MATHS

BOOKS - CBSE COMPLEMENTARY MATERIAL MATHS (HINGLISH)

VECTORS

One Marks Questions

1. If $\overrightarrow{AB} = 3\hat{i} + 2\hat{j} - \hat{k}$ and the coordinate of A are $(4, 1, 1)$, then find the coordinates of B.

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2. Let $\vec{a} = -2\hat{i} + \hat{j}$, $\vec{b} = \hat{i} + 2\hat{j}$ and $\vec{c} = 4\hat{i} + 3\hat{j}$. Find the value of x and y such that $\vec{c} = x\vec{a} + y\vec{b}$.

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3. Fina a unit vector in the direaction of the resultant of the vectors $\hat{i} - \hat{j} + 3\hat{k}, 2\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} + 2\hat{j} - 2\hat{k}$.

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4. Find a vactor of magnitude of 5 units parallel to the resultant of vector $\vec{a} = 2\hat{i} + 3\hat{j} + \hat{k}$ and $\vec{b} = \left(\hat{i} - 2\hat{j} - \hat{k}\right)$

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5. For what value of λ are the vector $\vec{a}$ and $\vec{b}$ perpendicular to each other ? Where $\vec{a} = \lambda\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{b} = 5\hat{i} - 9\hat{j} + 2\hat{k}$

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6. Write the value of p for which $\vec{a} = 3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\vec{b} = \hat{i} + p\hat{j} + 3\hat{k}$ are parallel vectors.

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7. For any two vectors $\vec{a}$ and $\vec{b}$ write when $\left|\vec{a} + \vec{b}\right| = \left|\vec{a} - \vec{b}\right|$ holds.

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8. Find the value of p if $\left(2\hat{i} + 6\hat{j} + 27\hat{k}\right) \times \left(\hat{i} + 3\hat{j} + p\hat{k}\right) = \vec{0}$

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9. Evaluated: $\hat{i}\left(\hat{j} \times \hat{k}\right) + \left(\hat{i} \times \hat{k}\right).\hat{j}$

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10. If $\vec{a} = 2\hat{i} - 3\hat{j}$, $\vec{b} = \hat{i} + \hat{j} - \hat{k}$, $\vec{c} = 3\hat{i} - \hat{k}$, find $\left[a\,\vec{b}\,\vec{c}\right]$

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11. If $\vec{a} = 5\hat{i} - 4\hat{j} + \hat{k}$, $\vec{b} = -4\hat{i} + 3\hat{j} - 2\hat{k}$ and $\vec{c} = \hat{i} - 2\hat{j} - 2\hat{k}$, then evaluate $\vec{c}.\left(\vec{a} \times \vec{b}\right)$

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12. Show that vector $\hat{i} + 3\hat{j} + \hat{k}, 2\hat{i} - \hat{j} - \hat{k}, 7\hat{j} + 3\hat{k}$ are parallel to same plane.

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13. Find a vector of magnitude 6 which is perpendicular to both the vectors $2\hat{i} - \hat{j} + 2\hat{k}$ and $4\hat{i} - \hat{j} + 3\hat{k}$.

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14. If $\vec{a} . \vec{b} = 0,$ then what can you say about $\vec{a}$ and $\vec{b}$?

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15. If $\vec{a}$ and $\vec{b}$ are two vectors such that $\left|\vec{a} \times \vec{b}\right| = \vec{a} . \vec{b},$ then what is the angle between $\vec{a}$ and $\vec{b}$?

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16. Show that the asreas of the parallelogram having diagonals $3\hat{i} + \hat{j} - 2h * k$ and $\hat{i} - 3\hat{j} + 4\hat{k}is5\sqrt{3}$

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17. If $\hat{i}, \hat{j}$ and $\hat{k}$ are three mutually perpendicular vectors, then find the value of $\hat{j} . \left(\hat{k} \times \hat{i}\right).$

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18. P and Q are two points with positon vectors $3\vec{a} - 2\vec{b}$ and $\vec{a} + \vec{b}$ respectively. Write the positon vector of a point R which divides the segment PQ in the ratio $2:1$ extermally.

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19. Find lamda when the scalar projection of $\vec{a} = \lambda\hat{i} + \hat{j} + 4\hat{k} on \vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$ is 4 units.

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20. Find "a" so that the vectors $\vec{p} = 3\hat{i} - 2\hat{j}$ and $\vec{q} = 2\hat{i} + a\hat{j}$ be orthogonal.

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21. If $\vec{a} = \hat{i} - \hat{j} + \hat{k}, \vec{b} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{c} = \lambda\hat{i} - \hat{j} + \lambda\hat{k}$ are coplanar, find the value of λ.

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22. What is the point of trisection of PQ nearer to P if positions of P and Q are $3\hat{i} + 3\hat{j} - 4\hat{k}$ and $9\hat{i} + 8\hat{j} - 10\hat{k}$ respectively ?

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23. what is the angle between $\vec{a}$ and $\vec{b}$, if $\vec{a}.\vec{b} = 3$ and $\left|\vec{a} \times \vec{b}\right| = 3\sqrt{3}$.

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Two Marks Questions

1. A vector $\vec{r}$ is inclined to x-axis at 45° and y-axis at 60° if $\left|\vec{r}\right| = 8$ units. Find $\vec{r}$.

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2. If $\left|\vec{a} + \vec{b}\right| = 60 \left|\vec{a} - \vec{b}\right| = 40$ and $\left|\vec{b}\right| = 46$ find $\left|\vec{a}\right|$

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3. Write the projection of $\vec{b} + \vec{c}$ on $\vec{a}$ where $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$ and $\vec{c} = 2\hat{i} - \hat{j} + 4\hat{k}$

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4. If the points $(-1, -1, 2), (2, m, 5)$ and $(3, 11, 6)$ are collinear, find the value of m.

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5. For any three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ write value of the following $\vec{a} \times \left(\vec{b} + \vec{c}\right) + \vec{b} \times \left(\vec{c} + \vec{a}\right) + \vec{c} \times \left(\vec{a} + \vec{b}\right)$

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6. If $\left|\vec{a} \times \vec{b}\right|^2 + \left|\vec{a} . \vec{b}\right|^2 = 144$ and $\left|\vec{a}\right| = 4$, then $\left|\vec{b}\right|$ is equal to --

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7. If for any two vectors $\vec{a}$ and $\vec{b}$. $\left(\vec{a} + \vec{b}\right)^2 + \left(\vec{a} - \vec{b}\right)^2 = \lambda\left[\left(\vec{a}\right)^2 + \left(\vec{b}\right)^2\right]$ then write the value of λ.

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8. If $\vec{a}, \vec{b}$ are two vectors such that $\left|\left(\vec{a}+\vec{b}\right)\right|=\left|\vec{a}\right|$ then prove that $2\vec{a}+\vec{b}$ is perpendicular to $\vec{b}$.

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9. Show that the vectors $a=3\hat{i}-2\hat{j}+\hat{k}, b=\hat{i}-3\hat{j}+5\hat{k}$ and $c=2\hat{j}+\hat{j}-4\hat{k}$ form a right angled triangle.

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10. If $\vec{a}, \vec{b}, \vec{c}$ are three vectors such that $\vec{a}+\vec{b}+\vec{c}=0$ and $\left|\vec{a}\right|=5, \left|\vec{b}\right|=12. \left|\vec{c}\right|=13,$ then find $\vec{a}\vec{b}+\vec{b}\vec{c}+\vec{c}\vec{a}$

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11. The two vectors $\hat{j}+\hat{k}$ and $3\hat{i}-\hat{j}+4\hat{k}$ represent the two side vectors $\overrightarrow{A}B$ and $\overrightarrow{A}C$ respectively of triangle ABC. Find the length of the through A.

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Four Marks Questions

1. The points A,B and C with position vectors $3\hat{i}-y\hat{j}+2\hat{k}, 5\hat{i}-\hat{j}+\hat{k}$ and $3x\hat{i}+3\hat{j}-\hat{k}$ are collinear. Find the values of x and y and also the ratio in which the point B divides AC.

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2. If the sum of two unit vectors is a unit vector, prove that the magnitude of their difference is $\sqrt{3.}$

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3. Let $\vec{a} = 4\hat{i} + 5\hat{j} - \hat{k}$, $\vec{b} = \hat{i} - 4\hat{j} + 5\hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j} - \hat{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and satisfying $\vec{d} \cdot \vec{c} = 21$

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4. If $\hat{a}$ and $\hat{b}$ are unit vectors inclined at an angle θ then prove that $\cos\frac{\theta}{2} = \frac{1}{2}|\hat{a} + \hat{b}|$

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5. If $\hat{a}$ and $\hat{b}$ are unit vectors inclined at an angle θ then prove that $\tan\frac{\theta}{2} = \left|\frac{\hat{a} - \hat{b}}{\hat{a} + \hat{b}}\right|$

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6. If $\vec{a}, \vec{b}, \vec{c}$ are mutually perpendicular vectors of equal magnitude show that $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}, \vec{b}$ and $\vec{c}$

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7. For any vector $\vec{a}$

$\left|\vec{a} \times \hat{i}\right|^2 + \left|\vec{a} \times \hat{j}\right|^2 + \left|\vec{a} \times \hat{k}\right|^2$ is equal to

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8. Show that $\left(\vec{a} \times \vec{b}\right)^2 = \left|\vec{a}\right|^2 \left|\vec{b}\right|^2 - \left(\vec{a} . \vec{b}\right)^2 = \begin{vmatrix} \vec{a} . \vec{a} & \vec{a} . \vec{b} \\ \vec{a} . \vec{b} & \vec{b} . \vec{b} \end{vmatrix}$

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9. If $\vec{a}, \vec{b}$ and $\vec{c}$ are the position vectors of vertices A,B,C of a ΔABC, show that the area of triangle ABC is $\frac{1}{2}\left|\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a}\right|$. Deduce the condition for points $\vec{a}, \vec{b}$ and $\vec{c}$ to be collinear.

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10. Let $\vec{a}, \vec{b}, \vec{c}$ be unit vectors such that $\vec{a} \cdot \vec{b} = 0 = \vec{a} \cdot \vec{c}$. If the angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{6}$, then $\vec{a}$ equals

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11. if $\vec{a} + \vec{b} + \vec{c} = 0$, then show that $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$.

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12. If $\vec{a} = \hat{i} + \hat{j} + \hat{k}, \vec{c} = \hat{j} - \hat{k}$ are given vectors, then find a vector $\vec{b}$ satisfying the equation $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{a} \cdot \vec{b} = 3$.

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13. Let, $\vec{a}$, $\vec{b}$ and $\vec{c}$ be three non zero vectors such that $\vec{c}$ is a unit vector perpendicular to both $\vec{a}$ and $\vec{b}$. if the angle between $\vec{a}$ and $\vec{b}$ is $\pi/6$, prove that $\left[\vec{a}\,\vec{b}\,\vec{c}\right]^2 = \frac{1}{4}\left|\vec{a}\right|^2\left|\vec{b}\right|^2$

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14. If the vectors $\vec{\alpha} = a\hat{i} + \hat{j} + \hat{k}$, $\vec{\beta} = \hat{i} + b\hat{j} + \hat{k}$ and $\vec{\gamma} = \hat{i} + \hat{j} + c\hat{k}$ are coplanar, then prove that $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 1$ where $a \neq 1, b \neq 1$ and $c \neq 1$

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15. Find the altitude of a parallelepiped determined by the vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ if the base is taken as parallelogram detemined by $\vec{a}$ and $\vec{b}$ and if $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + 4\hat{j} - \hat{k}$ and $\vec{c} = \hat{i} + \hat{j} +$

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16. Prove that the four points $\left(4\hat{i}+5\hat{j}+\hat{k}\right)$, $-\left(\hat{j}+\hat{k}\right)$, $\left(3\hat{i}+9\hat{j}+4\hat{k}\right)$ and $4\left(-\hat{i}+\hat{j}+\hat{k}\right)$ are coplanar.

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17. If $\left|\vec{a}\right|=3, \left|\vec{b}\right|=4$ and $\left|\vec{c}\right|=5$ such that each is perpendicular to sum of the other two, find $\left|\vec{a}+\vec{b}+\vec{c}\right|$

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18. Decompose the vector $6\hat{i}-3\hat{j}-6\hat{k}$ into vectors which are parallel and perpendicular to the vector $\hat{i}+\hat{j}+\hat{k}$.

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19. If $\vec{a}, \vec{b}$ and $\vec{c}$ are vectors such that $\vec{a} . \vec{b} = \vec{a} . \vec{c}, \vec{a} \times \vec{b} = \vec{a} \times \vec{c}, a \neq 0.$ then show that $\vec{b} = \vec{c}.$

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20. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three non zero vectors such that $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{b} \times \vec{c} = \vec{a}.$ Prove that $\vec{a}, \vec{b}$ and $\vec{c}$ are mutually at right angles and $\left|\vec{b}\right| = 1$ and $\left|\vec{c}\right| = \left|\vec{a}\right|$

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21. For any three vectors $\vec{a}, \vec{b}, \vec{c}$ the value of $\left[\vec{a} - \vec{b} \quad \vec{b} - \vec{c} \quad \vec{c} - \vec{a}\right]$, is

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22. If $\left[\vec{a}\ \vec{b}\ \vec{c}\right] = 2$ find the volume of the parallelepiped whose co-teminus edges are $2\vec{a} + \vec{b}, 2\vec{b} + \vec{c}, 2\vec{c} + \vec{a}$.

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23. If $\vec{a} + \vec{b} + \vec{c} = 0, \left|\vec{a}\right| = 3, \left|\vec{b}\right| = 5, \left|\vec{c}\right| = 7$, then find the angle between $\vec{a}$ and $\vec{b}$.

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24. If the magnitude of the vector product of the vector $\hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum of vector $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\lambda\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to $\sqrt{2}$, then find the value of $'\lambda'$

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25. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$ show that $\left(\vec{a} - \vec{d}\right)$ is parallel to $\left(\vec{b} - \vec{c}\right)$. $Itisgivent\hat{}$vec!=vecd and vecb!=vecc.

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26. Find a vector of magnittude$\sqrt{171}$ which is perpendicular to both of the vectors $\hat{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\hat{b} = 3\hat{i} - \hat{j} + 2\hat{k}$.

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27. If a is a nonzero real number prove that the vectors

$\overset{r}{\alpha} = a\hat{i} + 2a\hat{j} - 3a\hat{k}, \overset{i}{\beta} = (2a+1)\hat{i} + (2a+3)\hat{j} + (a+1)\hat{k}$ and $\overset{r}{\gamma} = (3a$

are never coplanar,

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28. If with reference to a right handed system of mutually perpendicular unit vectors $\hat{i}, \hat{j}, \hat{k}$ we have $\vec{\alpha} = 3\hat{i} - \hat{j}, \text{ and } \vec{\beta} = 2\hat{i} + \hat{j} - 3\hat{k}$. Express $\vec{\beta}$ in the form $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2, \text{ where } \vec{\beta}_1$ is parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ is perpendicular to $\vec{\alpha}$.

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29. Find a unit vector perpendicular to plane ABC when position vectors of A,B,C are $3\hat{i} - \hat{j} + 2\hat{k}, \hat{i} - \hat{j} - 3\hat{k}$ and $4\hat{i} - 3\hat{j} + \hat{k}$ respectively.

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30. Find a unit vector in XY plane which makes an angle 45° with the vector $\hat{i} + \hat{j}$ at angle of 60° with the vector $3\hat{i} - 4\hat{j}$.

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31. Suppose $\vec{a} = \lambda\hat{i} - 7\hat{j} + 3\hat{k}$, $\vec{b} = \lambda\hat{i} + \hat{j} + 2\lambda\hat{k}$. If the angle between $\vec{a}$ and $\vec{b}$ is greater than 90° then prove that λ satisfies the inequality $-7 < \lambda < 1$.

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32. Let $\vec{V} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{W} = \hat{i} + 3\hat{k}$. if $\vec{U}$ is a unit vector, then the maximum value of the scalar triple product $\left[\vec{U}\,\vec{V}\,\vec{W}\right]$ is

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33. Let $\vec{a} = \hat{i} - \hat{k}$, $\vec{b} = x\hat{i} + \hat{j} + (1-x)\hat{k}$ and $\vec{c} = y\hat{i} + x\hat{j} + (1+x-y)\hat{k}$. T

[veca vecb vecc]` depends on (A) only x (B) only y (C) neither x nor y (D) both x and y

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34. Let a, b and c be distinct non-negative numbers. If vectos $a\hat{i} + a\hat{j} + c\hat{k}, \hat{i} + \hat{k}$ and $c\hat{i} + c\hat{j} + b\hat{k}$ are coplanar, then c is

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35. If $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix} = 0$ and the vectors $A \equiv (1, a, a^2), B \equiv (1, b, b^2), C \equiv (1, c, c^2)$ are non-coplanar then the value of abc equal to

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