

India's Number 1 Education App

MATHS

BOOKS - TELUGU ACADEMY MATHS (TELUGU ENGLISH)

PRODUCT OF VECTORS

1 D Vsaq

1. If
$$ar a=2ar i+ar j-3ar k,$$
 $ar b=3ar j-2ar j-ar k$ then find the angle between .



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- **2.** Find the angle between the vectors $ar{i}+2ar{j}+3ar{k}$ and $3ar{i}-ar{j}+2ar{k}$.
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3. If ar a=ar i+2ar j-3ar k, ar b=3ar i-ar j+2ar k then S.T ar a+ar b, ar a-ar b are perpendicular.



4. If vectors $\lambdaar i-3ar j+5ar k, 2\lambdaar i-\lambdaar j-ar k$ are perpendicular to each other find $\lambda.$



5. If the vectors $2ar i+\lambdaar j-ar k$ and 4ar i-2ar j+2ar k are perpendicular to each other than find $\lambda.$



6. For what values of λ the vectors $ar i-\lambdaar j+2ar k, 8ar i+6ar j-ar k$ are at right angles.

7. If
$$|ar{a}+ar{b}|=|ar{a}-ar{b}|$$
 then find the angle between $ar{a}\,$ and $\,ar{b}.$



8. If
$$ar a=ar i-ar j-ar k,$$
 $ar b=2ar i-3ar j+ar k$ then find the projection vector of $ar b$ on $ar a$ and its magnitude.



9. If
$$ar a=ar i+ar j+ar k,$$
 $ar b=2ar i+3ar j+ar k$ then find the projection vector of $ar b$ on $ar a$ and its magnitude.



10. If $\bar{a}=\bar{i}+\bar{j}+\bar{k},$ $\bar{b}=2\bar{i}+3\bar{j}+\bar{k}$ then find the projection vector of \bar{b} on \bar{a} and its magnitude.



11. Find the Cartesian equation of the plane passing through the point (-2,1,3) and perpendicular to the vector $3\bar i+\bar j+5\bar k$.



12. Find the cartesian equation of the plane through the point $A(2,\,-1,\,-4)$ and parallel to the plane 4x-12y-3z-7=0.



13. Find the angle between the planes 2x-3y-6z=5 and 6x+2y-9z=4

14. Find anle between planes
$$ar r.\left(2ar i-ar j+2ar k
ight)=3, ar r.\left(3ar i+6ar j+ar k
ight)=4$$

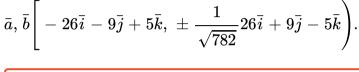
15. If $ar a=2ar i-ar j+ar k,\ ext{ and } ar b=ar i-3ar j-5ar k$ then find ar a imesar bar l.



16. Find a unit vector perpendicular to the plane containing the vector
$$ar a=4ar i+3ar j-ar k,$$
 $ar b=2ar i-6ar j-3ar k$



18. If
$$ar a=2ar i-3ar j+5ar k,$$
 $ar b=-ar i+4ar j+2ar k$ then find $ar a imesar b$ and unit vector perpendicular to both





19. If $4ar{i}+rac{2p}{3}ar{j}+par{k}$ is parallel to the vector $ar{i}+2ar{j}+3ar{k}$, find p.

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20. Let
$$\bar{a}=2\bar{i}-\bar{j}+\bar{k},$$
 $\bar{b}=3\bar{i}+4\bar{j}-\bar{k}$ and if θ is the angle between $\bar{a},$ \bar{b} then find $\sin\theta.$



21. If heta is the angle between the vectors $ar{i}+ar{j},\,ar{j}+ar{k}$ then find $\sin heta.$



22. Find the area of the triangle having $\left(3\bar{i}+4\bar{j}\right),\left(-5\bar{i}+7\bar{j}\right)$ as adjacent sides.



23. If ar a=ar i+2ar j+3ar k, ar b=3ar i+5ar j-ar k are 2 sides of a triangle, find its area.



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



25. Find the area of the parallelgram whose adjacent sides are $ar a=2ar i-3ar i,\,ar b=3ar i-ar k$



26. Find the vector area and area of the parallelogram having $ar a=ar i+2ar j-ar k,\,ar b=2ar i-ar j+2ar k$ as adjacent sides.



27. Find the area of the parallelogram whose diagonals are $3ar i+ar j-2ar k,\ ar i-3ar j+4ar k$



28. Find the volume of the parallelopiped having co-terminus edges $\bar{i}+\bar{j}+\bar{k}, \bar{i}-\bar{j}, \bar{i}+2\bar{j}-\bar{k}.$

29. Find the volume of the parallelopiped having co-tenninus edges are represented by the vectors $2\bar{i}-3\bar{j}+\bar{k},\,\bar{i}-\bar{j}+2\bar{k},\,2\bar{i}+\bar{j}-\bar{k}.$



30. Find the volume of the tetrahedron having the edges

$$,ar{i}+ar{j}+ar{k},\,ar{i}-ar{j},\,ar{i}+2ar{j}+ar{k}.$$



31. Find the volume of the tetrahedron, whose vertices are (1, 2, 1), (3, 2, 5), (2, -1, 0), (-1, 0, 1).

32. Prove that the vectors
$$ar a=2ar i-ar j+ar k,$$
 $ar b=ar i-3ar j-5ar k$ and $ar c=3ar i-4ar j-4ar k$ are coplanar.



33. If the vectors ar a=2ar i-ar j+ar k, ar b=ar i+2ar j-3ar k, ar c=3ar i+par j+5ar k are coplanar then find p.



34. Find t, for which the vectors $2ar i-3ar j+ar k,\,ar i+2ar j-3ar k,\,ar j-tar k$ are coplanar.



1. If $\bar{a}, \bar{b}, \bar{c}$ are non-coplaner, then show that the vectors

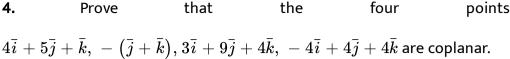
$$ar{a}-ar{b},ar{b}+ar{c},ar{c}+ar{a}$$
 are coplanar

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2. It a,b and c are non-coplanar vectors and the four points with position vectors 2a+3b-c, a-2b+3c, 3a+4b+2c and ka-6b+6c are coplanar, then k=



- **3.** $\bar{a}, \, \bar{b}, \, \bar{c}$ are coplanar vectors . Prove that of the following four points are coplanar. $6\bar{a}+2\bar{b}-\bar{c}, \, 2\bar{a}-\bar{b}+3\bar{c}, \, -\bar{a}+2\bar{b}-4\bar{c}, \, -12\bar{a}-\bar{b}-3\bar{c}.$
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- **5.** Find the area of the triangle formed with the points A(1,2,3), B(2,3,1), C(3,1,2).
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- **6.** Find the unit vector perpendicular to the plane passing through the points (1,2,3),(2,-1,1) and (1,2,-4).
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7. Find the vector having magnitude $\sqrt{6}$ units and perpendicular to both $2ar{i}-ar{k}, 3ar{j}-ar{i}-ar{k}.$

8. Find a vector of magnitude 3 and perpendicular to both the vectors
$$\bar{b}-2\bar{i}-2\bar{j}+\bar{k}, \bar{c}=2\bar{i}+2\bar{j}+3\bar{k}.$$



$$(ar{a} imes b).\ ig(b imes a)$$

 $ig(ar{a} imesar{b}ig)$. $ig(ar{b} imesar{c}ig)$

11. If ar a=2ar i+ar j-ar k, ar b=-ar i+2ar j-4ar k, ar c=ar i+ar j+ar k then find

9. If ar a+ar b+ar c=ar 0 then prove that ar a imesar b=ar b imesar c=ar c imesar a.

10. For any vector $ar{a}$, show that $ig|ar{a} imesar{j}ig|^2+ig|ar{a} imesar{k}ig|^2=2|ar{a}|^2.$

1 D Laq

1. P.T the smaller angle heta between any two diagonals of a cube is given by



 $\cos \theta = 1/3$

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2. If $ar{a}, \, ar{b}, \, ar{c}$ are any three vectors then $ig(ar{a} imes ar{b}ig) imes ar{c}$ is a vector



3. If ar a=ar i-2ar j-3ar k, ar b=2ar i+ar j-ar k, ar c=ar i+3ar j-2ar k then verify that

$$ar{a} imesig(ar{b} imesar{c}ig)=(ar{a}.\,ar{c})ar{b}-ig(ar{a}.\,ar{b}ig)ar{c}.$$



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If $ar{a}=ar{i}-2ar{j}+ar{k},$ $ar{b}=2ar{i}+ar{j}+ar{k},$ $ar{c}=ar{i}+2ar{j}-ar{k},$ then

 $ar{a} imes (ar{b} imesar{c})$ and $|(ar{a} imesar{b}) imesar{c}|.$

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, then compute $|(ar{a} imes ar{b}) imes (ar{c} imes ar{d})|$.

 $\bar{a} \times (\bar{b} \times \bar{c}).$

7.

 $ar{a}=ar{i}-2ar{j}+3ar{k}, ar{b}=2ar{i}+ar{j}+ar{k}, ar{c}=ar{i}+ar{j}+2ar{k} \ ext{ then find } \left(ar{a} imesar{b}
ight) imesar{c}|$

lf

If

4.

6. If
$$ar a=ar i-2ar j-3ar k,$$
 $ar b=2ar i+ar j-ar k,$ $ar c=ar i+3ar j-2ar k,$ find

 $ar{a} = 2ar{i} + ar{j} - 3ar{k}, \, ar{b} = ar{i} - 2ar{j} + ar{k}, \, ar{c} = \, -\, ar{i} + ar{j} - 4ar{k} \; \; ext{and} \; \; ar{d} = ar{i} + ar{j} + ar{k}$

8. If
$$ar{a}=2ar{i}+3ar{j}+4ar{k},$$
 $ar{b}=ar{i}+ar{j}-ar{k},$ $ar{c}=ar{i}-ar{j}+ar{k}$, compute $ar{a}xig(ar{b}xar{c}ig)$ and verify that it is perpendicular to $ar{a}$.



9. If
$$ar a=ar i-2ar j-3ar k,$$
 $ar b=2ar i+ar j-ar k,$ $ar c=ar i+3ar j-2ar k$ then verify that

 $ar{a} imesig(ar{b} imesar{c}ig)=(ar{a}.\,ar{c})ar{b}-(ar{a}.\,ar{b})ar{c}.$

10. Find the shortest distance between the skew lines .

 $ar r = ig(6ar i + 2ar j + 2ar kig) + tig(ar i - 2ar j + 2ar kig) \,\, ext{and}\,\,ar r = ig(-4ar i - ar kig) + sig(3ar i - 2ar j - 2ar j - 2ar kig)$



11. If $A=(1,\ -2,\ -1), B=(4,0,\ -3), C=(1,2,\ -1), D=(2,\ -4,\ -5)$





12. By vector method prove that altitudes of a triangle are concurrent.



13. The perpendicular bisectors of the sides of a triangle are concurrent.



1. $\overrightarrow{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\overrightarrow{b} = \hat{i} - 3\hat{j} - 5\hat{k}$. Find the vector \overrightarrow{c} such that \overrightarrow{a} , \overrightarrow{b} and \overrightarrow{c} form the sides of a triangle.



- **2.** if ar a+ar b+ar c=ar 0, |ar a|=3, |ar b|=5, |ar c|=7 then find angle between ar a, ar b.
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- **3.** If ar a imesar b=ar b imesar c
 eq 0, then show that ar a+ar c=ar par b, where p is some scalar.
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4. If \bar{a}, \bar{b} and $\bar{a} - \bar{b}$ are unit vectors, then what is the angle between \bar{a} and \bar{b} ?

5. If ar a, ar b are non-zero vectors such that $ig|ar a+ar big|^2=|ar a|^2+ig|ar big|^2$, then find the angle between ar a, ar b.



6. If $4ar{i}+rac{2p}{3}ar{j}+par{k}$ is parallel to the vector $ar{i}+2ar{j}+3ar{k}$, find p.



7. If $|\bar{a}|=2,$ $|\bar{b}|=3,$ $|\bar{c}|=4$ and each of $\bar{a},$ $\bar{b},$ \bar{c} is perpendicular to the sum of the other two vectors, then find the magnitude of $\bar{a}+\bar{b}+\bar{c}$.



8. $\bar{a}, \bar{b}, \bar{c}$ are pair wise 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 vector $\bar{a} + \bar{b} + \bar{c}$.



9. Find unit vector parallel to the XOY-plane and perpendicular to the vector $4ar{i}-3ar{j}+ar{k}.$



10. Find the equation of the plane through the point $(3,\,-2,\,2)$ and perpendicular to the vector $(4,\,7,\,-4)$.



11. For any two vectors ar a, ar b prove that $ig|ar a imes ar big|^2 = ig|ar aig|^2 ig|ar big|^2 - ig(ar a, ar big)^2.$



12. For any three vectors ar a, ar b, ar c prove that igl[ar b+ar car c+ar aar a+ar bigr]=2igl[ar aar bar cigr].



13. If $\left(ar{b} imesar{c}
ight) imes\left(ar{b} imesar{a}
ight)=3ar{c}$, then find $\left[ar{b} imesar{c}ar{c} imesar{a}ar{a} imesar{b}
ight]$.



14. If $ar{a}, \, ar{b}, \, ar{c}$ are mutually perpendicular unit vectors, then find $\left[ar{a}ar{b}ar{c}
ight]^2$.



15. Show that ig(ar a+ar big). ig[ig(ar b+ar cig) imesig(ar c+ar a)ig]=2ig[ar aar bar cig].



16. Show that

- i) $ar{a} imes \left(ar{a} imes \left(ar{a} imes ar{b}
 ight)
 ight) = \left(ar{a}.\,ar{a}
 ight) \left(ar{b} imes ar{a}
 ight)$
- ii) $\left\{\left(\bar{a} imesar{b}
 ight) imes\left(\bar{a} imesar{c}
 ight)
 ight\}\!.\,ar{d} = \left(\bar{a}.\,ar{d}
 ight)\left[ar{a}ar{b}ar{c}
 ight]$



17. If ar a, ar b, ar c, ar d are any four vectors then (ar a imes ar b) imes (ar c imes ar d) is a vector



18. Find the value of $ig[ar{i}+ar{j}+ar{k},\,ar{i}-ar{j},\,ar{i}+2ar{j}-ar{k}ig].$



19. By vector method prove that the angle in a semi circle is a right angle.



20. In a paralledogram, the sum of the square of the lengths of the diagonals is equal to sum of the squares of the lengths of its sides.



21. The vectors AB = 3i - 2j + 2k and BC = -1 - 2k are the adjacent sides of a parallelogram. The angle between its diagonals is



22. Let \bar{a}, \bar{b} and \bar{c} be mutually orthogonal vectors of equal magnitudes. Prove that the vector $\bar{a} + \bar{b} + \bar{c}$ is equally inclined to each of \bar{a}, \bar{b} and \bar{c} , the angle of inclination being $\cos^{-1} \frac{1}{\sqrt{3}}$



23. Let $ar{a}$ be perpendicular to both $ar{b}, ar{c}$. If $|ar{a}|=2, \left|ar{b}\right|=3, \left|ar{c}\right|=4$ and $\left(ar{b}, ar{c}\right)=rac{2\pi}{3}$, compute $\left|\left[ar{a}ar{b}ar{c}\right]\right|$.



24. ar a,ar b,ar c are three unit vectors, ar b is not parallel to ar c and $ar a imes ar (ar b imes ar c)=rac{1}{2}ar b$ then ar (ar a,ar b)=, (ar a,ar c)=



25. Let \bar{a} and \bar{b} be vectors, satisfying $|\bar{a}|=|\bar{b}|=5$ and $(\bar{a},\bar{b})=45^\circ$. Find the area of the triangle having $\bar{a}-2\bar{b}$ and $3\bar{a}+2\bar{b}$ as two of its sides.



26. If \bar{a}, \bar{b} and \bar{c} represent the vertices A,B and C respectively of \triangle ABC, then prove that $\left|\left(\bar{a}\times\bar{b}\right)+\left(\bar{b}\times\bar{c}\right)+\left(\bar{c}\times\bar{a}\right)\right|$ is twice the

area of \triangle ABC.

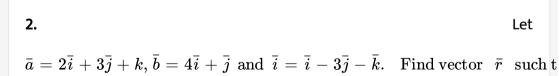


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3 D Miscellaneous

1. Ig
$$|ar a|=11,$$
 $|ar b|=23,$ $|ar a-ar b|=30$ then find the angle between the vectors $ar a,$ $ar b$ and also find $|ar a+ar b|.$





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Show

right angled triangle.

that the points $A(2ar{i}-ar{j}+ar{k}), B(ar{i}-3ar{j}-5ar{k}), C(3ar{i}-4ar{j}-4ar{k})$ are the vertices of a



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4. For any two vectors \bar{a} and \bar{b} show that

 $|\bar{a}.\bar{b}| \leq |\bar{a}||\bar{b}|$ (Caucy- Schwartz inequality).



5. For any two vectors \bar{a} and \bar{b} show that

 $|ar{a}+ar{b}|\leq |ar{a}|+|ar{b}|$ (triangle inequality).



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6. The volume of the tetrahedron with \bar{a},\bar{b},\bar{c} as co-terminus edges is $\frac{1}{6}|\left[\bar{a}\bar{b}\bar{c}\right]|.$

7. If ar a=2ar i-3ar j+5ar k, ar b=-ar i+4ar j+2ar k, then find $\left(ar a+ar b
ight) imes\left(ar a-ar b
ight)$ and unit vector perpendicular to both ar a+ar b and ar a-ar b



8. If $\bar{a}\bar{b}\bar{c}$ and \bar{d} are vectors such that $\bar{a}\times\bar{b}=\bar{c}\times\bar{d}$ and $\bar{a}\times\bar{c}=\bar{b}\times\bar{d}$. Then show that the vectors $\bar{a}-\bar{d}$ and $\bar{b}-\bar{c}$ are parallel.



9. Let $ar a, \, ar b, \, ar c$ be such that $ar c
eq 0, \, ar a imes ar b = ar c, \, ar b imes ar c = ar a.$ Show that $ar a, \, ar d, \, ar c$ are pair orthogonal vectors and $|ar b| = 1, \, |ar c| = |ar a|.$



10. Let a = 2i + j - 2k and b = I + j. If c is vector such that ac =
$$|c|$$
, $|c - a| = 2\sqrt{2}$ and the angle between $a \times b$ and c is 30° , then $|(a \times b) \times c|$ =

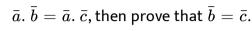


11. Let ar a, ar b be two non-collinear unit vectors, if ar lpha = ar a - ig(ar a. ar big)ar b and ar eta = ar a imes ar b, then show that ig|ar big| = ig|ar lphaig|.



12. Let $ar a=4ar i+5ar j-ar k,\,ar b-ar i-4ar j+5ar k$ and ar c=3ar i+ar j-ar k . Find the vector which is perpendicular to both ar a and ar b and ar lpha . ar c=21

13. If $ar{a}$ is a non-zero vector are two vectors such that $ar{a} imes ar{b} = ar{a} imes ar{c}$ and



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- **14.** Find the equation of the plane passing through the point A=(2,3,-1),B=
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(4,5,2),C=(3,6,5).

15. Find the distance of a point (2,5,-3) from the planer r.(6i-3j+2k)=4



1. If ar a=ar i+ar j+ar k, ar b=2ar i+3ar j+ar k then find the projection vector of ar b on ar a and its magnitude.



- **2.** Find unit vector perpendicular to both $ar{i}+ar{j}+ar{k}$ and $2ar{i}+ar{j}+3ar{k}$.
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- **3.** If $\bar{a}=2\bar{i}-3\bar{j}+5\bar{k}, \bar{b}=-\bar{i}+4\bar{j}+2\bar{k}$ then find $\bar{a}\times\bar{b}$ and unit vector perpendicular to both $\bar{a}, \bar{b}\bigg[-26\bar{i}-9\bar{j}+5\bar{k},\ \pm\frac{1}{\sqrt{782}}26\bar{i}+9\bar{j}-5\bar{k}\bigg).$
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- **4.** If heta is the angle between the vectors $ar{i}+ar{j},ar{j}+ar{k}$ then find $\sin heta.$
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5. If ar a=ar i+2ar j+3ar k, ar b=3ar i+5ar j-ar k are 2 sides of a triangle, find its area.



6. Find the area of the parallelgram whose adjacent sides are $ar{a}=2ar{i}-3ar{j},\,ar{b}=3ar{i}-ar{k}$



7. Find the volume of the parallelopiped having co-tenninus edges are represented by the vectors $2\bar{i}-3\bar{j}+\bar{k},\,\bar{i}-\bar{j}+2\bar{k},2\bar{i}+\bar{j}-\bar{k}.$



(2,-1,0) and (-1,0,1).

8. Find the volume of the tetrahedron, whose vertices are (1,2,1),(3,2,5) ,

- **9.** Find t, for which the vectors $2\bar{i}-3\bar{j}+\bar{k},\,\bar{i}+2\bar{j}-3\bar{k},\,\bar{j}-t\bar{k}$ are coplanar.
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10. $\bar{a},\,\bar{b},\,\bar{c}$ are coplanar vectors . Prove that of the following four points are

$$6ar{a}+2ar{b}-ar{c},\,2ar{a}-ar{b}+3ar{c},\,\,-ar{a}+2ar{b}-4ar{c},\,\,-12ar{a}-ar{b}-3ar{c}.$$



- **11.** Prove that the four points $4ar i+5ar j+ar k,\ -(ar j+ar k),\ 3ar i+9ar j+4ar k,\ -4ar i+4ar j+4ar k$ are coplanar.
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12. If ar a, ar b, ar c, ar d are any four vectors then ig(ar a imes ar big) imes ig(ar c imes ar dig) is a vector



13. If
$$ar a=ar i-2ar j-3ar k,$$
 $ar b=2ar i+ar j-ar k,$ $ar c=ar i+3ar j-2ar k$ then

If $ar{a}=ar{i}-2ar{j}-3ar{k}, ar{b}=2ar{i}+ar{j}-ar{k}, ar{c}=ar{i}+3ar{j}-2ar{k}$

find



 $ar{a} imes (ar{b} imesar{c})$ and $|(ar{b} imesar{c}) imesar{c}|$.

$$ar{a} imes \left(ar{b} imes ar{c}
ight)$$
 .

15. If ar a=2ar i+ar j-3ar k, ar b=ar i-2ar j+ar k, ar c=-ar i+ar j-4ar k and ar d=ar i+ar j+ar k

, then compute $|(ar{a} imesar{b}) imes(ar{c} imesar{d})|.$

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