**MATHEMATICS**

**PAGEMAKER10**

**VECTOR**

Q1. If position vectors of four points and are and respectively, then AB and CD are related as

(a) perpendicular

(b) parallel

(c) independent

(d) None of these

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q2. If then what is the value of ?

(a) 10

(b) 5

(c) 8

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q3. Point is is and divides in the ratio 2 : 3. The position vector is

(a)

(b)

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q4. If and are non-coplanar, then is equal to

(a) 0

(b)

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q5. If is a non-zero vector of modulus and is a non-zero scalar and is a unit vector, then

(a)

(b)

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q6. If and represent the sides and of a regular hexagon then is equal to

(a)

(b)

(c)

(d) None of these

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q7. If two concurrent forces be represented by and respectively, then their resultant is given by , where is such that

(a)

(b)

(c) is mid-point of

(d) None of these

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q8. In a are the mid-points of the sides and respectively, the vector is equal to

(a)

(b)

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q9. If is the centroid of a then is equal to

(a) 0

(b) 3 GA

(c) 3 GB

(d) 3 GC

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q10. The area of parallelogram whose adjacent sides are is

(a)

(b)

(c) 6

(d) None of these

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q11. If and are three mutually perpendicular vectors of equal magnitude, then the angle which makes with any one of three given vectors is given by

(a)

(b)

(c)

(d) None of these

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q12. If and such that each is perpendicular to sum of the other two, then is

(a)

(b)

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q13. If a, b and c be non-zero vectors, then which of the following statements is correct?

(a)

(b)

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q14. If is the angle between vectors a and b and then is equal to

(a) 0

(b) 180°

(c) 135°

(d) 60°

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q15. If be any vector, then is equal to

(a)

(b)

(c)

(d) 0

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q16. If and then holds for

(a) all reap

(b) no real

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q17. If and are unit vectors and is the angle between them, then sin is equal to

(a)

(b)

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q18. Four points with position vectors and form a

(a) rhombus

(b) parallelogram but not rhombus

(c) rectangle

(d) square

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q19. If are non-coplanar unit vectors such that and are non-parallel, then the angle between and is

(a)

(b)

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

Q20. If and then is equal to

(a)

(b)

(c)

(d)

L1Difficulty1

Qtag Mathematics

Qcreator Pagemaker10

**Solutions**

S1. Ans. (b)

Sol.

Therefore, and are parallel.

S2. Ans. (a)

Sol.

=

=

 (on comporing with RHS)

S3. Ans. (c)

Sol.

Let be the position vector of then divides in the ratio of

S4. Ans. (a)

Sol.

On putting the value of from the given relations, we have

 …(i)

 …(ii)

 =

Since, and are non-coplanar, we have on comparing the coefficients

 and

 and

On putting for in Eq. (ii) or in

Eq. (i), we get

S5. Ans. (c)

Sol.

Since, a is a unit vector.

S6. Ans. (b)

Sol.

****

S7. Ans. (b)

Sol.

We have, …(i)

and …(ii)

On multiply Eq. (i) by and Eq. (ii) by and add, we get the result as given, i.e.

If

or

or

S8. Ans. (d)

Sol.

****

S9. Ans. (a)

Sol.

Let the position vectors of the vertices be and respectively, so that the position vector of the centroid is

 of of

Similarly,

S10. Ans. (b)

Sol.

Area =

S11. Ans. (a)

Sol.

Let

and

Now,

or

S12. Ans. (a)

Sol.

Now,

S13. Ans. (a)

Sol.

S14. Ans. (c)

Sol.

 |

S15. Ans. (b)

Sol.

Let then

S16. Ans. (**d**)

Sol.

In squaring both sides, we get

Again, or squaring both sides, we get

S17. Ans. (**a**)

Sol.

S18. Ans. (**a**)

Sol.

 of of

All the vectors have same modulus

Hence, the points enclose either a square or a rhombus.

But

Hence, is not perpendicular to

S19. Ans. (**d**)

Sol.

Given

On comparing the coefficient of and on both sides, we get

 and

Let be the angle between and

 .

S20. Ans. (**a**)

Sol.

**LEVEL-II**

Q1. If then what is the unit vector parallel to in the opposite direction?

(a)

(b)

(c)

(d) None of these

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q2. Let is a parallelogram. If and then what is equal to?

(a)

(b)

(c)

(d)

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q3. The vector lies

(a) in the plane of

(b) in the plane of

(c) in the plane of

(d) along the -axis

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q4. The vector is coplanar with

(a) Only a

(b) Only b

(c) Both a and b

(d) Neither a nor b

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q5. If and then which one of the following is correct?

(a) a is parallel to b

(b) a is perpendicular to b

(c) a = 0 or b = 0

(d) None of these

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q6. The magnitude of the scalar for which the vector is of unit length is

(a) 1/8

(b) 1/64

(c)

(d)

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q7. What is the value of for which

(a) 2

(b)

(c) 1

(d) 7

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q8. Consider the following

I. II.

Which of the above statement(s) is/are correct?

(a) Only I

(b) Only II

(c) Both I and II

(d) Neither I nor II

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q9. If is the angle between the vectors and then what is equal to?

(a) 0

(b) 1/2

(c) 1

(d) 2

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q10. Which one of the following vectors is normal to the vector ?

(a)

(b)

(c)

(d) None of these

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q11. If and are unit vectors, then the greatest value of is

(a)

(b)

(c) 2

(d)

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q12. In a regular hexagon where is equal to

(a) 1

(b) 2

(c) 3

(d) none of these

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q13. If and are the mid points of the diagonals and respectively of a quadrilateral then

(a)

(b)

(c)

(d) none of these

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q14. Five forces act at the vertex of a regular hexagon If is the centroid of the hexagon, then their resultant is a force given by

(a)

(b)

(c)

(d) none of these

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q15. is parallelogram. If and are the middle points of and then

(a)

(b)

(c)

(d) none of these

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q16. is a quadrilateral and the point of intersection of the lines joining the middle points of opposite sides. If is any point, then the resultant of and is equal to

(a)

(b)

(c)

(d) none of these

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q17. Two forces act at the vertex of a quadrilateral represented by and two at represented by and . If and are the middle points of and respectively, then their resultant is represented by

(a)

(b)

(c)

(d)

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q18. If and then

(a)

(b)

(c)

(d)

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q19. If the unit vectors and are inclined at angle and then lies in the interval

(a)

(b)

(c)

(d) none of these

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

Q20. If are three vectors such that and are perpendicular to respectively, then

(a)

(b)

(c)

(d)

L3Difficulty3

Qtag Mathematics

Qcreator Pagemaker10

**Solutions**

S1. Ans. (c)

Sol.

Given, and

Now,

 [say]

 Unit vector

But in opposite direction

S2. Ans. (d)

Sol.

Since, opposite sides of parallelogram are same

and

****

Applying addition formula in

S3. Ans. (b)

S4. Ans. (c)

Sol.

Given that,

which is the vector triple product.

 d

where, and are scalar quantity.

Hence, is coplanar with both and

S5. Ans. (c)

Sol.

Given that,

i.e. and are perpendicular to each other and

i.e. and are parallel to each other.

So, both conditions are possible iff and

S6. Ans. (d)

Sol.

 [given]

S7. Ans. (a)

Sol.

Given,

 )

On comparing the coefficient of, we get

S8. Ans. (c)

Sol.

I.

II.

 Divisibility in vectors are not possible.

 Hence, both I and II are true.

S9. Ans. (c)

Sol.

Let and

Let be the angle between and

S10. Ans. (d)

Sol.

Let

Let any vector normal to then dot product of both vector should be zero.

(a)

(b) (

(c) (

S11. Ans. (a)

Sol.

Let be the angle between and . Then,

Now,

Similarly,

S12. Ans. (c)

Sol.

 [

****

S13. Ans. (b)

Sol.

In is the mid-point of

 …(1)



In is the mid point of ,

 …(2)

Adding (1) and (2), we have

 …(3)

In is the mid-point of

From (3), we get

S14. Ans. (c)

Sol.

If is the resultant of given forces, then



 and

S15. Ans. (b)

Sol.

.



Adding,

S16. Ans. (c)

Sol.

Let be the mid-points of sides respectively of a quadrilateral By geometry the figure formed by joining the mid-points will be a parallelogram. Hence, its diagonals will bisect each other, say at



Now, is the mid-point of

 …(1)

And is the mid-point of

 …(2)

Adding (1) and (2), we have

 is mid-point of

S17. Ans. (d)

Sol.

We have,

 where is mid-point of



Also,

where is the mid-point of

S18. Ans. (a)

Sol.

 [

S19. Ans. (a)

Sol.

 lies on

S20. Ans. (d)

Sol.

 …(1)

Similarly …(2)

and …(3)

Adding (1), (2), (3), we get

Now,

Hence,

**LEVEL-III**

Q1. A parallelogram is constructed on the vector and given that and the angle between and is The length of a diagonal is

(a)

(b)

(c)

(d) none of these

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q2. If and are position vectors of and respectively, then the position vector of a point in produced such that is

(a)

(b)

(c)

(d)

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q3. Let and be three vectors. A vector in the plane of and whose projection on is of magnitude is

(a)

(b)

(c)

(d)

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q4. A vector has components and w.r.t. a rectangular cartesian system. This system is rotated through a certain angle about the origin in the counter-clockwise sense. If w.r.t. the new system, has components and then

(a)

(b) or

(c) or

(d) or

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q5. If then

(a) 12

(b) 2

(c) 0

(d)

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q6. If the moduli of vectors are are respectively and and and and are mutually perpendicular then the modulus of is

(a)

(b) 12

(c) 5

(d) 50

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q7. If and than a vector which is linear combination of and and also perpendicular to is

(a)

(b)

(c)

(d) none of these

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q8. A unit vector in plane that makes an angle of 45° with the vector and an angle of with the vector is

(a)

(b)

(c)

(d) none of these

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q9. If and then is equal to

(a)

(b)

(c)

(d)

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q10. Let be a regular hexagon. If and then

(a) 4

(b)

(c) 2

(d)

L5Dfficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q11. If is a regular hexagon, then is equal to

(a)

(b)

(c)

(d)

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q12. Let be the three vectors such that and then

(a) 13

(b) 81

(c) 9

(d) 5

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q13. A vector is collinear with vector of magnitude 50 making an obtuse angle with -axis is

(a)

(b)

(c)

(d) none of these

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q14. Given a cube with lower base upper base and the lateral edges and and are the centres of the faces and respectively. is a point on line , such that

 then if

(a)

(b)

(c)

(d)

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q15. Let and where are non-collinear. Let denote the area of the quadrilateral and denote the area of the parallelogram with and as adjacent sides. Then is equal to

(a) 4

(b) 6

(c)

(d) none of these

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q16. The triangle is defined by the vertices and Let be the foot of the altitude drawn from the vertex to side . Then

(a)

(b)

(c)

(d) none of these

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q17. The position vectors and of four distinct points and lie on a plane are such that then the point is the

(a) centroid of

(b) orthocentre of

(c) circumcentre of

(d) none of these

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q18. The values of for which the angle between the vectors and is acute and the angle between the vector and the -axis lies between and are

(a)

(b)

(c) all

(d) or

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q19. A unit vector in plane that makes an angle of 45° with the vector and an angle of 60° with the vector is

(a)

(b)

(c)

(d) none of these

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

Q20. Consider a tetrahedron with faces Let be the vectors whose magnitudes are respectively equal to areas of and whose directions are perpendicular to their faces in outward direction. Then equals

(a) 1

(b) 4

(c) 0

(d) none of these

L5Difficulty5

Qtag Mathematics

Qcreator Pagemaker10

**Solutions**

S1. Ans. (b)

Sol.

The diagonals of the parallelogram are represented by the vectors.

and

Now,

Similarly,

Hence the lengths of the diagonals are and

S2. Ans. (d)

Sol.

S3. Ans. (a, c)

Sol.

Any vector in the plane of and is

Projection of on is =

 or 1

Hence or

S4. Ans. (b)

Sol.

Let be unit vectors along the co-ordinate axes

 …(i)

On rotation, let be the vector having components and

 …(2)

where are unit vectors along the new co-ordinate axes.

But on rotation

 or .

S5. Ans. (d)

Sol.

We have,

=

= [

=

S6. Ans. (c)

Sol.

According to the given condition, we have

 …(i)

 …(ii)

 …(iii)

Now adding (i), (ii) and (iii), we get

 [ etc.]

Hence

S7. Ans. (c)

Sol.

We have,

[ and

S8. Ans. (d)

Sol.

Let the required unit vector in the -plane be

or …(1)

Now the angle between and vector is

 …(2)

and …(3)

There exists no real values of and satisfying equations (1), (2) and (3).

S9. Ans. (a)

Sol.

Here and are non-collinear vectors.

 Let …(1)

And

 from (1),

S10. Ans. (b)

Sol.

Since is a regular hexagon, from plane geometry, we have

****

 and

 and …(1)

Given that

 by (1)

 …(2)

Again, given that or

 using (2)

 …(3)

From (2) and (3),

S11. Ans. (b)

Sol.

Let be the length of each side of the hexagon so that Also from plane geometry,

****

Hence, we have

S12. Ans. (c)

Sol.

Adding

we get

Hence

S13. Ans. (a)

Sol.

Let

A unit vector along is ±

 a vector of length 50 along

Since makes obtuse angle with -axis, so we must have

Thus,

S14. Ans. (a)

Sol.

 (given)

S15. Ans. (b)

Sol.

Given,

and

S16. Ans. (a)

Sol.

Since is the component of to

****

S17. Ans. (c)

Sol.

We have, and According to the given condition

Thus, is the circumcentre of

S18. Ans. (c)

Sol.

 and .

 and .

 and

 or and

Hence, is the required solution.

S19. Ans. (d)

Sol.

Let the required unit vector in the - plane be

 …(1)

Since angle between and vector is and the angle between and vector is

 …(2)

 …(3)

No real values of and exist satisfying equations (1), (2), and (3).

S20. Ans. (c)

Sol.

We have,

 and