

# MATHEMATICS

## ALGEBRA AND TRIGONOMETRY

### I. ALGEBRA ..... 60%

#### A. BASIC PROPERTIES OF THE REAL NUMBERS

#### B. LINEAR AND QUADRATIC EQUATIONS

##### 1. Linear Equations

##### 2. Quadratic Equations

a. Equations of the form  $x^2 - p = 0$

b. Equations of the form  $k(x + r)^2 - p = 0$ , where  $k \neq 0$

c. Equations of the form  $ax^2 + bx + c = 0$ , where  $a \neq 0$

d. The discriminant

#### C. POLYNOMIAL EQUATIONS

##### 1. Equivalent Polynomials

##### 2. Addition and Subtraction of Polynomials

##### 3. Multiplication of Polynomials

##### 4. Division of Polynomials

##### 5. Division of Polynomials and Solving Polynomial Equations

##### 6. Proof of the Rational Root Theorem

##### 7. Proof of the Factor Theorem

##### 8. Complex Numbers

a. Addition of complex numbers

b. Multiplication of complex numbers

c. Division of complex numbers

#### D. FUNCTIONS

##### 1. Preliminaries

##### 2. Definition of a Function

##### 3. Many-to-One Functions versus One-to-One Functions

##### 4. Inverse Functions

## E. GRAPHING

1. The Graph of a Linear Function  $y = ax + b$
2. The Graph of a Quadratic Function  $y = ax^2 + bx + c$ 
  - a. *The case  $y = x^2$*
3. The Graphs of Polynomials
4. The Graph of the Exponential Function  $y = a^x$
5. The Graph of the Logarithmic Function  $y = \log_a x$
6. Transformations of Graphs
  - a. *Graphing  $y = f(x + c)$  from the graph of  $y = f(x)$*
  - b. *Graphing  $y = f(x) + C$  from the graph of  $y = f(x)$*
  - c. *Graphing  $y = f(ax)$  from the graph of  $y = f(x)$*
  - d. *Graphing  $y = Af(x)$  from the graph of  $y = f(x)$*

## F. NON-POLYNOMIAL EQUATIONS

1. Rational Equations
  - a. *Solving rational equations*
  - b. *Graphs of rational functions*
2. Exponential Equations
  - a. *Basic properties*
  - b. *Solving exponential equations*
3. Logarithmic Equations
  - a. *Basic properties*
  - b. *Solving logarithmic equations*
4. Radical Equations
  - a. *Method 1*
  - b. *Method 2*

## G. INEQUALITIES

1. Linear Inequalities
2. Quadratic Inequalities
  - a. *Inequalities of the form  $ax^2 + bx + c > 0$  and  $a > 0$*
  - b. *Inequalities of the form  $ax^2 + bx + c < 0$  and  $a > 0$*

## H. COORDINATE GEOMETRY

1. The Pythagorean Theorem
2. Points
3. Lines
  - a. *Slope form*

- b. *Point-point form*
- c. *Slope-point form*
- d. *Mutual positions of lines*
- 4. Circles
- 5. Solving Geometry Problems Using Coordinate Geometry

## II. TRIGONOMETRY . . . . . 40%

### A. TRIGONOMETRIC FUNCTIONS

- 1. The Sine Function for Acute Angles
- 2. The Tangent Function for Acute Angles
- 3. The Cosine and Cotangent Functions for Acute Angles
- 4. Relations among Trigonometric Functions
- 5. Trigonometric Functions of Special Angles
- 6. Trigonometric Functions of Angles of Any Measure
  - a. *Definitions and properties*
  - b. *Negative angles*
- 7. Trigonometric Identities
  - a. *Sum and difference identities*
  - b. *Double-angle identities*
  - c. *Half-angle identities*
  - d. *Sum-to-product identities*
  - e. *Product-to-sum identities*
- 8. Graphs of Trigonometric Functions
- 9. Inverse Trigonometric Functions
- 10. Trigonometric Equations
- 11. The Law of Sines and Cosines
- 12. Radians