EE 1004 Foundation of Information Systems and Data Analysis

Semester A 2023/24

Part II -- Exercise 03

**Question 1**

A vector has magnitude 15.3 and is in the same direction as the line, , where has coordinates and C has coordinates . Find the component form of .

**Question 2**

A vector is parallel to the line through and, whilst a vector is parallel to the line through and . Both vectors have magnitude 4. Find and in component form.

**Question 3**

If the vertices of a triangle are the points , and , what are the vectors that represent the sides? Determine the length of each side.

**Question 4**

Find the value of such that , and

.

**Question 5**

Find a unit vector parallel to the resultant of the vectors , and

**Question 6**

A set of rectangular cartesian axes is so arranged that the x-axis points east, the y-axis points north and the z-axis points vertically upwards. Evaluate the scalar products of the vectors and in the following cases.

1. is of magnitude 3 and points SE, is of magnitude 2 and points E.
2. is of unit magnitude and points NE, is of magnitude 2 and points vertically upwards.
3. is of unit magnitude and points NE, is of magnitude 2 and points W.

**Question 7**

Find for the following cases.

1. and
2. and

**Question 8**

Axes Oxyz are positioned so that Ox points east, Oy points north and Oz points vertically upwards. Find the vector product of vectors and in the following cases.

1. is of unit magnitude and points E, is of magnitude 2 and points N of E.
2. is of unit magnitude and points E, is of magnitude 2 and points SW.
3. is of unit magnitude and points vertically upwards, is of unit magnitude and points NE.

**Question 9**

Find of and .

**Question 10**

Find eigenvalues and the corresponding eigenvectors for the following cases.

Solution

**Question 1**

A vector has magnitude 15.3 and is in the same direction as the line, , where has coordinates and C has coordinates . Find the component form of .

and

**Question 2**

A vector is parallel to the line through and, whilst a vector is parallel to the line through and . Both vectors have magnitude 4. Find and in component form.

**Question 3**

If the vertices of a triangle are the points , and , what are the vectors that represent the sides? Determine the length of each side.

Let the points be , & .

**Question 4**

Find the value of such that , and .

**Question 5**

Find a unit vector parallel to the resultant of the vectors , and

Let be the resultant of the vectors , & .

**Question 6**

A set of rectangular cartesian axes is so arranged that the x-axis points east, the y-axis points north and the z-axis points vertically upwards. Evaluate the scalar products of the vectors and in the following cases.

* 1. is of magnitude 3 and points SE, is of magnitude 2 and points E.
  2. is of unit magnitude and points NE, is of magnitude 2 and points vertically upwards.
  3. is of unit magnitude and points NE, is of magnitude 2 and points W.

(i)

(ii)

(iii)

**Question 7**

Compute

(i)

(ii)

**Question 8**

Axes Oxyz are positioned so that Ox points east, Oy points north and Oz points vertically upwards. Find the vector product of vectors and in the following cases.

1. is of unit magnitude and points E, is of magnitude 2 and points N of E.
2. is of unit magnitude and points E, is of magnitude 2 and points SW.
3. is of unit magnitude and points vertically upwards, is of unit magnitude and points NE.

(i)

It is a vertically upwards unit vector.

(ii)

It is a vector of magnitude pointing downwards.

(iii)

It is a unit vector pointing NW.

**Question 9**

Compute of (1, 3, -2), (-1, 5, 7).

**Question 10**

Find eigenvalues and the corresponding eigenvectors for the following cases.

(i)

Eigenvalues are & .

When ,

The corresponding eigenvector of for .

When ,

can be any values

The corresponding eigenvector of for .

(ii)

or

Eigenvalues are & .

When ,

The corresponding eigenvector of for .

When ,

The corresponding eigenvector of for .

(iii)

Eigenvalues are & .

When ,

can be any values

The corresponding eigenvector of for .

When ,

can be any values

The corresponding eigenvector of for .

(iv)

or

Eigenvalues are & .

When ,

can be any values

The corresponding eigenvector of for .

When ,

The corresponding eigenvector of for .

(v)

, or

Eigenvalues are , & .

When ,

can be any values

The corresponding eigenvector of for .

When ,

The corresponding eigenvector of for .

-

When ,

can be any values

The corresponding eigenvector of for .

(vi)

or

Eigenvalues are & .

When ,

There are two sets of solution.

If we set ,

If we set ,

The corresponding eigenvectors of for

.

When ,

The corresponding eigenvector of for .