MATHS

BOOKS - TELUGU ACADEMY MATHS (TELUGU ENGLISH)

ADDITION OF VECTORS

1 D Vsaq

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

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3. Find a vector in the direction of vector $\bar{a} = \bar{i} - 2\bar{j}$ has magnitude 7 units.

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

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5. Find the angles made by the straight line passing through the points $(1, -3, 2)$ and $(3, -5, 1)$ with the corrdinate axes.

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6. Consider two points P ans Q with position vectors $\overline{OQ} = \bar{3}(a) + \bar{2}(b)$ and $\overline{OQ} = \bar{a} + \bar{b}$. Find the position the line joining P and Q in the ratio 2 : 1

internally

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7. Consider two points P and Q with position vectors $\overline{OP} = 3\bar{a} - 2\bar{b}$ and $\overline{OQ} = \bar{a} + \bar{b}$. Find the position vector of a point R which divides the line joining P and Q in the ratio 2:1

externally.

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8. Show that the points $A\left(2\bar{i} - \bar{j} + \bar{k}\right), B\left(\bar{i} - 3\bar{j} - 5\bar{k}\right), C\left(3\bar{i} - 4\bar{j} - 4\bar{k}\right)$ are the vertices of a right angled triangle.

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9. 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 $m + n$

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10. 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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11. 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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12. 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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13. 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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14. 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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15. If $\bar{a}, \bar{b}, \bar{c}$ are P.V's 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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16. OABC is a parallelogram. If $\overline{OA} = \bar{a}, \overline{OC} = \bar{c}$, find the vector equation of the side BC.

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17. 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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2 D Saq

1. If $\bar{i}, \bar{j}, \bar{k}$ are unit vectors along the positive directions of the coordinate axes, then shown that the four points $4\bar{i}+5\bar{j}+\bar{k}, \ -\bar{j}-\bar{k}, 3\bar{i}+9\bar{j}+4\bar{k}$ and $-4\bar{i}+4\bar{j}+4\bar{k}$ are coplanar

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2. 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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3. 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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4. Test for the collinearity of the points with position vectors $2\bar{a} + 5\bar{b} - 4\bar{c}, \bar{a} + 4\bar{b} - 3\bar{c}, 4\bar{a} + 7\bar{b} - 6\bar{c}$ are collinear , where $\bar{a}, \bar{b}, \bar{c}$ are non-coplanar vectors .

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5. 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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6. 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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7. In ΔABC, if $\bar{a},\bar{b},\bar{c}$ are position vectors of the vertices A, B, and C respectively, then prove that the position vector of the centroid G is $\frac{1}{3}(\bar{a}+\bar{b}+\bar{c})$

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8. 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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9. 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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10. 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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11. 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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12. 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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13. 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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3 D Miscellaneous

1. 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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2. 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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3. 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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4. 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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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. 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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7. 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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8. ABCD is a parallelogram . If L arid M and the middle points of BC and CD respec tively, then find

AL and AM interms of AB and AD

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9. ABCD is a parallelogram . If L arid M and the middle points of BC and CD respec tively, then find

λ, if AM = $\lambda AD - LM$

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10. In ΔOAB, E is the mid point of AB and F is a point on OA such that OF=2FA. If C is the point of intersection of OE and BF, then find the ratios OC : CE and BC : CF are

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11. In a quadrilateral ABCD , if the midpoints of one pair of opposite sides and the point of intersection of the diagonals are collinear , using vector methods , prove that the quadrilateral ABCD is a trapezium .

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12. 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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13. If $\bar{a}+\bar{b}+\bar{c}=\overline{ab}, \bar{b}+\bar{c}+\bar{d}=\beta\bar{a}$ 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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14. Show that the points (5,-1,1),(7,-4,7),(1,-6,10) and (-1,-3,4) are the vertices of a rhombus.

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Spq

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

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

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3. 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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4. 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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5. 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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6. Find the vector equation of plane passing through Points (0,0,0) , (0,5,0) and (2,0,1)

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7. S.T the points whose P.V are $\bar{a} - 2\bar{b} + 3\bar{c}, 2\bar{a} + 3\bar{b} - 4\bar{c}, -7\bar{b} + 10\bar{c}$ are collinear.

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