MATHS

AIMED AT STUDENTS PREPARING FOR IIT JEE EXAMINATION

PROPERTIES OF VECTORS

Example

1. $\bar{r} = 2\bar{i} + 3\bar{j} - 6\bar{k}$ then find $|\bar{r}|$.

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2. Find the length of the lines segment joining the points whose position vectors are $7\bar{j} + 10\bar{k}, \; -4\bar{i} + 9\bar{j} + 6\bar{k}$.

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3. Find the direction cosines of the line joining the points with position vectors $-\bar{i}+\bar{j}+\bar{k}, 2\bar{i}+3\bar{j}-5\bar{k}$.

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4. Write direction ratios of the vector $\bar{r}=\bar{i}+\bar{j}-2\bar{k}$ and hence calculate its direction cosines.

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5. Find the position vector of the point which divides the line joining the points $3\bar{a}-4\bar{b}$ and $4\bar{a}-3\bar{b}$ in the ratio 2 : 3 (i) internally and (ii) externally.

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6. Find the ratio in which the point $\bar{i} + 2\bar{j} + 3\bar{k}$ divides the join of $-2\bar{i} + 3\bar{j} + 5\bar{k}$ and $7\bar{i} - \bar{k}$.

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7. Find the position vector of the midpoint of the line segment joining $3\bar{a} + 2\bar{b} - c, \bar{a} - 4\bar{b} + 5\bar{c}$.

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8. Write the position vector of the centroid of the triangle formed by the points whose position vectors are $3\bar{i} + 2\bar{j} - \bar{k}, 2\bar{i} - 2\bar{j} + 5\bar{k}, \bar{i} + 3\bar{j} - \bar{k}$.

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9. Find the position vector of the centroid of the tetrahedron formed by the points $2\overline{i} - \overline{j} - 3\overline{k}, 4\overline{i} + \overline{j} + 3\overline{k}, 3\overline{i} + 2\overline{j} - \overline{k}, \overline{i} + 4\overline{j} + 2\overline{k}.$

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10. Find a unit vector bisecting the angle between $2\overline{i} - \overline{j} + 2\overline{k}, 3\overline{i} + 2\overline{j} - 6\overline{k}.$

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11. Find the vector equation of the straight line passing through the point (2, 3, -1) and parallel to the vector (1, -2, 3).

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12. Find the vector equation of the line passing through the points $2\overline{i} + 3\overline{j} + 4\overline{k}, 3\overline{i} - 2\overline{j} + 2\overline{k}.$

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13. Find the equation of the line passing through the point $2\bar{i} + 3\bar{j} - 4\bar{k}$ and parallel to the vector $6\bar{i} + 3\bar{j} - 2\bar{k}$ in cartesian form.

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14. Using the vector equation of the straight line passing through two points, prove that the points whose position vectors are $\bar{a}, \bar{b}$ and $(3\bar{a} - 2\bar{b})$ are collinear.

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15. Find the vector equation of the line passing through the points $-2\bar{i} + 3\bar{j} + 5\bar{k}, \bar{i} + 2\bar{j} + 3\bar{k}$.

A. r = (1 - t) $(-2\bar{i} + 3\bar{j} + 5\bar{k}) + t(\bar{i} + 2\bar{j} + 3\bar{k})$

B. r = (1 - t) $(2\bar{i} + 3\bar{j} + 5\bar{k}) + t(\bar{i} + 1\bar{j} + 3\bar{k})$

C. r = (1 - t) $\left(-2\bar{i}-3\bar{j}+5\bar{k}\right)+t\left(\bar{i}-2\bar{j}+3\bar{k}\right)$

D. r = (1 - t) $\left(2\bar{i}+3\bar{j}-5\bar{k}\right)+t\left(\bar{i}+2\bar{j}+3\bar{k}\right)$

Answer: $\dfrac{x+2}{3}=\dfrac{y-3}{-1}=\dfrac{z-5}{-2}$

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16. Find the vector equation of the plane passing through the point $\bar{i}+\bar{j}+\bar{k}$ and parallel to the vectors $2\bar{i}+3\bar{j}+4\bar{k},\ \bar{i}-2\bar{j}+3\bar{k}$.

A. r=(i+j+k)+s(2i+3j+4k)+t(i-2j+3k)

B. r=(i+j+k)+s(2i-3j+4k)+t(i-2j+3k)

C. r=(i+j+k)+s(2i+3j+4k)+t(i +2j+3k)

D. r=(i+j+k)+s(2i+3j+4k)+t(i-2j-3k)

Answer:

$\bar{r}=\left(\bar{i}+\bar{j}+\bar{k}\right)+s\left(2\bar{i}+3\bar{j}+4\bar{k}\right)+t\left(\bar{i}-2\bar{j}+3\bar{k}\right),\ s,t\in R$

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17. Find the vector equation of the plane passing through the points $2\bar{i} + \bar{j} - \bar{k}, \bar{i} - \bar{j} + 2\bar{k}$ and parallel to $\bar{i} - 2\bar{j} - 2\bar{k}$

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18. Find the vector equation of the plane passing through the points $2\bar{i} + \bar{j} - \bar{k}, \bar{i} - \bar{j} + 2\bar{k}, \bar{i} - 2\bar{j} - 2\bar{k}.$

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Solved Examples

1. If $\bar{a} = 2\bar{i} + 5\bar{j} + \bar{k}, \bar{b} = 4\bar{i} + m\bar{j} + n\bar{k}$ are collinear vectors then find m and n.

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2. $\bar{a}, \bar{b}, \bar{c}$ are non-zero vectors and no two of them are collinear. If $\bar{a} + 2\bar{b}$ is collinear with $\bar{c}$ and $\bar{b} + 3\bar{c}$ is collinear with $\bar{a}$. Then find $\bar{a} + 2\bar{b} + 6\bar{c}$.

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3. If $\bar{a}, \bar{b}$ are two non-collinear vectors such that $\bar{a} + 2\bar{b}$ and $\bar{b} - \lambda\bar{a}$ are collinear, find λ.

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4. Show that the points $7\bar{j} + 10\bar{k}, \ -\bar{i} + 6\bar{j} + 6\bar{k}, \ -4\bar{i} + 9\bar{j} + 6\bar{k}$ form a right angled isosceles triangle.

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5. Show that the points $-2\bar{i} + 3\bar{j} + 6\bar{k}, 6\bar{i} - 2\bar{j} + 3\bar{k}, 3\bar{i} + 6\bar{j} - 2\bar{k}$ form an equilateral triangle.

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6. Show that the four points with position vectors $3\bar{i}+5\bar{j}, 3\bar{j}-5k, 5\bar{i}-19\bar{j}-3\bar{k}, 6\bar{i}-5\bar{j}$ are non coplanar.

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7. If $\bar{a}, \bar{b}, \bar{c}$ are non coplanar, show that the vectors $\bar{a}+2\bar{b}-\bar{c}, 2\bar{a}-3\bar{b}+2\bar{c}, 4\bar{a}+\bar{b}+3\bar{c}$ are linearly independent.

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8. Show that $\bar{a}=\bar{i}+2\bar{j}+\bar{k}, \bar{b}=2\bar{i}+\bar{j}+3\bar{k}$ and $\bar{c}=\bar{i}+\bar{k}$ are linearly independent.

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9. OACB is parallelogram. If D is the mid point of OA, prove that BD and CO intersect in the same ratio and find the ratio.

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10. Let $\bar{a}, \bar{b}, \bar{c}, \bar{d}$ be the position vectors of A, B, C and D respectively which are the vertices of a tetrahedron. Then prove that the lines joining the vertices to the centroids of the opposite faces are concurrent. (This point is called the centroid of the tetrahedron)

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11. Find the vector equation of the line passing through the points $\bar{i}+\bar{j}+\bar{k}$ and $\bar{i}-\bar{j}+\bar{k}$.

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12. If $\bar{a}, \bar{b}, \bar{c}$ are noncoplanar, find the point of intersection of the line passing through the points $2\bar{a}+3\bar{b}-\bar{c}, 3\bar{a}+4\bar{b}-2\bar{c}$ with the line joining the points $\bar{a}-2\bar{b}+3\bar{c}$ and $\bar{a}-6\bar{b}+6\bar{c}$.

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13. ABCD is a parallelogram and P is themid point of the side AD. The line BP meets the diagonal AC in Q. Then the ratio AQ : QC =

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Additional Solved Examples

1. If $\bar{a} = 2\bar{i} - \bar{j} + k, \bar{b} = \bar{i} + 3\bar{j} - 2\bar{k}, \bar{c} = -2\bar{i} + \bar{j} - 3\bar{k}$ and $\bar{d} = 3\bar{i} + 2\bar{j} -$

and if $\bar{d} = p\bar{a} + q\bar{b} + r\bar{c}$ then show that $q, \dfrac{p}{2}, r$ are in A.P.

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2. A point I is the centre of a circle inscribed in a triangle ABC then show that

$$|\overline{BC}|\overline{IA} + |\overline{CA}|\overline{IB} + |\overline{AB}|\overline{IC} = \bar{0}$$

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3. If the position vectors of orthocentre and circumcentre of triangle ABC are respectively $3\bar{i} + 2\bar{j} - 4k$ and $\bar{i} + 6\bar{j} - 10\bar{k}$ then find the position vector of the nine point centre of ΔABC

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4. Find the vector equation of the angular bisector of $\angle CAB$ of ΔABC where position vector of A is $3\bar{i} + \bar{j} - \bar{k}$ and $\overline{AB} = \bar{i} - 2\bar{j} + 2\bar{k}$, $\overline{AC} = 2\bar{i} + \bar{j} + 2\bar{k}$.

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5. If $\overline{OA} = \bar{a}, \overline{OB} = \bar{b}, \overline{OC} = 2\bar{a} - 4\bar{b}$ then prove that C lies outside of ΔOAB but inside the $\angle OBA$

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6. In ΔABC, if D is the midpoint of BC then prove that $\overline{AD} = \dfrac{\overline{AB} + \overline{AC}}{2}$

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7. In ΔABC, P is a point on the side BC such that 3BP = 2PC. Q is a point on the side CA such that 4CQ = QA. The lines AP and BQ intersect in R. Produce the line CR to meet the side AB in S. Find the ratio in which S divides AB.

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8. In ΔOAB, L is the midpoint of OA and M is a point on OB such that $\frac{OM}{MB} = 2$. P is the mid point of LM and the line AP is produced to meet OB at Q. If $\overline{OA} = \bar{a}, \overline{OB} = \bar{b}$ then find vectors $\overline{OP}$ and $\overline{AP}$ interms of $\bar{a}$ and $\bar{b}$.

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9. Through the mid point P of the side AD of a parallelogram ABCD, straight line BP is drawn cutting AC at R and CD produced at Q. Prove that $\overline{QR} = 2\overline{RB}$.

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10. In the plane of ΔABC, let 'O' be any point different from the vertices. Suppose the lines AO, BO and CO meet the opposite sides BC, CA and AB in D, E and F respectively using vector methods prove that $\frac{OD}{AD} + \frac{OE}{BE} + \frac{OF}{CF} = 1$.

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Exercise 1 1 Very Short Answer Questions

1. If

$\overline{OA} = \bar{i} + \bar{j} + \bar{k}, \overline{AB} = 3\bar{i} - 2\bar{j} + \bar{k}, \overline{BC} = \bar{i} + 2\bar{j} - 2\bar{k}, \overline{CD} = 2\bar{i} + \bar{j} +$

then find the vector $\overline{OD}$.

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2. Let A, B, C, D be four points with position vectors $\bar{a} + 2\bar{b}, 2\bar{a} - \bar{b}, \bar{a}$ and $3\bar{a} + \bar{b}$ respectively. Express the vectors $\overline{AC}, \overline{DA}, \overline{BA}$ and $\overline{BC}$ interms of $\bar{a}$ and $\bar{b}$.

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3. If the position vectors of A, B, C, D respectively are $2\bar{i} + 4\bar{k}, 5\bar{i} + 3\sqrt{3}j + 4\bar{k}, -2\sqrt{3}\bar{j} + \bar{k}$ and $2\bar{i} + \bar{k}$ respectively, then prove that $\overline{CD}$ is parallel to $\overline{AB}$ and $\overline{CD} = \frac{2}{3}\overline{AB}$.

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4. If $4\bar{i} + \frac{2p}{3}\bar{j} + p\bar{k}$ is parallel to the vector $\bar{i} + 2\bar{j} + 3\bar{k}$, find p.

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5. If vectors $-3\bar{i} + 4\bar{j} + \lambda\bar{k}$, $\mu\bar{i} + 8\bar{j} + 6\bar{k}$ are collinear vectors then find $\lambda \& \mu$.

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6. Let $\bar{a}, \bar{b}$ be non-collinear vectors. If $\alpha = (x + 4y)\bar{a} + (2x + y + 1)\bar{b}$, $\beta = (y - 2x + 2)\bar{a} + (2x - 3y - 1)\bar{b}$ are such that $3\alpha = 2\beta$ then find x, y.

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7. If the position vectors of the points A,B,C are $-2\bar{i}+\bar{j}-\bar{k}, \ -4\bar{i}+2\bar{j}+2\bar{k}, 6\bar{i}-3\bar{j}-13\bar{k}$ respectively and $\overline{AB}=\lambda\overline{AC}$ then find the value of λ.

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8. Let $\bar{a}=\bar{i}+2\bar{j}+3\bar{k}$ and $\bar{b}=3\bar{i}+\bar{j}$. Find the unit vector in the direction of $\bar{a}+\bar{b}$.

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9. If $\bar{a}=2\bar{i}+4\bar{j}-5\bar{k}, \bar{b}=\bar{i}+\bar{j}+\bar{k}$ and $\bar{c}=\bar{j}+2\bar{k}$. Find the unit vector in the opposite direction of $\bar{a}+\bar{b}+\bar{c}$.

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10. Find the unit vector in the direction of the sum of the vectors

$\bar{a} = 2\bar{i} + 2\bar{j} - 5\bar{k}$ and $\bar{b} = 2\bar{i} + \bar{j} + 3\bar{k}$.

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11. Find unit vector in the direction of vector $\bar{a} = (2\bar{i} + 3\bar{j} + \bar{k})$

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12. Show that the triangle formed by the vectors

$3\bar{i} + 5\bar{j} + 2\bar{k}, 2\bar{i} - 3\bar{j} - 5\bar{k}, \ -5\bar{i} - 2\bar{j} + 3\bar{k}$ is equilateral.

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13. If $\bar{a} = 2\bar{i} - \bar{j} + \bar{k}, \bar{b} = \bar{i} - 3\bar{j} - 5\bar{k}$, find the vector $\bar{c}$ such that

$\bar{a}, \bar{b}$ and $\bar{c}$ form the sides of a triangle.

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14. If α, β and γ are the angles made by the vector $3\bar{i} - 6\bar{j} + 2\bar{k}$ with the positive directions of the coordinate axes then find $\cos\alpha, \cos\beta$ and $\cos\gamma$.

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Exercise 1 1 Short Answer Questions

1. ABCDE is a pentagon. If the sum of the vectors $\overline{AB}, \overline{AE}, \overline{BC}, \overline{DC}, \overline{ED}, \overline{AC}$ is $\lambda\overline{AC}$ then find the value of λ.

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2. If ABCDEF is a regular hexagon with centre O , then P.T $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF} = 3\overline{AD} = 6\overline{AO}$

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3. If $\bar{a}, \bar{b}, \bar{c}$ are non coplanar vectors, then test for the collinearity of the following points whose position vectors are given.

i) $\bar{a} - 2\bar{b} + 3\bar{c}, 2\bar{a} + 3\bar{b} - 4\bar{c}, -7\bar{b} + 10\bar{c}$

ii) $3\bar{a} - 4\bar{b} + 3\bar{c}, -4\bar{a} + 5\bar{b} - 6\bar{c}, 4\bar{a} - 7\bar{b} + 6\bar{c}$

iii) $2\bar{a} + 5\bar{b} - 4\bar{c}, \bar{a} + 4\bar{b} - 3\bar{c}, 4\bar{a} + 7\bar{b} - 6\bar{c}$

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4. Show that the points whose P,V are $-2\bar{a} + 3\bar{b} + 5\bar{c}, \bar{a} + 2\bar{b} + 3\bar{c}, 7\bar{a} - \bar{c}$ are collinear, where $\bar{a}, \bar{b}, \bar{c}$ are non-coplanar vectors.

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5. i) $\bar{a}, \bar{b}, \bar{c}$ are pairwise non zero and non collinear vectors. If $\bar{a} + \bar{b}$ is collinear with $\bar{c}$ and $\bar{b} + \bar{c}$ is collinear with $\bar{a}$ then find the vector $\bar{a} + \bar{b} + \bar{c}$.

ii) If $\bar{a}+\bar{b}+\bar{c}=\alpha\bar{d}, \bar{b}+\bar{c}+\bar{d}=\beta\bar{a}$ and $\bar{a}, \bar{b}, \bar{c}$ are non coplanar vectors, then show that $\bar{a}+\bar{b}+\bar{c}+\bar{d}=\bar{0}$.

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6. i) If $\bar{a}, \bar{b}, \bar{c}$ are non coplanar vectors, then prove that the vectors $5\bar{a}-6\bar{b}+7\bar{c}, 7\bar{a}-8\bar{b}+9\bar{c}$ and $\bar{a}-3\bar{b}+5\bar{c}$ are coplanar.

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7. Prove that the following four points are coplanar.

i) $4\bar{i}+5\bar{j}+\bar{k}, -\bar{j}-\bar{k}, 3\bar{i}+9\bar{j}+4\bar{k}, -4\bar{i}+4\bar{j}+4\bar{k}$

ii)

$-\bar{a}+4\bar{b}-3\bar{c}, 3\bar{a}+2\bar{b}-5\bar{c}, -3\bar{a}+8\bar{b}-5\bar{c}, -3\bar{a}+2\bar{b}+\bar{c}$ $(\bar{a}, \bar{b}, \bar{c}$ are non-coplanar vectors)

iii) $6\bar{a}+2\bar{b}-\bar{c}, 2\bar{a}-\bar{b}+3\bar{c}, -\bar{a}+2\bar{b}-4\bar{c}, -12\bar{a}-\bar{b}-3\bar{c}$ $(\bar{a}, \bar{b}, \bar{c}$ are non-coplanar vectors)

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8. If the points whose position vectors are $3\bar{i} - 2\bar{j} - \bar{k}, 2\bar{i} + 3\bar{j} - 4\bar{k}, \ - \bar{i} + \bar{j} + 2\bar{k}, 4\bar{i} + 5\bar{j} + \lambda\bar{k}$ are coplanar, then show that $\lambda = \ - \frac{146}{17}$.

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9. Show that the following vectors are linearly dependent

i) $\bar{i} + \bar{j} + 2\bar{k}, \bar{j} + 2\bar{k}, \bar{i} + 2\bar{j} + 4\bar{k}$

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10. Show that the following vectors are linearly dependent

$\bar{i} + \bar{j}, \bar{j} + \bar{k}, \ - \bar{k} + \bar{i}$

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11. Show that the following vectors are linearly dependent

$\bar{a} - 2\bar{b} + \bar{c}, 2\bar{a} + \bar{b} - \bar{c}, 7\bar{a} - 4\bar{b} + \bar{c}$ where $\bar{a}, \bar{b}, \bar{c}$ are non-coplanar vectors

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12. Show that the following vectors are linearly dependent

$\bar{a} - 2\bar{b} + 3\bar{c}, \; - 2\bar{a} + 3\bar{b} - 4\bar{c}, \; - \bar{b} + 2\bar{c}$

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13. Show that the following vectors are linearly dependent

$3\bar{a} - 2\bar{b} - 4\bar{c}, \; - \bar{a} + 2\bar{c}, \; - 2\bar{a} + \bar{b} + 3\bar{c}$

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14. If the vectors $\bar{a} = \bar{i} + \bar{j} + \bar{k}, \bar{b} = 4\bar{i} + 3\bar{j} + 4\bar{k},$ and $\bar{c} = \bar{i} + \alpha\bar{j} + \beta\bar{k}$ are linearly dependent and $|\bar{c}| = \sqrt{3}$ then show that $\alpha = \pm 1, \beta = 1$

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15. If $\bar{a}, \bar{b}, \bar{c}$ are linearly independent vectors, then show that $\bar{a} - 3\bar{b} + 2\bar{c}, 2\bar{a} - 4\bar{b} - \bar{c}, 3\bar{a} + 2\bar{b} - \bar{c}$ are linearly independent.

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16. Find a linear relation between the vectors $\bar{a} + 3\bar{b} + 4\bar{c}, \bar{a} - 2\bar{b} + 3\bar{c}, \bar{a} + 5\bar{b} - 2\bar{c}$ and $6\bar{a} + 14\bar{b} + 4\bar{c}$ where $\bar{a}, \bar{b}, \bar{c}$ are non coplanar vectors.

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Exercise 1 2 Very Short Answer Questions

1. Find the position vector of the point which divides the line joining the points $\bar{i}+\bar{j}-4\bar{k}$ and $\bar{i}+\bar{j}+\bar{k}$ in the ratio 3 : 2.

A. i+j-k

B. i-j+k

C. i-j-k

D. i+j+k

Answer: $\bar{i}+\bar{j}-\bar{k}$

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2. A(2, 4, 2), B(1, 2, 1), C(4, 3, -1) and D are the vertices of a parallelogram ABCD. Then find the position vector of the point D.

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3. A(3, 1, 5), B(-1, -1, 9) and C(0, -5, 1) are the vertices of a triangle. Then find the position vector of the centroid of ΔABC.

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Exercise 1 2 Short Answer Questions

1. The points O, A, B, X and Y are such that $\overline{OA} = \bar{a}, \overline{OB} = \bar{b}, \overline{OX} = 3\bar{a}$ and $\overline{OY} = 3\bar{b}$, find $\overline{BX}$ and $\overline{AY}$ in terms of $\bar{a}$ and $\bar{b}$. Further if the point p divides $\overline{AY}$ in the ratio 1 : 3 then express $\overline{BP}$ interms of $\bar{a}$ and $\bar{b}$.

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2. The point 'E' divides the segment PQ internally in the ratio 1 : 2 and R is any point not on the line PQ. If F is a point on QR such that QF : FR = 2 : 1 then show that EF is parallel to PR.

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3. OABC is a tetrahedron D and E are the mid points of the edges $\overline{OA}$ and $\overline{BC}$. Then the vector $\overline{DE}$ in terms of $\overline{OA}$, $\overline{OB}$ and $\overline{OC}$.

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4. If O is the circumcentre, 'H' is the orthocentre of triangle ABC, then show that

$\overline{OA} + \overline{OB} + \overline{OC} = \overline{OH}$

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5. In ΔABC, P, Q and R are mid points of the sides AB, BC, and CA respectively. If D is any point

i) then express $\overline{DA} + \overline{DB} + \overline{DC}$ in terms of $\overline{DP}$, $\overline{DQ}$ and $\overline{DR}$

ii) If $\overline{PA} + \overline{QB} + \overline{RC} = \bar{a}$ then find $\bar{a}$.

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6. In the cartesian plane, O is the origin of the coordinate axes. A person starts at O and walks a distance of 3 units in the NORTH - EAST direction and reaches the point P. From P he walks 4 units distance parallel to NORTH - WEST direction and reaches the point Q. Express the vector $\overline{OQ}$ interms of $\bar{i}$ and $\bar{j}$ (Observe $\angle XOP = 45^{\circ}$)

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Exercise 1 3 Very Short Answer Questions

1. Find the vector equation of the line passing through the point $2\bar{i} + 3\bar{j} + \bar{k}$ and parallel to the vector $4\bar{i} - 2\bar{j} + 3\bar{k}$

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2. Find the vector equation of the line passing through the points $2\bar{i} + \bar{j} + 3\bar{k}$ and $-4\bar{i} + 3\bar{j} - \bar{k}$.

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3. Find the vector equation of the line passing through the points $\bar{i}+\bar{j}+\bar{k}$ and $\bar{i}-\bar{j}+\bar{k}$.

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4. OACB is a parallelogram with $\overline{OC}=\bar{a}, \overline{AB}=\bar{b}$ then $\overline{OA}=$

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5. If $\bar{a}, \bar{b}, \bar{c}$ are the position vectors of the vertices A, B, C respectively of ΔABC then find the vector equation of the median through the vertex A.

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6. Find the vector equation of the line through the centroid of triangle ABC and parallel to side BC where position vector of A, B, C are respectively are $\bar{i} - 2\bar{j} + \bar{k}, 2\bar{i} - \bar{j}, \bar{i} + \bar{j} + 3\bar{k}.$

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7. Find the vector equation of the plane passing through the points $\bar{i} - 2\bar{j} + 5\bar{k}, \ - 5\bar{j} - \bar{k}, \ - 3\bar{i} + 5\bar{j}.$

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8. Find the vector equation of plane passing through Points (0,0,0) , (0,5,0) and (2,0,1)

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9. Find the vector equation of the plane passing through the point (1, -2, 5) and parallel to the vectors (6, -5, -1), (-3, 5, 0).

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Exercise 1 3 Short Answer Questions

1. In the two dimensional plane, prove by using vector methods, the equation of the line whose intercepts on the axes are a and b is $\frac{x}{a} + \frac{y}{b} = 1.$

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2. Using the vector equation of the straight line passing through two points, prove that the points whose position vectors are $\bar{a}, \bar{b} \text{ and } (3\bar{a} - 2\bar{b})$ are collinear.

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3. Show that the line joining the pair of points $6\bar{a} - 4\bar{b} + 4\bar{c}, \ -4\bar{c}$ and the line joining the pair of points, $-\bar{a} - 2\bar{b} - 3\bar{c}, \bar{a} + 2\bar{b} - 5\bar{c}$ intersect at the point $-4\bar{c}$ when $\bar{a}, \bar{b}, \bar{c}$ are non-coplanar vectors.

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4. Find the equation of the line parallel to the vector $2\bar{i} - \bar{j} + 2\bar{k}$, and which passes through the point A whose position vector is $3\bar{i} + \bar{j} - \bar{k}$. If P is a point on this line such that AP = 15, find the position vector of P.

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5. Find the vector equation of the plane passing through the points. $4\bar{i} - 3\bar{j} - \bar{k}, 3\bar{i} + 7\bar{j} - 10\bar{k}$ and $2\bar{i} + 5\bar{j} - 7\bar{k}$ and show that the point $\bar{i} + 2\bar{j} - 3\bar{k}$ lies in the plane.

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6. Find the point of intersection of the line

$\bar{r} = 2\bar{a} + \bar{b} + t(\bar{b} - \bar{c})$ and the plane

$\bar{r} = \bar{a} + x(\bar{b} + \bar{c}) + y(\bar{a} + 2\bar{b} - \bar{c})$ where

$\bar{a}, \bar{b}, \bar{c}$ are non coplanar vectors.

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7. Find the vector equation of the plane which passes through the points $2\bar{i} + 4\bar{j} + 2\bar{k}, 2\bar{i} + 3\bar{j} + 5\bar{k}$ and parallel to the vector $3\bar{i} - 2\bar{j} + \bar{k}$. Also find the point where this plane meets the line joining the points $2\bar{i} + \bar{j} + 3\bar{k}$ and $4\bar{i} - 2\bar{j} + 3\bar{k}$.

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8. ABCD is trapezium in which AB and CD are parallel. Prove by vector methods that the mind points of the sides AB, CD and the intersection of the diagonals are collinear.

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Exercise 1 3 Long Answer Questions

1. In ΔOAB, E is the midpoint of AB and F is a point on OA such that OF = 2FA. If C is the point of intersection of $\overline{OE}$ and $\overline{BF}$, then find the ratios OC : CE and BC : CF.

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2. The median AD to ΔABC is bisected at E and BE is produced to meet the side AC in F. Show that $\overline{AF} = \frac{1}{3}\overline{AC}$

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Additional Exercise

1. In the parallelogram if $\overline{AB} = \bar{a}$ and $\overline{AD} = \bar{d}$ then find $\overline{BD}$.

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2. If $\bar{a} \neq \bar{0}$, then are the vectors $2\bar{a} \text{ and } \frac{\sqrt{3}}{2}\bar{a}$ like or unlike vectors ?

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3. In ΔABC, if D, E, F are the midpoints of the sides BC, CA and AB respectively, then what is the magnitude of the vector $\overline{AD} + \overline{BE} + \overline{CF}$?

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4. The position vectors of A and B are $\bar{a} \text{ and } \bar{b}$ respectively. If C is a point on the line $\overline{AB}$ such that $\overline{AC} = 5\overline{AB}$ then find the position vector of C.

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5. If C is the mid point of AB and if P is any point out side AB then show that $\overline{PA} + \overline{PB} = 2\overline{PC}$.

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6. The position vector of the points P, Q, R, S are $\bar{i} + \bar{j} + \bar{k}, 2\bar{i} + 5\bar{j}, 3\bar{i} + 2\bar{j} - 3\bar{k}$ and $\bar{i} - 6\bar{j} - \bar{k}$ respectively. Prove that $\overline{PQ}$ and $\overline{RS}$ are parallel and find the ratio of their lengths.

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7. Find the position vector of two points on the line through $P(\bar{i} + \bar{j} - 2\bar{k})$ at a distance 6 units from P, if the line is parallel to $2\bar{i} + 2\bar{j} + \bar{k}$.

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8. If $\bar{a} = \bar{i} + \bar{j} + \bar{k}$ and $\bar{b} = 2\bar{i} - 3\bar{j} - \bar{k}$, find the unit vector in the direction of $\bar{a} + \bar{b}$.

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9. Find the equation of the line passing through the point $2\bar{i}$ and parallel to the vector $\bar{j} + \bar{k}$.

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10. Find the Cartesian equation of the plane passing through the points with position vectors $\bar{i}, \bar{j}$ and $\bar{k}$.

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Exercise I

1. The position vectors of A and B are $\bar{a}$ and $\bar{b}$ respectively. If C is a point on the line $\overline{AB}$ such that $\overline{AC} = 5\overline{AB}$ then find the position vector of C.

A. $5\bar{b} - 4\bar{a}$

B. $5\bar{b} + 4\bar{a}$

C. $4\bar{b} - 5\bar{a}$

D. $4\bar{b} + 5\bar{a}$

Answer: A

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2. If $\lambda(2\bar{i} - 4\bar{j} + 4\bar{k})$ is a unit vector then $\lambda =$

A. $\pm\frac{1}{4}$

B. $\pm\frac{1}{7}$

C. $\pm\frac{1}{5}$

D. $\pm\frac{1}{6}$

Answer: D

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3. If $\bar{a} = \bar{i} + \bar{j}, \bar{b} = \bar{j} + \bar{k}, \bar{c} = \bar{i} + \bar{k},$ then the unit vector in the opposite direction of $\bar{a} - 2\bar{b} + 3\bar{c}$ is

A. $\frac{1}{3\sqrt{2}}\left(4\bar{i} - \bar{j} + \bar{k}\right)$

B. $-\frac{1}{3\sqrt{2}}\left(4\bar{i} - \bar{j} + \bar{k}\right)$

C. $\frac{1}{3\sqrt{2}}\left(\bar{i} - 4\bar{j} + \bar{k}\right)$

D. $\frac{1}{3\sqrt{2}}\left(\bar{i} + \bar{j} - 4\bar{k}\right)$

Answer: B

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4. The unit vector(s) parallel to $\bar{i} - 3\bar{j} - 5\bar{k}$ is

A. $+\frac{1}{\sqrt{35}}(\bar{i}-3\bar{j}-5\bar{k})$

B. $\bar{i}-3\bar{j}-5\bar{k}$

C. $-\frac{1}{\sqrt{35}}(\bar{i}-3\bar{j}-5\bar{k})$

D. Both 1 and 3

Answer: D

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5. If $\overline{OP}=2\bar{i}+3\bar{j}-\bar{k}, \overline{OQ}=3\bar{i}-4\bar{j}+2\bar{k}$ then d.c's of $\overline{PQ}$ are

A. $\frac{1}{\sqrt{59}}(-1, 7, 3)$

B. $\frac{1}{\sqrt{59}}(1, -7, 3)$

C. $\frac{1}{\sqrt{59}}(1, 7, -3)$

D. $\frac{1}{\sqrt{59}}(1, -7, -3)$

Answer: B

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6. Unit vector making angles $\frac{\pi}{6}, \frac{\pi}{6}, \frac{\pi}{3}$ with $\bar{i}, \bar{j}, \bar{k}$ directions is

A. $\frac{1}{\sqrt{3}}(\bar{i}+\bar{j}+\bar{k})$

B. $\frac{1}{\sqrt{3}}(\bar{i}-\bar{j}+\bar{k})$

C. $\frac{1}{\sqrt{3}}(\bar{i}-\bar{j}-\bar{k})$

D. impossible to get such a vector

Answer: D

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7. If a straight line makes an angle $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$ with each of the positive x, y and z-axis, a vector parallel to that line is

A. $\bar{i}$

B. $\bar{i}+\bar{j}$

C. $\bar{j}+\bar{k}$

D. $\bar{i}+\bar{j}+\bar{k}$

Answer: D

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8. If $(\bar{a},\bar{b})=60^\circ$ then $(-\bar{a},-\bar{b})=$

A. 60°

B. 30°

C. 45°

D. 90°

Answer: A

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9. Any two collinear vectors are

A. L.D

B. L.I

C. both 1 and 2

D. neither 1 nor 2

Answer: A

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10. Any three coplanar vectors are

A. L.I

B. L.D.

C. both 1 and 2

D. neither 1 nor 2

Answer: B

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11. If $\bar{a}$ and $\bar{b}$ are two non-zero, non-collinear vectors such that $x\bar{a} + y\bar{b} = \bar{0}$ then

A. $x \neq 0, y \neq 0$

B. $x = 0, y \neq 0$

C. $x \neq 0, y = 0$

D. $x = 0, y = 0$

Answer: D

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12. If $\bar{a} = \bar{i} - 2\bar{j} + \bar{k}, \bar{b} = 4\bar{i} + 2\bar{j} - \bar{k}, \bar{c} = \bar{i} + 2\bar{j} - \bar{k}$ and $\bar{a} + \lambda\bar{b}$ is parallel to $\bar{c}$ then $\lambda =$

A. $\frac{-2}{3}$

B. $\frac{2}{3}$

C. $\frac{3}{2}$

D. $\frac{-3}{2}$

Answer: A

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13. If $\bar{a} = \bar{i} + 2\bar{j} + 2\bar{k}$ and $\bar{b} = 3\bar{i} + 6\bar{j} + 2\bar{k}$ then the vector in the direction of $\bar{a}$ and having magnitude as $|\bar{b}|$ is

A. $\frac{1}{3}(\bar{i} + 2\bar{j} + 2\bar{k})$

B. $\frac{7}{3}(\bar{i} + 2\bar{j} + 2\bar{k})$

C. $\frac{5}{3}(\bar{i} + 2\bar{j} + 2\bar{k})$

D. $\frac{2}{3}(\bar{i} + 2\bar{j} + 2\bar{k})$

Answer: B

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14. If $2\bar{i} + 3\bar{j} - 6\bar{k}, 6\bar{i} - 2\bar{j} + 3\bar{k}$ are two consecutive sides of a triangle, then perimeter of triangle is

A. $17 + \sqrt{74}$

B. $\sqrt{74} + 14$

C. $\sqrt{74} + 19$

D. $\sqrt{74} + 7$

Answer: B

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15. If ABCD is a parallelogram such that $\overline{AB} = \bar{a}, \overline{BC} = \bar{b}$ then $\overline{AC}, \overline{BD}$ are

A. $\bar{a} + \bar{b}, \bar{b} - \bar{a}$

B. $\bar{a}+\bar{b}, \bar{a}-\bar{b}$

C. $\bar{a}+\bar{b}, \ -\bar{a}-\bar{b}$

D. both 1 and 2

Answer: A

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16. A point $C=\dfrac{5a+4b-5c}{3}$ divides the line joining A = a - 2b + 3c and B in the ratio 2 : 1, then the poistion vector of B is

A. $\bar{a}+3\bar{b}-4\bar{c}$

B. $2\bar{a}-3\bar{b}+4\bar{c}$

C. $2\bar{a}+3\bar{b}+4\bar{c}$

D. $2\bar{a}+3\bar{b}-4\bar{c}$

Answer: D

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17. P, Q, R, S have position vectors $\bar{p}, \bar{q}, \bar{r}, \bar{s}$ respectively such that $(\bar{p} - \bar{q}) = 2(\bar{s} - \bar{r})$, then QS and PR

A. Bisect each other

B. Trisect each other

C. Trisect each other externally

D. all the above

Answer: B

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18. The ratio in which the line segment joining the points with P.V.'s $\bar{i} + 2\bar{j} + 3\bar{k}, \ -3\bar{i} + 6\bar{j} - 8\bar{k}$ is divided by xy-plane is

A. $3:8$

B. $3:5$

C. $5:3$

D. $8:3$

Answer: A

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19. The ratio in which $\bar{i}+2\bar{j}+3\bar{k}$ divides the join of $-2\bar{i}+3\bar{j}+5\bar{k}$ and $7\bar{i}-\bar{k}$ is

A. $1:2$

B. $2:3$

C. $3:4$

D. $1:4$

Answer: A

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20. Let 'O' be the origin and A, B be two points. $\bar{p}, \bar{q}$ are vectors represented by $\overline{OA}, \overline{OB}$ and their magnitudes are p, q respectively. Unit vector bisecting $\angle AOB$ is

A. $\dfrac{\frac{\bar{p}}{p} + \frac{\bar{q}}{q}}{\left|\frac{\bar{p}}{p} + \frac{\bar{q}}{q}\right|}$

B. $\dfrac{\frac{\bar{p}}{p} - \frac{\bar{q}}{q}}{\left|\frac{\bar{p}}{p} - \frac{\bar{q}}{q}\right|}$

C. $\dfrac{\bar{p}}{p} + \dfrac{\bar{q}}{q}$

D. $\dfrac{\bar{p}}{p} - \dfrac{\bar{q}}{q}$

Answer: A

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21. The vector equation of the line passing through the point $2\bar{i} + \bar{j} - 3\bar{k}$ and parallel to $\bar{i} + 2\bar{j} + \bar{k}$ is

A. $\bar{r} = (2+t)\bar{i} + (1+2t)\bar{j} + (t-3)\bar{k}$

B. $\bar{r} = (2-t)\bar{i} + (1+2t)\bar{j} + (t+3)\bar{k}$

C. $\bar{r} = (2+t)\bar{i} - (1+2t)\bar{j} + (t-3)\bar{k}$

D. $\bar{r} = 2\bar{i} - (1-2t)\bar{j} + (t+4)\bar{k}$

Answer: A

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22. The equation to the line passing through the points $A(\bar{i} + \bar{j} + \bar{k})$ and $B(\bar{i} + \bar{j} - \bar{k})$ is

A. $\bar{r} = \bar{i} + (1+t)\bar{j} + (1-2t)\bar{k}$

B. $\bar{r} = (1+t)\bar{i} + \bar{j}(1-2t)\bar{k}$

C. $\bar{r} = \bar{i} + \bar{j} + (1-2t)\bar{k}$

D. $\bar{r} = \bar{i} - 2\bar{j} + t\bar{k}$

Answer: C

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23. The cartesian equation of the line passing through the point (2, -1, 4) and parallel to the vector $\bar{i} + \bar{j} - 2\bar{k}$ is

A. $\frac{x-2}{1} = \frac{y+1}{1} = \frac{z-4}{-2}$

B. $\frac{x+2}{1} = \frac{y-1}{1} = \frac{z-4}{-2}$

C. $\frac{x-2}{2} = \frac{y+1}{1} = \frac{z-4}{-2}$

D. $\frac{x+2}{1} = \frac{y-1}{1} = \frac{z+4}{-2}$

Answer: A

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24. The cartesian equation to the line passing through the points A(1, 2, -1) and B(2, 1, 1) is

A. $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z+1}{1}$

B. $\frac{x+1}{2} = \frac{y+2}{1} = \frac{z-1}{1}$

C. $\frac{x-1}{1} = \frac{y-2}{-1} = \frac{z+1}{2}$

D. $\frac{x-1}{-1}=\frac{y-2}{-1}=\frac{z+1}{2}$

Answer: C

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25. If $\bar{a}, \bar{b}, \bar{c}$ are three non-coplanar vectors, then the vector equation

$\bar{r}=(1-p-q)\bar{a}+p\bar{b}+q\bar{c}$ represents

A. a st. line

B. plane

C. plane passing through origin

D. sphere

Answer: B

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26. If $\bar{a}, \bar{b}$ are two non collinear vectors, then $\bar{r} = s\bar{a} + t\bar{b}$ represents

A. line

B. plane

C. plane passing through origin

D. sphere

Answer: C

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27. If $\bar{r} = s\bar{a} + t\bar{b}$ represents a line passing through the points $\bar{a}, \bar{b}$ then

A. s = t

B. $s + t = 0$

C. $s + t = 1$

D. $s + t = -1$

Answer: C

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28. If $A(2\bar{i}-\bar{j}-3\bar{k}), B(4\bar{i}+\bar{j}-\bar{k}), C(\bar{i}-3\bar{j}+2\bar{k}), D(\bar{i}-\bar{j}-2\bar{k})$ then the vector equation of the plane parallel to $\overline{ABC}$ and passing through the centroid of the tetra-hedron ABCD is

A. $\bar{r}=(2\bar{i}-\bar{j}-\bar{k})+s(\bar{i}+\bar{j}+\bar{k})+t(\bar{i}+2\bar{j}-5\bar{k})$

B. $\bar{r}=(2\bar{i}-\bar{j}+\bar{k})+s(\bar{i}-\bar{j}+\bar{k})+t(\bar{i}+2\bar{j}+5\bar{k})$

C. $\bar{r}=(2\bar{i}+\bar{j}-\bar{k})+s(\bar{i}+\bar{j}-\bar{k})+t(\bar{i}-2\bar{j}+5\bar{k})$

D. $\bar{r}=(2\bar{i}+\bar{j}+\bar{k})+s(\bar{i}-\bar{j}-\bar{k})+t(\bar{i}+2\bar{j}-5\bar{k})$

Answer: A

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29. The vector equation of the plane passing through the points (1, -2, 5), (0, -5, -1), (-3, 5, 0) is

A. $\bar{r} = (1 - s - t)(\bar{i} - 2\bar{j} - 5\bar{k}) + s(-5\bar{j} - \bar{k}) + t(-3\bar{i} + 5\bar{j})$

B.

$$\bar{r} = (1 - s - t)(\bar{i} + 2\bar{j} + 3\bar{k}) + s(3\bar{i} + 2\bar{j} + \bar{k}) + t(2\bar{i} + \bar{j} + 3\bar{k})$$

C. $\bar{r} = (1 - s - t)(\bar{i} - 2\bar{j} + 4\bar{k}) + s(-5\bar{j} - \bar{k}) + t(-3\bar{i} + 5\bar{j})$

D. $\bar{r} = (1 - s - t)(\bar{i} - 2\bar{j}) + s(-5\bar{j} - \bar{k}) + t(\bar{i} + \bar{j})$

Answer: A

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30. ABCD is a parallelogram and P is themid point of the side AD. The line BP meets the diagonal AC in Q. Then the ratio AQ : QC =

A. $1:2$

B. $2:1$

C. $1:3$

D. $3:1$

Answer: A

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31. The cartesian equation of the plane whose vector equation is $\bar{r} = (1 + \lambda - \mu)\bar{i} + (2 - \lambda)\bar{j} + (3 - 2\lambda + 2\mu)\bar{k}$ where λ, μ are scalars is

A. $2x + y = 5$

B. $2x - y = 5$

C. $2x - z = 5$

D. $2x + z = 5$

Answer: D

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Exercise Ii

1. If the points with position vectors $60\bar{i}+3\bar{j}, 40\bar{i}-8\bar{j}, a\bar{i}-52\bar{j}$ are collinear then a =

A. -40

B. 40

C. -80

D. 80

Answer: A

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2. If the vectors 2i + 3j, 5i + 6j, 8i + λj have their initial point at (1, 1) then the value of λ so that the vectors terminated on one line is

A. 3

B. 6

C. 9

D. 12

Answer: C

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3. The position vector of a point lying on the line joining the points whose position vectors are $\bar{i}+\bar{j}-\bar{k}$ and $\bar{i}-\bar{j}+\bar{k}$ is

A. $\bar{j}$

B. $\bar{i}$

C. $\bar{k}$

D. $\bar{0}$

Answer: B

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4. The points with P.V's $\overline{i}+2\overline{j}+\overline{k}, 2\overline{i}+3\overline{j}+4\overline{k}$ and $4\overline{i}+5\overline{j}+10\overline{k}$ form

A. An acute angled triangle

B. obtuse angled triangle

C. Right angled triangle

D. collinear

Answer: D

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5. The points $2\overline{a}+3\overline{b}+\overline{c}, \overline{a}+\overline{b}, 6\overline{a}+11\overline{b}+5\overline{c}$ are

A. Collinear

B. Coplanar but non collinear

C. non coplanar

D. cannot be determined

Answer: A

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6. i) If $\bar{a}, \bar{b}, \bar{c}$ are non coplanar vectors, then prove that the vectors $5\bar{a}-6\bar{b}+7\bar{c}, 7\bar{a}-8\bar{b}+9\bar{c}$ and $\bar{a}-3\bar{b}+5\bar{c}$ are coplanar.

A. Collinear

B. Coplanar but non collinear

C. non coplanar

D. cannot be determined

Answer: B

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7. If $\bar{a}, \bar{b}, \bar{c}$ are non coplanar then the vectors $\bar{a}-2\bar{b}+3\bar{c},\ -2\bar{a}+3\bar{b}-4\bar{c}, \bar{a}-3\bar{b}+5\bar{c}$ are

A. Collinear

B. Coplanar but non collinear

C. non coplanar

D. cannot be determined

Answer: C

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8. The vectors $2\bar{i}-3\bar{j}+\bar{k}, \bar{i}-2\bar{j}+3\bar{k}, 3\bar{i}+\bar{j}-2\bar{k}$

A. Collinear

B. Coplanar but non collinear

C. non coplanar

D. cannot be determined

Answer: B

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9. Let $\bar{a} = \bar{i} + \bar{j}, \bar{b} = \bar{j} + \bar{k}$ and $\bar{c} = \alpha\bar{a} + \beta\bar{b}$. If the vectors $\bar{i} - 2\bar{j} + \bar{k}, 3\bar{i} + 2\bar{j} - \bar{k}$ and $\bar{c}$ are coplanar then $\frac{\alpha}{\beta}$ equals

A. -1

B. 2

C. 3

D. -3

Answer: D

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10. The number of distinct real values of λ for which the vectors $-\lambda^2\bar{i} + \bar{j} + \bar{k}, \bar{i} - \lambda^2\bar{j} + \bar{k}, \bar{i} + \bar{j} - \lambda^2\bar{k}$ are coplanar is

A. 2

B. 4

C. 5

D. 9

Answer: A

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11. If $\bar{a} = \bar{i} + \bar{j} + \bar{k}, \bar{b} = 4\bar{i} + 3\bar{j} + 4\bar{k}, \bar{c} = \bar{i} + \alpha\bar{j} + \beta\bar{k}$ are linearly dependent vectors and $|\bar{c}| = \sqrt{3}$ then

A. $\alpha = 1, \beta = -1$

B. $\alpha = 1, \beta = \pm 1$

C. $\alpha = -1, \beta = \pm 1$

D. $\alpha = \pm 1, \beta = 1$

Answer: D

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12. If $\bar{a} = 2\bar{i} - \bar{j} + 3\bar{k}, \bar{b} = -\bar{i} + 4\bar{j} - 2\bar{k}, \bar{c} = 5\bar{i} + \bar{j} + 7\bar{k}$ and $x\bar{a} + y\bar{b} = \bar{c}$ then (x, y) =

A. (3, 1)

B. (3, -1)

C. (-3, 1)

D. (-3, -1)

Answer: A

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13. If the points $A(\bar{a}), B(\bar{b}), C(\bar{c})$ satisfy the relation $3\bar{a} - 8\bar{b} + 5\bar{c} = \bar{0}$ then the points are

A. coplanar

B. noncoplanar

C. collinear

D. vertices of a right angled triangle

Answer: C

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14. If $x\bar{a}+y\bar{b}+z\bar{c}, x\bar{b}+y\bar{c}+z\bar{a}, x\bar{c}+y\bar{a}+z\bar{b}=\bar{0}$ where $\bar{a}, \bar{b}, \bar{c}$ are non-coplanar, then (x, y, z) =

A. (0, 0, 0)

B. (1, 3, 5)

C. (1, -3, 2)

D. (3, 1, 1)

Answer: A

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15. If

$\bar{r} = 3\bar{i} + 2\bar{j} - 5\bar{k}, \bar{a} = 2\bar{i} - \bar{j} + \bar{k}, \bar{b} = \bar{i} + 3\bar{j} - 2\bar{k}$ and $\bar{c} = -2\bar{i} + \bar{j} -$

such that $\bar{r} = \lambda\bar{a} + \mu\bar{b} + \delta\bar{c}$ then $\mu, \dfrac{\lambda}{2}, \delta$ are in

A. A.P

B. G.P

C. H.P

D. A.G.P

Answer: A

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16. The vector of magnitude $3\sqrt{6}$ along the bisector of the angle between the vectors $4\bar{i} - 7\bar{j} + 4\bar{k}$ and $\bar{i} + 2\bar{j} - 2\bar{k}$ is

A. $7\bar{i} - \bar{j} - 2\bar{k}$

B. $\pm(7\bar{i} - \bar{j} - 2\bar{k})$

C. $-7\bar{i} - \bar{j} - 2\bar{k}$

D. $\pm(-7\bar{i} + \bar{j} - 2\bar{k})$

Answer: B

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17. The vector $a\bar{i} + b\bar{j} + c\bar{k}$ is a bisector of the angle between the vectors $\bar{i} + \bar{j}$ and $\bar{j} + \bar{k}$ if

A. a = b

B. a = c

C. a + b = c

D. $a = b = c$

Answer: B

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18. If the vector $-\bar{i}+\bar{j}-\bar{k}$ bisects the angles between the vector $\bar{c}$ and the vector $3\bar{i}+4\bar{j}$, then the unit vector in the direction of $\bar{c}$ is

A. $11\bar{i}+10\bar{j}+2\bar{k}$

B. $-(11\bar{i}+10\bar{j}+2\bar{k})$

C. $-\frac{1}{15}(11\bar{i}+10\bar{j}+2\bar{k})$

D. $\frac{1}{15}(11\bar{i}+10\bar{j}+2\bar{k})$

Answer: C

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19. If A(1, -1, -3), B(2, 1, -2), C(-5, 2, -6) are the vertices of a ΔABC, then the length of internal bisector of angle A is

A. $\frac{3}{4}\sqrt{10}$

B. $\frac{1}{2}\sqrt{10}$

C. $\frac{1}{4}\sqrt{10}$

D. $\sqrt{10}$

Answer: A

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20. The median AD of the triangle ABC is bisected at E. BE meets AC in F then AF : AC is

A. $3:4$

B. $1:3$

C. $1:2$

D. $1:4$

Answer: B

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21. If S is the circumcentre, G the centroid, O the orthocentre of Δ ABC, then $\vec{S}A + \vec{S}B + \vec{S}C =$

A. $\overline{SG}$

B. $\overline{OS}$

C. $\overline{SO}$

D. $\overline{OG}$

Answer: C

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22. If S is the circumcentre, O is the orthocentre of Δ ABC then $\vec{O}A + \vec{O}B + \vec{O}C =$

A. $\overline{SO}$

B. $2\overline{SO}$

C. $\overline{OS}$

D. $2\overline{OS}$

Answer: D

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23. The P.V.'s of the vertices of a ΔABC are $\overline{i}+\overline{j}+\overline{k}, 4\overline{i}+\overline{j}+\overline{k}, 4\overline{i}+5\overline{j}+\overline{k}$. The P.V. of the circumcentre of ΔABC is

A. $\frac{5}{2}\overline{i}+3\overline{j}+\overline{k}$

B. $5\overline{i}+\frac{3}{2}\overline{j}+\overline{k}$

C. $5\overline{i}+3\overline{j}+\frac{1}{2}\overline{k}$

D. $\overline{i}+\overline{j}+\overline{k}$

Answer: A

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24. The P.V.'s of the vertices of a triangle are $2\bar{i}+3\bar{j}+4\bar{k}, 4\bar{i}+6\bar{j}+3\bar{k}, 3\bar{i}+2\bar{j}+3\bar{k}$ P.V. of its orthocentre is

A. $2\bar{i}-3\bar{j}+4\bar{k}$

B. $2\bar{i}+3\bar{j}-4\bar{k}$

C. $2\bar{i}+3\bar{j}+4\bar{k}$

D. $-2\bar{i}+3\bar{j}+4\bar{k}$

Answer: C

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25. ΔABC be an equilateral triangle whose orthocentre is the origin 'O'. If $\overline{OA}=\bar{a}, \overline{OB}=\bar{b}$ then $\overline{OC}$ is

A. $\bar{a}+\bar{b}$

B. $\dfrac{\bar{a}+\bar{b}}{2}$

C. $-(\bar{a}+\bar{b})$

D. $-2(\bar{a}+\bar{b})$

Answer: C

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26. The P.V.'s of A, B, C are $\bar{i}+\bar{j}+\bar{k}, 4\bar{i}+\bar{j}+\bar{k}, 4\bar{i}+5\bar{j}+\bar{k}$, then the P.V. of the incentre of ΔABC is

A. $\frac{1}{3}\bar{i}+\frac{1}{3}\bar{j}+\frac{1}{3}\bar{k}$

B. $\frac{\bar{i}+\bar{j}-\bar{k}}{3}$

C. $\bar{i}+\bar{j}-\bar{k}$

D. $\frac{\bar{i}-\bar{j}-\bar{k}}{3}$

Answer: A

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27. In a ΔABC, P.V.'s of midpoints of AB, AC are $\bar{i}-\bar{j}+\bar{k}$, $\bar{i}+2\bar{k}$. The P.V. of centroid of ΔABC is $2\bar{i}+3\bar{j}+4\bar{k}$. P.V. of A is

A. $-4\bar{i}-9\bar{j}-6\bar{k}$

B. $-4\bar{i}+9\bar{j}+6\bar{k}$

C. $4\bar{i}+9\bar{j}-6\bar{k}$

D. $\bar{i}+4\bar{j}+6\bar{k}$

Answer: A

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28. The vectors of $\overline{AB}=3\bar{i}+4\bar{k}$ and $\overline{AC}=5\bar{i}-2\bar{j}+4\bar{k}$ are the sides of a triangle ABC. The length of the median through A is

A. $\sqrt{72}$

B. $\sqrt{33}$

C. $\sqrt{288}$

D. $\sqrt{18}$

Answer: B

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29. If D, E, F are the midpoints of BC, CA, AB of Δ ABC, then $\vec{A}D + \vec{B}E + \vec{C}F =$

A. $\overline{O}$

B. $\overline{AE}$

C. $\overline{BD}$

D. $\overline{CE}$

Answer: A

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30. If D, E and F are respectively the mid-points of AB, AC and BC in ΔABC then $\overline{BE}+\overline{AF}=$

A. $\overline{DC}$

B. $\frac{1}{2}\overline{BF}$

C. $2\overline{BF}$

D. $\frac{3}{2}\overline{BF}$

Answer: A

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31. If ABCD is a parallelogram then $\overline{AC}+\overline{BD}=$

A. $\overline{AB}$

B. $2\overline{AB}$

C. $\overline{BC}$

D. $2\overline{BC}$

Answer: D

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32. ABCD is a parallelogram, with AC, BD as diagonals, then $\bar{AC} - \bar{BD}$ is equal to

A. $\overline{AB}$

B. $2\overline{AB}$

C. $\overline{BC}$

D. $2\overline{BC}$

Answer: B

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33. OACB is a parallelogram with $\overline{OC} = \bar{a}, \overline{AB} = \bar{b}$ then $\overline{OA} =$

A. $\frac{\bar{a}+\bar{b}}{2}$

B. $\bar{a}+\bar{b}$

C. $\frac{\bar{a}-\bar{b}}{2}$

D. $\bar{a}-\bar{b}$

Answer: C

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34. If the diagonals of a parallelogram are $\bar{i}+5\bar{j}-2\bar{k}$ and $-2\bar{i}+\bar{j}+3\bar{k}$ then the lengths of its sides are

A. 5, 7

B. $\frac{\sqrt{28}}{2}, \frac{\sqrt{48}}{2}$

C. $\frac{\sqrt{38}}{2}, \frac{\sqrt{50}}{2}$

D. $\frac{5}{2}, \frac{7}{2}$

Answer: C

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35. ABCD is a quadrilateral. E is the point of intersection of the line joining the middle points of the opposite sides. If O is any point then $\overline{OA}+\overline{OB}+\overline{OC}+\overline{OD}=$

A. $4\overline{OE}$

B. $3\overline{OE}$

C. $2\overline{OE}$

D. $\overline{OE}$

Answer: A

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36. ABCDE is a pentagon then

$\overline{AB}+\overline{AE}+\overline{BC}+\overline{DC}+\overline{ED}+\overline{AC}=$

A. $3\overline{AC}$

B. $\overline{AC}$

C. $2\overline{AC}$

D. $4\overline{AC}$

Answer: A

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37. ABCDEF is a regular hexagon.

If $\overline{AB} + \overline{AE} + \overline{BC} + \overline{DC} + \overline{ED} + \overline{AC} = \lambda\overline{AC} \text{ then } \lambda =$

A. 1

B. 2

C. 3

D. 4

Answer: C

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38. ABCDEF is a regular hexagon.

$\overline{AB} + \overline{AC} + \overline{AD} + \overline{EA} + \overline{FA} =$

A. $3\overline{AB}$

B. $4\overline{AB}$

C. $\overline{AB}$

D. $2\overline{AB}$

Answer: B

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39. ABCDEF is a regular hexagon.

If $\overline{AB} = \bar{a}, \overline{BC} = \bar{b}$ then $\overline{CE} =$

A. $(\bar{b} - 2\bar{a})$

B. $2(\bar{a}-\bar{b})$

C. $\bar{b}-\bar{a}$

D. $\bar{a}-\bar{b}$

Answer: A

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40. ABCDEF is a regular hexagon.

If $\overline{AB}=\bar{a}, \overline{BC}=\bar{b}$ then $\overline{FA}=$

A. $\bar{b}-\bar{a}$

B. $2(\bar{b}-\bar{a})$

C. $2(\bar{a}-\bar{b})$

D. $\bar{a}-\bar{b}$

Answer: D

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41. ABCDEF is a regular hexagon.

O is centre and P.V. of A, B are $\bar{i}-\bar{j}+2\bar{k}, 2\bar{i}+\bar{j}+\bar{k}$ then $\overline{BC}=$

A. $-\bar{i}+\bar{j}+2\bar{k}$

B. $-\bar{i}+\bar{j}-2\bar{k}$

C. $-\bar{i}+\bar{j}+\bar{k}$

D. $-\bar{i}+\bar{j}$

Answer: A

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42. If OABC, OCDE, OEFA are adjacent faces of a cube OABCDEF then $\overline{OB}+\overline{OD}+\overline{OF}$ interms of $\overline{OA}, \overline{OE}, \overline{OC}$ is

A. $2(\overline{OA}+\overline{OC}+\overline{OE})$

B. $2(\overline{OA}+\overline{OB}+\overline{OC})$

C. $2(\overline{OA} - \overline{OC} + \overline{OE})$

D. $\overline{OA} - \overline{OC} - \overline{OE}$

Answer: A

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43. If I is the centre of a circle inscribed in a ΔABC, then $|\overline{BC}|\overline{IA} + |\overline{CA}|\overline{IB} + |\overline{AB}|\overline{IC} =$

A. $\bar{0}$

B. $\overline{IA} + \overline{IB} + \overline{IC}$

C. $\dfrac{\overline{IA} + \overline{IB} + \overline{IC}}{3}$

D. $2(\overline{IA} + \overline{IB} + \overline{IC})$

Answer: A

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44. If $\bar{r} = 3\bar{p} + 4\bar{q}$ and $2\bar{r} = \bar{p} - 3\bar{q}$ then

A. $\bar{r}, \bar{q}$ have same direction and $|\bar{r}| < 2 \quad |\bar{q}|$

B. $\bar{r}, \bar{q}$ have opposite direction and $|\bar{r}| > 2 \quad |\bar{q}|$

C. $\bar{r}, \bar{q}$ have opposite direction and $|\bar{r}| < 2 \quad |\bar{q}|$

D. $\bar{r}, \bar{q}$ have same direction and $|\bar{r}| > 2 \quad |\bar{q}|$

Answer: B

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45. If $\bar{e} = l\bar{i} + m\bar{j} + n\bar{k}$ is a unit vector then maximum value of $'lm + mn + nl'$ is

A. -1/2

B. 2

C. 3

D. 4

Answer: A

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46. If l, m, n are d.c's of vector $\overline{OP}$ then maximum value of lmn is

A. $\frac{1}{\sqrt{3}}$

B. $\frac{1}{2\sqrt{3}}$

C. $\frac{1}{3\sqrt{3}}$

D. $\frac{2}{\sqrt{3}}$

Answer: C

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47. A vector $\bar{a}$ has components a_1, a_2, a_3 in the right handed system OXYZ. If the coordinate system is rotated about z-axis through an angle $\pi/2$, the component of $\bar{a}$ in the new system are

A. $(a_2, \ -a_1, a_3)$

B. (a_2, a_1, a_3)

C. $(-a_2, a_1, a_3)$

D. $(-a_2, \ -a_1, a_3)$

Answer: A

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48. A vector $\bar{a}$ has components 2p and 1 w.r.t a rectangular cartesian system. It is rotated through a certain angle about the origin in the counter clockwise direction. With respect to the new system, if $\bar{a}$ has components p +1, 1 then p =

A. $\left(1, \frac{-1}{3}\right)$

B. $\left(1, \frac{1}{3}\right)$

C. $\left(-1, \frac{1}{3}\right)$

D. $\left(-1, \frac{-1}{3}\right)$

Answer: A

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49. In a ΔOAB The P.V.'s of A, B are $\bar{a}, \bar{b}$ respectively. The P.V. of 'C' is $\frac{3\bar{a}}{4}+\frac{\bar{b}}{2}$ then 'C' lies

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50. The position vectors A, B are $\bar{a}, \bar{b}$ respectively. The position vector of C is $\frac{5\bar{a}}{3}-\bar{b}$. Then

A. C is outside the ΔOAB but inside the angle OBA

B. C is outside the ΔOAB but inside the angle BOA

C. C is outside the ΔOAB but inside the angle COA

D. inside the triangle OAB

Answer: A

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51. If $\bar{a}, \bar{b}, \bar{c}$ are the position vectors of the vertices A, B, C of the triangle ABC, then the equation of the median from A to BC is

A. $\bar{r} = \bar{a} + t(\bar{b} + \bar{c})$

B. $\bar{r} = \bar{a} + t\left[\frac{1}{2}(\bar{b} + \bar{c}) - \bar{a}\right]$

C. $\bar{r} = \bar{a} + t(\bar{b}) + \bar{c}$

D. $\bar{r} = -\bar{a} + t(\bar{b}) + \bar{c}$

Answer: B

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52. The equation to the altitude of the triangle formed by (1, 1, 1), (1, 2, 3), (2, -1, 1) through (1, 1, 1) is

A. $\bar{r} = (\bar{i} + \bar{j} + \bar{k}) + t(\bar{i} - \bar{j} - 2\bar{k})$

B. $\bar{r} = (\bar{i} - \bar{j} + \bar{k}) + t(\bar{i} + \bar{j} + 2\bar{k})$

C. $\bar{r} = (\bar{i} + \bar{j} + \bar{k}) + t(\bar{i} - \bar{j} + 2\bar{k})$

D. $\bar{r} = (\bar{i} - \bar{j} - \bar{k}) + t(\bar{i} + \bar{j} - 2\bar{k})$

Answer: C

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53. If the position vectors of A, B are $2\bar{i} - 9\bar{j} - 4\bar{k}, 6\bar{i} - 3\bar{j} + 8\bar{k}$ then the unit vector in the direction of $\overrightarrow{AB}$ is

A. $\bar{r} = t(4\bar{i} - 6\bar{j} + 8\bar{k})$

B. $\bar{r} = t(4\bar{i} - 2\bar{k})$

C. $\bar{r} = t(2\bar{i} + 3\bar{j} - 6\bar{k})$

D. $\bar{r} = t(6\bar{i} - 3\bar{j} + 2\bar{k})$

Answer: B

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54. If the position vectors of A, B, C, D are $3\bar{i}+2\bar{j}+\bar{k}, 4\bar{i}+5\bar{j}+5\bar{k}, 4\bar{i}+2\bar{j}-2\bar{k}, 6\bar{i}+5\bar{j}-\bar{k}$ respectively then the position vector of the point of intersection of lines AB and CD is

A. $2\bar{i}+\bar{j}-3\bar{k}$

B. $2\bar{i}-\bar{j}+3\bar{k}$

C. $2\bar{i}+\bar{j}+3\bar{k}$

D. $2\bar{i}-\bar{j}-3\bar{k}$

Answer: D

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55. The lineas r = (6 - 6s) a + (4s - 4) b + (4 - 8s) c and r = (2t - 1) a + (4t - 2) b - (2t + 3) c intersect at

A. $4\bar{c}$

B. $-4\bar{c}$

C. $3\bar{c}$

D. $-2\bar{c}$

Answer: B

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56. A point on the line passing through (1, 1, 1) and parallel to (1, -2, -1) is

A. (0, 3, 1)

B. (2, 3, 0)

C. (0, 3, 2)

D. (1, 3, 2)

Answer: C

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57. A line passing through the point $A(3\bar{i}+\bar{j}-\bar{k})$ and parallel to $2\bar{i}-\bar{j}+2\bar{k}$. If P is a point such that AP=15 then $\overline{OP}$ is

A. $(3\bar{i}+\bar{j}+\bar{k}) \pm 5(2\bar{i}+\bar{j}+2\bar{k})$

B. $(3\bar{i}+\bar{j}+\bar{k}) \pm 5(2\bar{i}-\bar{j}+2\bar{k})$

C. $(3\bar{i}+\bar{j}-\bar{k}) \pm 5(2\bar{i}-\bar{j}-2\bar{k})$

D. $(3\bar{i}+\bar{j}-\bar{k}) \pm 15(2\bar{i}-\bar{j}-2\bar{k})$

Answer: B

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58. The point of intersection of the line passing through $\bar{i}-2\bar{j}-\bar{k}, 2\bar{i}+3\bar{j}+\bar{k}$ and the plane passing through $2\bar{i}+\bar{j}-3\bar{k}, 4\bar{i}-\bar{j}+2\bar{k}, 3\bar{i}+\bar{k}$

A. $\frac{5}{3}i+\frac{4}{3}\bar{j}+\frac{1}{3}\bar{k}$

B. $\frac{5}{3}\bar{i}-\frac{4}{3}\bar{j}-\frac{1}{3}\bar{k}$

C. $\frac{5}{3}\bar{i} + \frac{4}{3}\bar{j} - \frac{1}{3}\bar{k}$

D. $\frac{5}{3}\bar{i} - \frac{4}{3}\bar{j} + \frac{1}{3}\bar{k}$

Answer: A

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59. Statement-I : If two vectors are collinear then those vectors are coplanar

Statement-II : For like vectors angle between them is 90°

Which of the above statement is true :

A. only I

B. only II

C. both I and II

D. Neither I nor II

Answer: A

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60. Statement-I : Two non zero, non collinear vectors are linearly independent.

Statement-II : Any three coplanar vectors are linearly dependent.

Which of the above statement is true?

A. Only I

B. only II

C. both I and II

D. Neither I nor II

Answer: C

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61. The descending order of magnitudes of the vectors $A = \dfrac{i - j}{\sqrt{2}}, B = \bar{i} + 2\bar{k}, C = 3\bar{i} + \bar{k}, D = \bar{i} + 3\bar{j} - \bar{k}$ is

A. $D > C > B > A$

B. $A > B > C > D$

C. $D < B < C < A$

D. $D < A < C < B$

Answer: A

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62. If D, E, F are mid points of sides BC, CA, AB of triangle ABC and G is centroid then

List-I		List-II	
A)	$\overline{AD} + \overline{BE} + \overline{CF}$	1)	$\overline{CB}$
B)	$\overline{GA} + \overline{GB}$	2)	$3\overline{OG}$
C)	$\overline{AB} + \overline{CA}$	3)	$\overline{O}$
D)	$\overline{OD} + \overline{OE} + \overline{OF}$	4)	$-\frac{2}{3}(\overline{AD} + \overline{BE})$
		5)	$3\overline{OI}$

The correct matching is

A. $\begin{matrix} A & B & C & D \\ 3 & 4 & 1 & 2 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 4 & 2 & 1 & 3 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 3 & 4 & 5 & 1 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 2 & 3 & 5 & 1 \end{matrix}$

Answer: A

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63. Observe the following statements :

Assertion (A) : Three vectors are coplanar if one of them is expressible as a linear combination of the other two.

Reason (R) : Any three coplanar vectors are linearly dependent.

Then which of the following is true?

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true but R is not the correct explanation of A.

C. A is true, but R is false.

D. A is false, but R is true.

Answer: B

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64. If the vector $\bar{a} = 2\bar{i} + 3\bar{j} + 6\bar{k}$ and $\bar{b}$ are collinear and $|\bar{b}| = 21$ then $\bar{b} =$

A. $\pm(2\bar{i} + 3\bar{j} + 6\bar{k})$

B. $\pm 3(2\bar{i} + 3\bar{j} + 6\bar{k})$

C. $\bar{i} + \bar{j} + \bar{k}$

D. $\pm 21(2\bar{i} + 3\bar{j} + 6\bar{k})$

Answer: B

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65. If three points A, B and C have position vectors (1, x, 3), (3, 4, 7) and (y, -2, -5) respectively and if they are collinear, then (x, y) =

A. (2, -3)

B. (-2, 3)

C. (-2, -3)

D. (2, 3)

Answer: A

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66. If the points whose position vectors are $2\bar{i}+\bar{j}+\bar{k}, 6\bar{i}-\bar{j}+2\bar{k}$ and $14\bar{i}-5\bar{j}+p\bar{k}$ are collinear, then the value of p is

A. 2

B. 4

C. 6

D. 8

Answer: B

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67. Let

$\bar{b} = \bar{i} - 2\bar{j} + 3\bar{k}, \bar{a} = 2\bar{i} + 3\bar{j} - \bar{k}$ and $\bar{c} = \lambda\bar{i} + \bar{j} + (2\lambda - 1)\bar{k}$. If $\bar{c}$

parallel to the plane containing $\bar{a}, \bar{b}$ then $\lambda =$

A. 0

B. 1

C. -1

D. 2

Answer: A

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68. The points whose position vectors are $2\bar{i}+3\bar{j}+4\bar{k}, 3\bar{i}+4\bar{j}+2\bar{k}$ and $4\bar{i}+2\bar{j}+3\bar{k}$ are the vertices of

A. an isosceles triangle

B. right angled triangle

C. equilateral triangle

D. right angled isosceles triangle

Answer: C

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69. If $\bar{i}-2\bar{j}, 3\bar{j}+\bar{k}, \lambda\bar{i}+3\bar{j}$ are coplanar then $\lambda=$

A. -1

B. $\frac{1}{2}$

C. $-\frac{3}{2}$

D. 2

Answer: C

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70. If $3\bar{i} + 3\bar{j} + \sqrt{3}\bar{k}, \ \bar{i} + \bar{k}, \ \sqrt{3}\bar{i} + \sqrt{3}\bar{j} + \lambda\bar{k}$ are coplanar then $\lambda =$

A. 1

B. 2

C. 3

D. 4

Answer: A

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71. If $\bar{a} = \bar{i} + 4\bar{j}, \bar{b} = 2\bar{i} - 3\bar{j} \text{ and } \bar{c} = 5\bar{i} + 9\bar{j} \text{ then } \bar{c} =$

A. $2\bar{a} + \bar{b}$

B. $\bar{a} + 2\bar{b}$

C. $\bar{a} + 3\bar{b}$

D. $3\bar{a} + \bar{b}$

Answer: D

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72. If $\bar{a}, \bar{b} \& \bar{c}$ are non-coplanar vectors and if $\bar{d}$ is such that $\bar{d} = \frac{1}{x}(\bar{a} + \bar{b} + \bar{c})$ and $\bar{d} = \frac{1}{y}(\bar{b} + \bar{c} + \bar{d})$ where x and y are non-zero real numbers, then $\frac{1}{xy}(\bar{a} + \bar{b} + \bar{c} + \bar{d}) =$

A. $3\bar{c}$

B. $-\bar{a}$

C. $\bar{0}$

D. $2\bar{a}$

Answer: C

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73. Three non-zero non-collinear vectors $\bar{a}, \bar{b}, \bar{c}$ are such that $\bar{a} + 3\bar{b}$ is collinear with $\bar{c}$, while $\bar{c}$ is $3\bar{b} + 2\bar{c}$ collinear with $\bar{a}$.Then $\bar{a} + 3\bar{b} + 2\bar{c} =$

A. $\bar{0}$

B. $2\bar{a}$

C. $3\bar{b}$

D. $4\bar{c}$

Answer: A

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74. The vectors $2\bar{i} - 3\bar{j} + \bar{k}, \bar{i} - 2\bar{j} + 3\bar{k}, 3\bar{i} + \bar{j} - 2\bar{k}$

A. are linearly dependent

B. are linearly independent

C. form sides of a triangle

D. are coplanar

Answer: B

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75. For three vectors $\bar{p}, \bar{q}$ and $\bar{r}$ if $\bar{r} = 3\bar{p} + 4\bar{q}$ and $2\bar{r} = \bar{p} - 3\bar{q}$ then

A. $|\bar{r}| < 2|\bar{q}|$ and $\bar{r}, \bar{q}$ have the same direction

B. $|\bar{r}| > 2|\bar{q}|$ and $\bar{r}, \bar{q}$ have the opposite direction

C. $|\bar{r}| < 2|\bar{q}|$ and $\bar{r}, \bar{q}$ have the opposite direction

D. $|\bar{r}| > 2|\bar{q}|$ and $\bar{r}, \bar{q}$ have the same direction

Answer: B

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76. ABCDEF is a regualar hexagon whose centre is O. Then $\overline{AB} + \overline{AC} + \overline{AD} + \overline{AE} + \overline{AF}$ is

A. $2\overline{AO}$

B. $3\overline{AO}$

C. $5\overline{AO}$

D. $6\overline{AO}$

Answer: D

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77. P, Q, R and S are four points with the position vectors $3\bar{i} - 4\bar{j} + 5\bar{k}, 4\bar{k}, -4\bar{i} + 5\bar{j} + \bar{k}$ and $-3\bar{i} + 4\bar{j} + 3\bar{k}$ respectively. Then the line PQ meets the line RS at the point.

A. $3\bar{i} + 4\bar{j} + 3\bar{k}$

B. $-3\bar{i} + 4\bar{j} + 3\bar{k}$

C. $-\bar{i}+4\bar{j}+\bar{k}$

D. $\bar{i}+\bar{j}+\bar{k}$

Answer: B

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Practice Exercises

1. If $\overline{OA}=\bar{i}+2\bar{j}-3\bar{k}, \overline{OB}=3\bar{i}-2\bar{j}+5\bar{k}$ and $2\overline{AC}=3\overline{AB}$ then $\overline{AC}=$

A. $4\bar{i}-4\bar{j}+9\bar{k}$

B. $4\bar{i}+4\bar{j}-9\bar{k}$

C. $4\bar{i}+4\bar{j}+9\bar{k}$

D. $4\bar{i}-4\bar{j}-9\bar{k}$

Answer: A

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2. If the position vectors of A, B are $2\bar{i}-9\bar{j}-4\bar{k}, 6\bar{i}-3\bar{j}+8\bar{k}$ then the unit vector in the direction of $\overrightarrow{AB}$ is

A. $\frac{2\bar{i}+\bar{j}+2\bar{k}}{3}$

B. $\frac{-\bar{i}-2\bar{j}+2\bar{k}}{3}$

C. $\frac{2\bar{i}+3\bar{j}+6\bar{k}}{7}$

D. $\frac{-\bar{i}+2\bar{j}+6\bar{k}}{7}$

Answer: C

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3. If $(\bar{a}, \bar{i}) = (\bar{a}, \bar{j}) = \frac{\pi}{4}$ then $(\bar{a}, \bar{k}) =$

A. $\frac{\pi}{6}$

B. $\frac{\pi}{4}$

C. $\frac{\pi}{3}$

D. $\frac{\pi}{2}$

Answer: D

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4. Unit vector making angles $\frac{\pi}{3}, \frac{\pi}{3}, \frac{3\pi}{4}$ with $\bar{i}, \bar{j}, \bar{k}$ is

A. $\frac{1}{2}\bar{i} + \frac{1}{2}\bar{j} - \frac{1}{2}\bar{k}$

B. $\frac{1}{2}\bar{i} + \frac{1}{2}\bar{j} - \frac{1}{\sqrt{2}}\bar{k}$

C. $\frac{1}{2}\bar{i} - \frac{1}{2}\bar{j} - \frac{1}{\sqrt{2}}\bar{k}$

D. $\bar{i} - \bar{j} + \bar{k}$

Answer: A

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5. If $\bar{a} = \bar{i} + \bar{j} + \bar{k}, \bar{b} = 2\bar{i} + 3\bar{j}, \bar{c} = 3\bar{i} + 5\bar{j} - 2\bar{k}$ and $\bar{d} = \bar{k} - \bar{j}$, then the ratio of moduli of $\bar{b} - \bar{a}$ and $\bar{d} - \bar{c}$ is

A. $2:3$

B. $1:3$

C. $3:1$

D. $4:1$

Answer: B

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6. If $\overline{\alpha} = 2\bar{i} + 3\bar{j}, \bar{\beta} = 4\bar{i} + \bar{j}, \bar{\gamma} = 5\bar{i} + d\bar{j}$ are three vectors having their initial point at origin. If their extremities are collinear, then d =

A. 0

B. 1

C. 2

D. 3

Answer: A

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7. $\bar{a}, \bar{b}, \bar{c}$ are three vectors of which every pair is non-collinear. If the vectors $\bar{a}+\bar{b}, \bar{b}+\bar{c}$ are collinear with $\bar{c}, \bar{a}$ respectively, then $\bar{a}+\bar{b}+\bar{c}=$

A. $\bar{a}$

B. $\bar{b}$

C. $\bar{c}$

D. $\bar{0}$

Answer: D

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8. Let a, b, g be the distinct real numbers. The points with position vectors $a\bar{i} + b\bar{j} + g\bar{k}, b\bar{i} + g\bar{j} + a\bar{k}, g\bar{i} + a\bar{j} + b\bar{k}$ are

A. Collinear

B. form an isosceles triangle

C. fom a right angled triangle

D. form an equilateral triangle

Answer: D

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9. If the position vectors of the four points A, B, C, D are $2\bar{a}, \bar{b}, 6\bar{b} \text{ and } 2\bar{a} + 5\bar{b}$ then ABCD is

A. square

B. rectangle

C. rhombus

D. parallelogram

Answer: D

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10. If the position vectors of three consecutive vertices of a parallelogram are $\bar{i} + \bar{j} + \bar{k}, 3\bar{j} + 5\bar{k}$ and $7\bar{i} + 9\bar{j} + 11\bar{k}$, then fourth vertex is

A. $8\bar{i} + 7\bar{j} + 7\bar{k}$

B. $8\bar{i} - 7\bar{j} - 7\bar{k}$

C. $7\bar{i} - 7\bar{j} - 7\bar{k}$

D. $7\bar{i} - 7\bar{j} + 8\bar{k}$

Answer: A

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11. A set of vectors $\bar{a}_1, \bar{a}_2, \ldots\ldots\ldots, \bar{a}_n$ is said to linearly independent if every relation of the form $l_1\bar{a}_1 + l_2\bar{a}_2 + \ldots\ldots\ldots + l_n\bar{a}_n = \bar{0}$ implies

A. $l_1 = l_2 = \ldots\ldots\ldots\ldots\ldots = l_n = 1$

B. $l_1 = l_2 = \ldots\ldots\ldots\ldots\ldots = l_n = 0$

C. $l_1 = l_2 = \ldots\ldots\ldots\ldots = l_n$

D. $l_1 + l_2 + \ldots\ldots\ldots\ldots\ldots + l_n = 0$

Answer: B

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12. If $4\bar{i} + 7\bar{j} + 8\bar{k}, 2\bar{i} + 3\bar{j} + 4\bar{k}, 2\bar{i} + 5\bar{j} + 7\bar{k}$ are the P.V.'s of the vertices A, B, C of a ΔABC. The P.V. of the point where the bisector of $\angle A$ meets BC is

A. $\frac{2}{3}\left(-6\bar{i} - 8\bar{j} - 6\bar{k}\right)$

B. $\frac{2}{3}\left(6\bar{i} + 8\bar{j} + 6\bar{k}\right)$

C. $\frac{1}{3}(6\bar{i} + 13\bar{j} + 18\bar{k})$

D. $4\bar{i} + 7\bar{j} + 8\bar{k}$

Answer: C

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13. If A=(1, 1, 1), B=(1, 2, 3), C=(2, -1, 1) be the vertices of a ΔABC, then the length of the internal bisector of the angle 'A' is

A. $\frac{1}{2}$

B. $\sqrt{\frac{3}{2}}$

C. $\frac{1}{4}$

D. 2

Answer: B

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14. If A is the point $\bar{a} + 2\bar{b}$, P is the point $\bar{a}$ and P devides AB in 2 : 3 then the P.V. of B is

A. $\bar{a} + 3\bar{b}$

B. $\bar{a} - 2\bar{b}$

C. $\bar{a} - 3\bar{b}$

D. $3\bar{a} - \bar{b}$

Answer: C

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15. The ratio in which $3\bar{i} + 4\bar{j} + 7\bar{k}$ divides the join of $\bar{i} + 2\bar{j} + 3\bar{k}$ and $-3\bar{i} - 2\bar{j} - 5\bar{k}$ is

A. $-1:3$

B. $1:2$

C. $1:3$

D. $3:1$

Answer: A

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16. In a ΔOAB, E is the mid point of OB and D is a point in AB such that AD : DB = 2 : 1. If OD and AE intersect at P, then OP : PD =

A. $3:2$

B. $2:3$

C. $1:4$

D. $4:1$

Answer: A

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17. If $2\bar{i}+3\bar{j}+5\bar{k}, 2\bar{i}+4\bar{j}+5\bar{k}$ and $2\bar{i}+4\bar{j}+7\bar{k}$ are the vertices of ΔABC, then its circum-centre is

A. $2\bar{i}+7\bar{j}+6\bar{k}$

B. $2\bar{i}+\frac{7}{2}\bar{j}+6\bar{k}$

C. $2\bar{i}+\bar{j}+\frac{3}{2}\bar{k}$

D. $2\bar{i}+\frac{1}{2}\bar{j}+\bar{k}$

Answer: B

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18. The P.V.'s of A, B, C are $\bar{i}+\bar{j}+\bar{k}, 4\bar{i}+\bar{j}+\bar{k}, 4\bar{i}+5\bar{j}+\bar{k}$, then the P.V. of the incentre of ΔABC is

A. $3\bar{i}+2\bar{j}+\bar{k}$

B. $3\bar{i}-2\bar{j}+\bar{k}$

C. $\bar{i}-2\bar{j}+\bar{k}$

D. $3\overline{i} - 2\overline{j} - \overline{k}$

Answer: A

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19. In a ΔABC, P.V.'s of A, mid-point of BC are $\overline{i} + 2\overline{j} + 3\overline{k}, \frac{5}{2}\overline{i} - \frac{5}{2}\overline{j}$. P.V. of centroid is

A. $\overline{i} - 2\overline{j} - \overline{k}$

B. $2\overline{i} + \overline{j} + \overline{k}$

C. $\overline{i} - 2\overline{j} + \overline{k}$

D. $2\overline{i} - \overline{j} + \overline{k}$

Answer: D

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20. If G is the centroid of ΔABC then $\overline{GA}+\overline{GB}+\overline{GC}=$

A. $\bar{0}$

B. $\overline{OG}$

C. $2\overline{OG}$

D. $3\overline{OG}$

Answer: A

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21. If G is the centroid of Δ ABC, G' is the centroid of Δ A' B' C' then $\overrightarrow{A}A' + \overrightarrow{B}B' + \overrightarrow{C}C' =$

A. $\bar{0}$

B. $\overline{GG^1}$

C. $2\overline{GG^1}$

D. $3\overline{GG^1}$

Answer: D

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22. If D, E are the midpoints of AB, AC of Δ ABC, then $\vec{B}E + \vec{D}C =$

A. $\overline{BC}$

B. $\frac{1}{2}\overline{BC}$

C. $2\overline{BC}$

D. $\frac{3}{2}\overline{BC}$

Answer: D

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23. If D is the midpoint of the side BC of a triangle ABC then $\overline{AB}^2 + \overline{AC}^2 =$

A. $\overline{AD}^2 + \overline{BD}^2$

B. $2\left(\overline{AD}^2 + \overline{BD}^2\right)$

C. $3\left(\overline{AD}^2 + \overline{BD}^2\right)$

D. $4\left(\overline{AD}^2 + \overline{BD}^2\right)$

Answer: B

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24. Find the area of the parallelogram whose adjacent sides are $\bar{a} = 2\bar{j} - \bar{k}, \bar{b} = -\bar{i} + \bar{k}$.

A. $\dfrac{\bar{i} + \bar{k}}{\sqrt{2}}, \dfrac{\bar{i} - \bar{j}}{\sqrt{2}}$

B. $\dfrac{\bar{i} - \bar{k}}{\sqrt{2}}, \bar{j}$

C. $\dfrac{\bar{i} + \bar{k}}{\sqrt{2}}$

D. $\dfrac{\bar{i} - \bar{k}}{\sqrt{2}}, \bar{k}$

Answer: C

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25. If the diagonals of a parallelogram are $\bar{i}+5\bar{j}-2\bar{k}$ and $-2\bar{i}+\bar{j}+3\bar{k}$ then the lengths of its sides are

A. $\sqrt{8}, \sqrt{10}$

B. $\sqrt{6}, \sqrt{14}$

C. $\sqrt{5}, \sqrt{12}$

D. $\sqrt{3}, \sqrt{12}$

Answer: B

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26. Let $\bar{a}, \bar{b}, \bar{c}, \bar{d}$ be the position vectors of A, B, C and D respectively which are the vertices of a tetrahedron. Then prove that the lines joining the vertices to the centroids of the opposite faces are concurrent. (This point is called the centroid of the tetrahedron)

A. $\bar{a} + \bar{b} = \bar{c} + \bar{d}$

B. $\bar{a} + \bar{b} = \bar{c} + \bar{d} = \bar{0}$

C. $\bar{a} + \bar{c} = \bar{b} + \bar{d}$

D. $\bar{a} + \bar{c} = \bar{b} + \bar{d} = \bar{0}$

Answer: C

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27. If $\bar{a}, \bar{b}$ represent $\overline{AB}, \overline{BC}$ respectively of a regular hexagon ABCDEF then $\overline{CD}, \overline{DE}, \overline{EF}, \overline{FA}$

A. $\bar{b} - \bar{a}, \ - \bar{a}, \ - \bar{b}, \bar{a} - \bar{b}$

B. $\bar{a} - \bar{b}, \bar{a}, \bar{b}, \bar{b} - \bar{a}$

C. $\bar{b} - \bar{a}, \bar{a}, \bar{b}, \bar{a} - \bar{b}$

D. $\bar{a} - \bar{b}, \ - \bar{a}, \ - \bar{b}, \bar{b} - \bar{a}$

Answer: A

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28. When a right handed rectangular cartesian system oxyz is rotated about the z-axis through an angle $\frac{\pi}{4}$ in the counter clockwise direction. It is found that a vector $\bar{a}$ has the components $2\sqrt{2}, 3\sqrt{2}, 4$. The components of $\bar{a}$ in the oxyz coordinate system are

A. 1, -5, 4

B. $-1, 5, 4$

C. $1, 5, \ -4$

D. $-1, \ -5, 4$

Answer: B

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29. The P.V.'s of A, B are $\bar{a}, \bar{b}$ respectively. The P.V. of 'C' is $\frac{\bar{a}}{2}+\frac{\bar{b}}{3}$ then 'C' lies

A. outside ΔOAB but inside $\angle OAB$

B. outside ΔOAB but inside $\angle AOB$

C. outside ΔOAB but inside $\angle OBA$

D. inside ΔOAB

Answer: D

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30. The P.V.'s of A, B are $\bar{a}, \bar{b}$ respectively. The P.V. of 'C' is $-3\bar{a}+5\bar{b}$ then 'C' lies

A. outside ΔOAB but inside $\angle OAB$

B. outside ΔOAB but inside $\angle AOB$

C. outside ΔOAB but inside $\angle OBA$

D. out side the ΔOAB

Answer: D

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31. The vector equation to the line through the point (2, 3, 1) and parallel to the vector (4, -2, 3)

A. $\bar{r} = (4\bar{i} - 2\bar{j} + 3\bar{k}) + t(2\bar{i} + 3\bar{j} + \bar{k})$

B. $\bar{r} = (2\bar{i} + 3\bar{j} + \bar{k}) + t(2\bar{i} - 5\bar{j} + 2\bar{k})$

C. $\bar{r} = (2\bar{i} + 3\bar{j} + \bar{k}) + t(4\bar{i} - 2\bar{j} + 3\bar{k})$

D. $\bar{r} = (4\bar{i} - 2\bar{j} + 3\bar{k}) + t(6\bar{i} + \bar{j} + 4\bar{k})$

Answer: C

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32. Find the vector equation of the line passing through the points $2\bar{i} + \bar{j} + 3\bar{k}, \ -\bar{i} + 3\bar{j} - \bar{k}.$

A. $\bar{r} = (3\bar{i} + 2\bar{j} - 4\bar{k}) + t(2\bar{i} + 2\bar{j} - 2\bar{k})$

B. $\bar{r} = (3\bar{i} + 2\bar{j} - 4\bar{k}) + t(2\bar{i} - 2\bar{j} + 2\bar{k})$

C. $\bar{r} = (3\bar{i} + 2\bar{j} - 4\bar{k}) + t(-2\bar{i} + 2\bar{j} - 2\bar{k})$

D. $\bar{r} = (5\bar{i} + 4\bar{j} - 6\bar{k}) + t(3\bar{i} + 2\bar{j} - 4\bar{k})$

Answer: A

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33. Cartesian equation of the line passing through the points $\bar{a} = 2\bar{i} + \bar{j} - 2\bar{k}$ and $\bar{b} = 2\bar{i} + 2\bar{j} - \bar{k}$ is

A. $x - 2 = \dfrac{y-1}{1} = \dfrac{z+2}{1}$

B. $x + 2 = y + 1 = z + 2$

C. $y - 1 = z + 2, x - 2 = 0$

D. $\dfrac{y-1}{2} = \dfrac{z-2}{1}, x - 2 = 0$

Answer: C

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34. The cartesian equation of the line passing through the points $\bar{a} = (1, -1, 1)$ and parallel to the vector $\bar{b} = (2, 1, 3)$ is

A. $\dfrac{x-1}{2} = \dfrac{y+1}{1} = \dfrac{z-1}{3}$

B. $\dfrac{x+1}{2} = \dfrac{y-1}{1} = \dfrac{z+1}{3}$

C. $\dfrac{x-1}{2} = \dfrac{y-1}{1} = \dfrac{z+1}{3}$

D. $\dfrac{x+1}{2} = \dfrac{y+1}{1} = \dfrac{z+1}{3}$

Answer: A

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35. Find the vector equation of the line passing through the points $\bar{i} + \bar{j} + \bar{k}$ and $\bar{i} - \bar{j} + \bar{k}$.

A. $\alpha + \beta + \gamma = 0$

B. $\alpha + \beta + \gamma = 1$

C. $\alpha + \beta = \gamma$

D. $\alpha^2 + \beta^2 + \beta^2 = 1$

Answer: B

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36. The vector equation of the plane passing through the point $2\bar{i} + 2\bar{j} - 3\bar{k}$ and parallel to the vectors $3\bar{i} + 3\bar{j} - 5\bar{k}$, $\bar{i} + 2\bar{j} + \bar{k}$ is

A. $\bar{r} = t(2\bar{i} + \bar{j} - \bar{k}) + s(\bar{i} + 2\bar{j} + 2\bar{k})$

B. $\bar{r} = (2\bar{i} + 2\bar{j} - 3\bar{k}) + t(3\bar{i} + 3\bar{j} - 5\bar{k}) + s(\bar{i} + 2\bar{j} + \bar{k})$

C. $\bar{r} = (\bar{i} + 2\bar{j} + 3\bar{k}) + t(-2\bar{i} + 3\bar{j} + \bar{k}) + s(2\bar{i} - 3\bar{j} + 4\bar{k})$

D. $\bar{r} = s\bar{i} + t(-2\bar{i} + 3\bar{j} + \bar{k}) + p(\bar{i} + \bar{j})$

Answer: B

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37. The vector equation of the plane passing through the origin and the point $4\bar{j}$ and $2\bar{j}+\bar{k}$ is

A. $\bar{r}=s(4\bar{j})+t(2\bar{j}+\bar{k})$

B. $\bar{r}=s(-2\bar{j}-\bar{k})+t(4\bar{j})$

C. $\bar{r}=s(4\bar{i})+t(2\bar{j}+\bar{k})$

D. $\bar{r}=s(2\bar{j})+t(\bar{t}+\bar{k})$

Answer: A

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38. If $2\bar{i}-\bar{j}+\bar{k},\ \bar{i}-3\bar{j}-5\bar{k},\ 3\bar{i}-4\bar{j}-4\bar{k}$ are the vertices of a triangle then the vector equation of the median passing through $2\bar{i}-\bar{j}+\bar{k}$ is

A. $\bar{r}=(2\bar{i}-\bar{j}+\bar{k})+t\left(2\bar{i}-\frac{7}{2}\bar{j}-\frac{9}{2}\bar{k}\right)$

B. $\bar{r}=(2\bar{i}-\bar{j}+\bar{k})+t(5\bar{j}+11\bar{k})$

C. $\bar{r}=(\bar{i}-3\bar{j}-5\bar{k})+t\left(2\bar{i}-\frac{9}{2}\bar{k}\right)$

D. $\bar{r} = (2\bar{i} - \bar{j} + \bar{k}) + t(5\bar{i} + 11\bar{k})$

Answer: B

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39. The vector equation of the line passing through the point $2\bar{i} + \bar{j} - 3\bar{k}$ and parallel to $\bar{i} + 2\bar{j} + \bar{k}$ is

A. $\bar{r} = 2\bar{i} + \bar{j} + \bar{k} + t(-\bar{i} + 5\bar{j} - 6\bar{k})$

B. $\bar{r} = 2\bar{i} - \bar{j} + \bar{k} + t(\bar{i} + 5\bar{j} - 6\bar{k})$

C. $\bar{r} = 2\bar{i} + \bar{j} - \bar{k} + t(-\bar{i} + 5\bar{j} + 6\bar{k})$

D. $\bar{r} = 2\bar{i} + \bar{j} - \bar{k} + t(\bar{i} - 5\bar{j} + 6\bar{k})$

Answer: A

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40. If $A(\bar{i}+2\bar{j}+3\bar{k}), B(-\bar{i}-\bar{j}+8\bar{k}), C(-4\bar{i}+4\bar{j}+6\bar{k})$ are the vertices of a triangle then the equation of the line passing through the circumcentre and parallel to $\overline{AB}$ is

A. $\bar{r}=\left(-\frac{4}{3}\bar{i}+\frac{5}{3}\bar{j}+\frac{17}{3}\bar{k}\right)+t(2\bar{i}+3\bar{j}-5\bar{k})$

B. $\bar{r}=(2\bar{i}+3\bar{j}+5\bar{k})+t(2\bar{i}-3\bar{j}-5\bar{k})$

C. $\bar{r}=\left(\frac{4}{3}\bar{i}-\frac{5}{3}\bar{j}-\frac{17}{3}\bar{k}\right)+t(2\bar{i}-3\bar{j}+5\bar{k})$

D. $\bar{r}=\left(-\frac{4}{3}\bar{i}-\frac{5}{3}\bar{j}-\frac{17}{3}\bar{k}\right)+t(2\bar{i}+3\bar{j}+5\bar{k})$

Answer: A

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41. A point on the line

$\bar{r}=(1-t)(2\bar{i}+3\bar{j}+4\bar{k})+t(3\bar{i}-2\bar{j}+2\bar{k})$ is

A. $-\bar{i}+5\bar{j}+2\bar{k}$

B. $\bar{i}+6\bar{j}+8\bar{k}$

C. $\bar{i} + 8\bar{j} + 6\bar{k}$

D. $\bar{i} - 8\bar{j} + 6\bar{k}$

Answer: C

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42. The point of intersection of the lines $\bar{r} = \bar{a} + t(\bar{b} + \bar{c}), \bar{r} = \bar{b} + s(\bar{c} + \bar{a})$ is

A. $\bar{c}$

B. $\bar{a}$

C. $\bar{b}$

D. $\bar{a} + \bar{b} + \bar{c}$

Answer: D

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43. The point P on the line passing through $A(3\bar{i}+2\bar{j}-3\bar{k})$ and parallel to the vectors $2\bar{i}-2\bar{j}+\bar{k}$ such that AP = 6 is

A. $7\bar{i}-2\bar{j}-\bar{k}$

B. $5\bar{i}-2\bar{k}$

C. $\bar{i}+4\bar{j}-4\bar{k}$

D. $\bar{i}-4\bar{j}+4\bar{k}$

Answer: A

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44. The point of intersection of the plane $\bar{r}=(\bar{a}-\bar{b})+s(\bar{a}+\bar{b}+\bar{c})+t(\bar{a}-\bar{b}+\bar{c})$ and the line $\bar{r}=(2\bar{a}+3\bar{b})+p\bar{c}$ is

A. $2\bar{a}-3\bar{b}+\bar{c}$

B. $2\bar{a}-3\bar{b}-\bar{c}$

C. $2\bar{a} + 3\bar{b} + \bar{c}$

D. $2\bar{a} + 3\bar{b} - \bar{c}$

Answer: C

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45. If 'O' is circumcente and 'H' is orthocentre of ΔABC, then

List-I	List-II
A) $\overline{OA} + \overline{OB} + \overline{OC}$	1) $\frac{1}{2}\overline{HO}$
B) $\overline{HA} + \overline{HB} + \overline{HC}$	2) $2\overline{HO}$
C) $\overline{AH} + \overline{HB} + \overline{HC}$	3) $2\overline{AO}$
D) $\overline{OG}$	4) $\frac{1}{3}\overline{OH}$
	5) $\overline{OH}$

The correct matching is

A. $\begin{matrix} A & B & C & D \\ 1 & 5 & 3 & 2 \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ 5 & 2 & 4 & 3 \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ 5 & 2 & 3 & 4 \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ 2 & 4 & 3 & 5 \end{matrix}$

Answer: C

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46. The vector $\bar{i} + x\bar{j} + 3\bar{k}$ is rotated through angle θ and doubled in magnitude, then it ecomes $4(i) + (4x - 2)\bar{j} + 2\bar{k}$. The value of x is

A. $2, \ -2/3$

B. $1/3, 2$

C. $2/3, 0$

D. $2, 7$

Answer: A

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47. $\bar{a}, \bar{b}, \bar{c}$ are three vectors of which every pair is non-collinear. If the vectors $\bar{a} + 2\bar{b}$ and $\bar{b} + 3\bar{c}$ are collinear with $\bar{c}$ and $\bar{a}$ respectively, then

$\bar{a} + 2\bar{b} + 6\bar{c} =$

A. $\bar{a}$

B. $\bar{b}$

C. $\bar{c}$

D. $\bar{0}$

Answer: D

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48. Consider the points A, B, C and D with P.V.'s $7\bar{i} - 4\bar{j} + 7\bar{k}, \ \bar{i} - 6\bar{j} + 10\bar{k}, \ -\bar{i} - 3\bar{j} + 4\bar{k}$ and $5\bar{i} - \bar{j} + \bar{k}$ respectively. Then ABCD is a

A. parallelogram but not a Rhombus

B. square

C. Rhombus

D. Rectangle

Answer: C

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49. i) If $\bar{a}, \bar{b}, \bar{c}$ are non coplanar vectors, then prove that the vectors $5\bar{a} - 6\bar{b} + 7\bar{c}, 7\bar{a} - 8\bar{b} + 9\bar{c}$ and $\bar{a} - 3\bar{b} + 5\bar{c}$ are coplanar.

A. All values of λ

B. No value of λ

C. All except two values of λ

D. All except three values of λ

Answer: C

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50. If $\bar{a} = i + j + k, \bar{b} = i - j + 2k$ and $\bar{c} = xi + (x - 2)j - k$. If the vector $\bar{c}$ lies in the plane of $\bar{a}$ and $\bar{b}$ then x equals to

A. 0

B. 1

C. -4

D. -2

Answer: D

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51. If G is the centroid of ΔABC then $\overline{GA} + \overline{GB} + \overline{GC} =$

A. $2\overline{GB}$

B. $2\overline{GA}$

C. $\overline{O}$

D. $2\overline{BG}$

Answer: D

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52. If C is the mid point of AB and P is any point outside AB, then

A. $\overline{PA}+\overline{PB}+\overline{PC}=\bar{0}$

B. $\overline{PA}+\overline{PB}+2\overline{PC}=\bar{0}$

C. $\overline{PA}+\overline{PB}=\overline{PC}$

D. $\overline{PA}+\overline{PB}=2\overline{PC}$

Answer: D

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53. If $\bar{i}+2\bar{j}+3\bar{k}, 3\bar{i}+2\bar{j}+\bar{k}$ are sides of a parallelogram then a unit vector parallel to one of the diagonals of the parallelogram is

A. $\dfrac{\bar{i}+\bar{j}+\bar{k}}{\sqrt{3}}$

B. $\dfrac{\bar{i}-\bar{j}+\bar{k}}{\sqrt{3}}$

C. $\dfrac{\bar{i}+\bar{j}-\bar{k}}{\sqrt{3}}$

D. $\dfrac{-\bar{i}+\bar{j}+\bar{k}}{\sqrt{3}}$

Answer: A

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54. Let ABC be a triangle whose circumcentre is at P. If the position vectors of A, B, C and P are $\bar{a}, \bar{b}, \bar{c}$ and $\dfrac{\bar{a}+\bar{b}+\bar{c}}{4}$ respectively, then the position vector of the orthocentre of this triangle is

A. $-\left(\dfrac{\bar{a}+\bar{b}+\bar{c}}{2}\right)$

B. $\bar{a}+\bar{b}+\bar{c}$

C. $\dfrac{\bar{a}+\bar{b}+\bar{c}}{2}$

D. $\bar{0}$

Answer: D

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55. Let a, b and c be distinct non-negative numbers. If the vectors $a\bar{i} + a\bar{j} + c\bar{k}, \bar{i} + \bar{k}$ and $c\bar{i} + c\bar{j} + b\bar{k}$ lie in a plane, then c is

A. G.M. of a and b

B. A.M. of a and b

C. Equal to zero

D. H.M. of a and b

Answer: A

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