**Example 2**

Given the vectors

 A=2i+6j and B=3i-2j, calculate C=A+B and D=A-B in the terms of polar coordants angles measured with respect to positive x-axis.

Solution:

C= (Ax+Bx) i + (Ay+ By) j

 = (2+3) i + (6-2) j

 = 5i + 4j

D= A – B

 = A + (-B)

 =(Ax+Bx) i + (Ay+ By) j

=(2-3)i + (6+2)j

 = -i +8j

**2.3 Components of a Vector and Unit Vectors**

**2.3.1 Components of a Vector**

Any vector can be completely described by its components. Consider a vector (A ⃗ )lying in the (xy plane) and making an angle (Ѳ) with the positive (x-axis) as shown in the figure below. This vector can be expressed as the sum of two other component vectors (A ⃗x), which is parallel to the (x-axis), and (A ⃗y), which is parallel to the (y-axis).

 A⃗= A⃗x + A⃗y



From the figure and the definition of sine and cosine, we see that

 = A*x* / A) and that A*y* / A). Hence, the components of

 A*x* = A and A*y* = A

The magnitude and direction of ) are related to its components through the expressions

 A= (magnitude of )

Ѳ = ) (direction of )

**2.3.2 Unit Vectors**

A **unit vector** is (a dimensionless vector having a magnitude of exactly one). Unit vectors are used to specify a given direction.

We shall use the symbols ( î , ĵ , and ƙ ) to represent unit vectors pointing in the positive (*x, y,* and *z*)directions, respectively.

The magnitude of each unit vector equals 1; that is, =1

*x* = î , *y* = . Therefore, the unit-vector notation for the vector is:

î

i= a unit vector along x-axis

j= a unit vector along y-axis

k= a unit vector along z-axis

* Consider a point lying in the *xy* plane and having Cartesian coordinates (*x, y*) as in the figure below. The point can be specified by the **position vector** which in unit-vector form is given by:

* The resultant vector ( = ) is:

 = (î ) + (î ) or

 = î )

Because + , we see that the components of the resultant vector are: = () and = ().

The magnitude of  and the angle it makes with the (*x*-axis) are obtained from its components using the relationships:

*R* = = Magnitude of

 = Direction of

* f both have three components ( *x,y,z* ), they can be expressed in the form:

î

î

The sum of is: = or

 = î ) +

**Example (2-3):**

**Find the sum of two displacement vectors lying in the *xy* plane and given by: m and m.**

**Solution:**

The resultant vector  : = = î )

 = î )

 = 4î- 2

The components of : m and -2 m

The magnitude of : *R* = = = = 4.5 m

The direction of : = = - 0.5

 Ѳ = - 27

This answer is correct if we interpret it to mean 27° clockwise from the (*x* – axis).

**Example (2-4): A car travels 20.0 km due north and then 35.0 km in a direction 60° west of north . Find the magnitude and direction of the car’s resultant displacement.**

**Solution:**



**Example (2-5): if**

**r1= 3i – 2j +K r2= 2i – 4j – 3K r3= -i +2j +2K**

**Find: 1- 2- r1+ r2 +r3 3-**

**Solutions:**

1. **2**

 **= [(-1)2 + (2)2 + (2)2]1/2**

 **=3 unit**

1. **r1+ r2 +r3 = (3i – 2j +K) + (2i – 4j – 3K ) + (-i +2j +2K)**

 **= 4i -4j + 0k**

 **= 4i -4j**

**3. r1 - 3 r2 -5 r3 = 2(3i – 2j +K) - 3 (2i – 4j – 3K ) -5(-i +2j +2K)**

 **= 5i – 2j +k**

**4.= [ (5)2+ (-2)2 +(1)2]1/2**

 **= (30)1/2**

 **= 5.47 unit**