RAFFLES INSTITUTION
H2 Mathematics (9758)
2016 Year 5

Chapter 3B: Vectors II - Equations of Straight Lines

SYLLABUS INCLUDE

- Vector and cartesian equations of lines
- Finding the distance from a point to a line
- Finding the angle between two lines
- Relationships between two lines (coplanar or skew)

CONTENT

INTRODUCTION

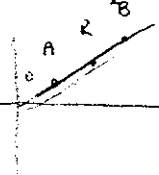
In this Chapter, we shall see how the equation of a straight line can be expressed in three forms, namely vector, parametric and cartesian. We will then use the equation to solve problems involving distances, intersections and angles.

1 EQUATIONS OF STRAIGHT LINES

1.1 Vector Equation of a Straight Line

Recall that to find the equation of a straight line in the $x-y$ plane, we need a point which lies on the line and the gradient of the line.

Similarly, to obtain a vector equation of a line, we need
(i) the position vector of a point on the line, and
(ii) a vector parallel to the line (known as the direction vector).



$\overrightarrow{OR} = \overrightarrow{OA} + \overrightarrow{AR}$
since $\overrightarrow{AR} \parallel \overrightarrow{AB}$,
$\overrightarrow{AR} = \lambda \overrightarrow{AB}$ for some $\lambda \in \mathbb{R}$

A straight line l which passes through a fixed point A with position vector $\mathbf{a}$ and is parallel to a vector $\mathbf{b}$ has vector equation given by

$$l: \mathbf{r} = \mathbf{a} + \lambda\mathbf{b}, \quad \lambda \in \mathbb{R},$$

where $\mathbf{r}$ represents the **position vector of any point** on the line l.

Each real value of λ gives the position vector of a point on the line l.