224 May 13th 2024

MTH213

Course Outline

Elementary Vector Algebra

Vector and triple vector algebra

Solutions of Vector

Plain Curve and Space Curve

Semifree Differential Equation

Gradient & Curve

Simple Application.

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Elementary Vector Algebra

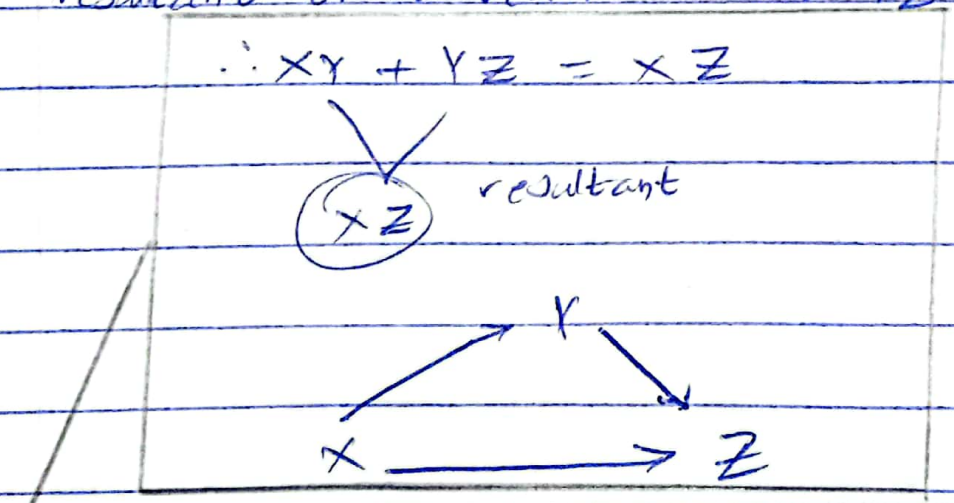
Vector quantities are quantities that have magnitude and direction.

Example of vector quantity are force, acceleration...

Scalar quantity has only magnitude and no direction.

If a particle moves from X to Y. The vector XY represent the displacement of Y w.r.t X.

If the particle further moves from Y to a new point Z the displacement of Z w.r.t Y is vector YZ The displacement of Z w.r.t X is represented by XZ. Thus the vector XZ is the resultant of the vector XY and YZ.



Fundamental Law of Addition of Displacement.

Parallelogram law of Addition of Displacement.

Vector addition is commutative.

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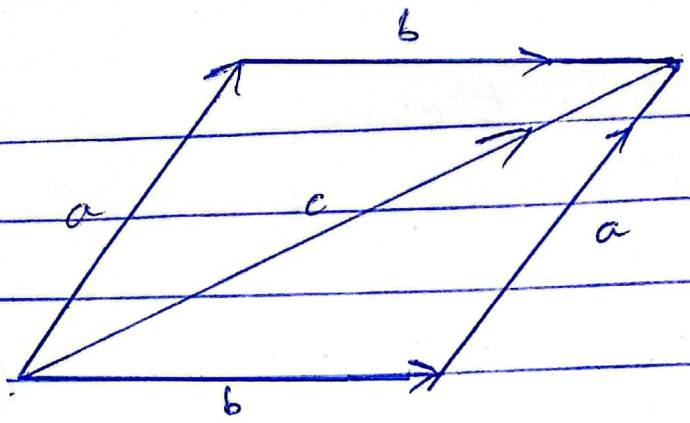


Example1: Vector $AB + BC + CD$

$$A(B + B)C + CD$$

$$A(C + C)D$$

$$AD$$

If A, B, C are three (3) vectors, then prove

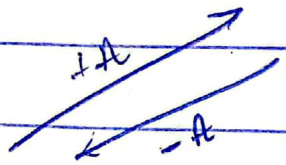
$$(A + B) + C = A + (B + C)$$

{Associative Law of Addition}

Example2: Find the sum:

(a) PQ, −TQ, PS, ST

(b) VX, XY, −ZY, ZX



$\Rightarrow -TQ = QT$

Solution

(a) $PQ - TQ + PS + ST$

$= PQ + QT + PS + ST$

$= PT + PT$

$= 2PT$

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(b) $VX + XY - ZY + ZX$

$= VY + YZ + ZX$

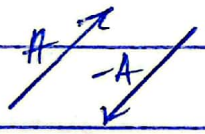
$= VX$

Laws of Algebra

The following definitions are fundamental.

1. Two vectors A and B are equal if they have the same magnitude and direction irrespective of their position point. Thus $\vec{A} = \vec{B}$

2. A vector having direction opposite to that of vector A but having the same magnitude and direction is denoted by $\vec{A} = -\vec{A}$



3. Scalars are nothing more than real numbers, it is a quantity having magnitude but no direction.

Vector Algebra - Two basic operations:

1. Vector Addition.
2. Scalar Multiplication.

Suppose A, B & C are vectors, the following theorem applies. m and n are scalar then the

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following laws hold:

1. $A + B = B + A$ (Commutative law of Addition)
2. $(A+B)+C = A+(B+C)$ (Associative law of Addition)
3. $mA = Am$ (Condition for Multiplication - Scalar)
4. $m(nA) = (mn)A$ (Associative law for Multiplication-Scalar)
5. $(m+n)A = mA + nA$ (Distributive Law
6. $m(A+B) = mA + mB$ (")
7. $1(A) = A$ (Unit multiplication)
8. $\exists$ a zero vector | for every vector A
   $A + 0 = 0 + A = A$ [existence of zero element]
9. for every vector A, $\exists -A \in$
   $A + (-A) = -A + A = 0$

Cartesian Coordinate System.