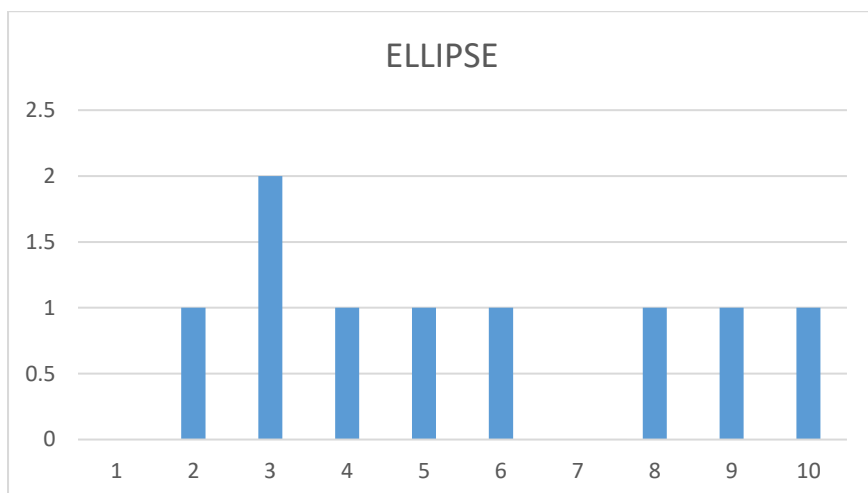
The second most important after straight line, it has 12 questions in 10 years. The important topics include equation of circle in various forms, under different conditions w.r.t x and y axis, equation of chord, tangent, normal and family of circles.

3. Parabola



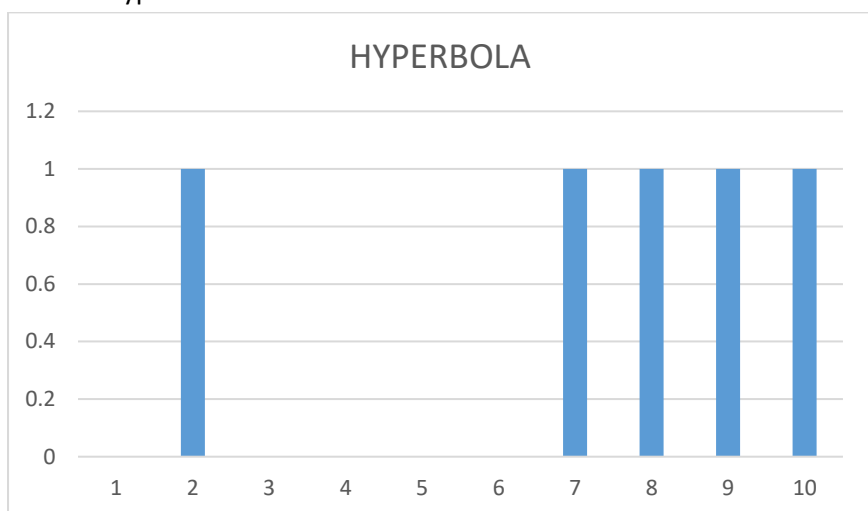
With just 8 questions it is at par in weightage with ellipse. Important topics include equation of parabola in various forms, tangents, normal, pair of tangents, chord of contact, a chord with given middle point etc.

4. Ellipse



9 questions in 10 years. Standard equation, latus rectum, area, position of point wrt ellipse, auxiliary circle and formulas to calculate the length of axis and latus rectum are some of the important topics in this chapter.

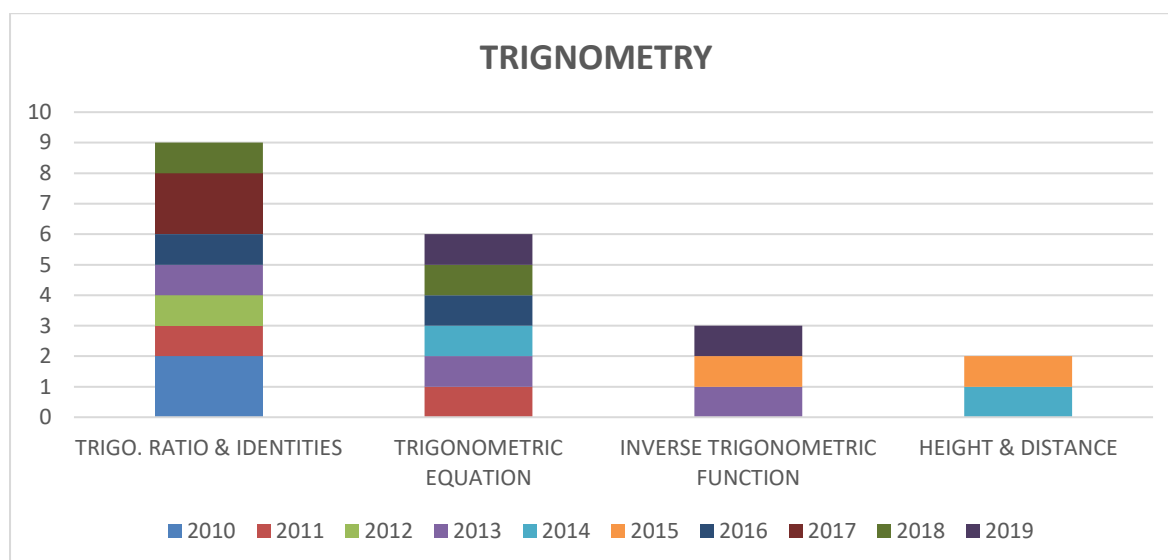
5. Hyperbola



Although 5 questions in 10 years were asked, recent 4 years have seen a constant question rate of 1. The chapter has basic formulas and equations which are similar to that of the above chapters and can be comfortably covered if time is present. Make sure to learn to distinguish between ellipse, parabola and hyperbola to avoid confusion.

UNIT 6 - TRIGONOMETRY

2 questions are asked every year from this unit. Even if not prepared extensively, it is important to know the basic ratios, identities and equations as it is very important for mathematics and even physics. Trigonometric Ratios & Identities is the most important chapter of this unit. All of the units are full of equations and graphs. Getting acquainted with solving by graphical means is equally important. There is no chapter wise analysis necessary for this unit since all of it essentially is like under one chapter.

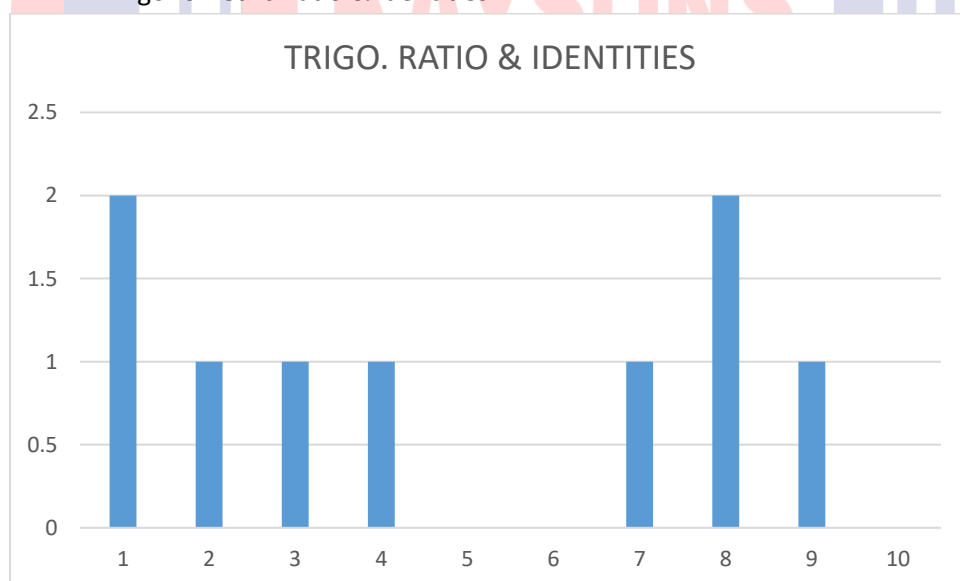


SYLLABUS

- Trigonometrical identities and equations, trigonometrical functions, inverse trigonometrical functions and their properties, heights and distance

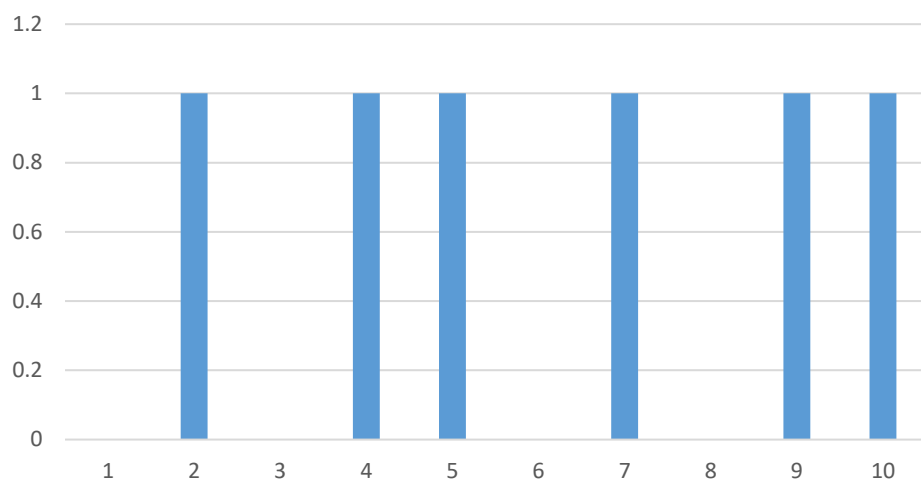
TRENDS

1. Trigonometric Ratio & Identities



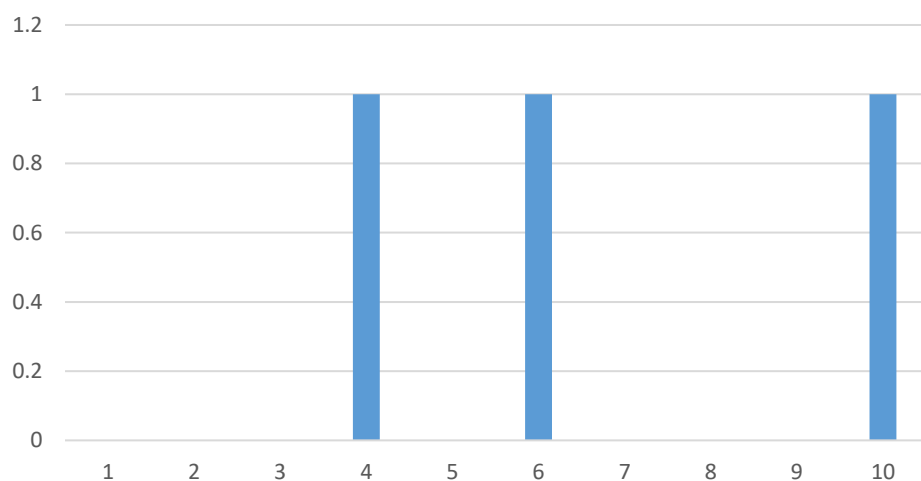
2. Trigonometric Equations

TRIGONOMETRIC EQUATION



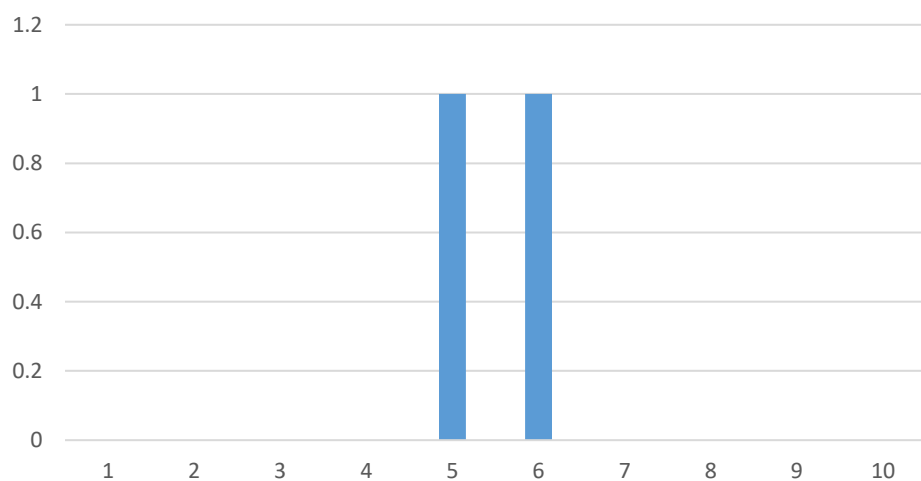
3. Inverse Trigonometric Functions

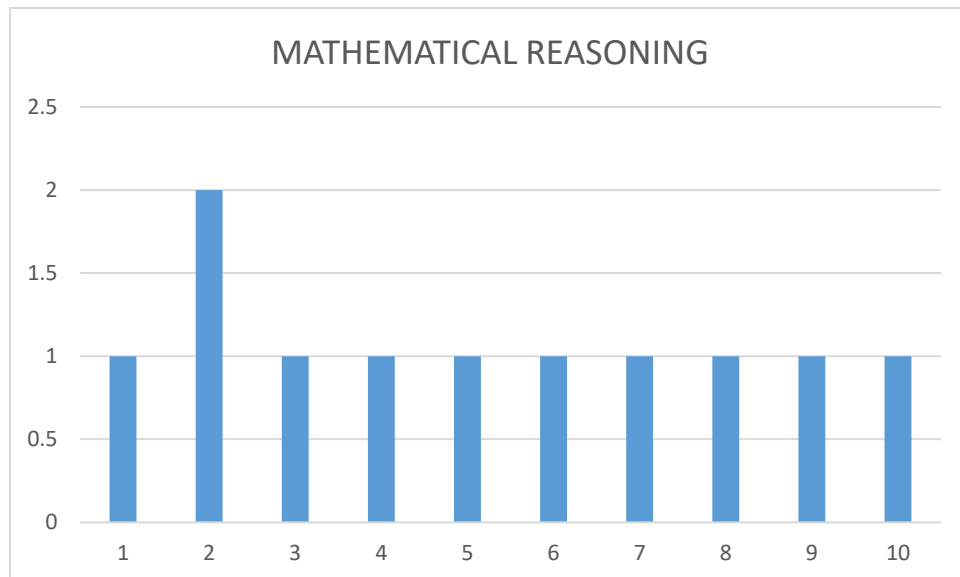
INVERSE TRIGONOMETRIC FUNCTION



4. Height & Distance

HEIGHT & DISTANCE



UNIT 7 - MATHEMATICAL REASONING**SYLLABUS**

- Statement logical operations and, or, implies, implied by, if and only if, understanding of tautology, contradiction, converse and contrapositive.

ANALYSIS

One question appears every year from this segment and is a relatively small portion that should be completed by every aspirant. The syllabus is relatively simple and can be understood to secure marks from this one question.

OTHERS: MATHEMATICAL INDUCTION**SYLLABUS**

- Principle of Mathematical Induction and its simple applications.

ANALYSIS

Only 1 question was asked from Mathematical Induction, the segment of mathematical technique to prove statements back in 2011 and thus can be considered safe to ignore.