

APOLLO

Vectors in Space

FBISE Mathematics Class 11 (HSSC-I)

Domain B: Geometry

46 questions | questions

Original FBISE question crops. National Curriculum 2022-23 topic.

FBISE model paper | Section A Q18 | 0.75 marks

18.	Two direction angles of vector $\vec{a}$ are 30° and 60° . What is the value of third direction angle?	135°	90°	45°	30°
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FBISE model paper | Section A Q19 | 0.75 marks

19.	The vector parallel to $2\hat{i} + 6\hat{j} - 5\hat{k}$ and with magnitude 3 is:	$\left[\frac{12}{\sqrt{65}}, \frac{-18}{\sqrt{65}}, \frac{75}{\sqrt{65}}\right]$	$\left[\frac{12}{\sqrt{65}}, \frac{18}{\sqrt{65}}, \frac{25}{\sqrt{65}}\right]$	$\left[\frac{6}{\sqrt{65}}, \frac{18}{\sqrt{65}}, \frac{-15}{\sqrt{65}}\right]$	$\left[\frac{6}{\sqrt{65}}, \frac{-18}{\sqrt{65}}, \frac{8}{\sqrt{65}}\right]$
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FBISE model paper | Section A Q20 | 0.75 marks

20.	The area of a parallelogram having adjacent sides $\vec{a} = [2, 5, -2]$ and $\vec{b} = [1, 4, -2]$ is:	$\sqrt{17}$	$\frac{\sqrt{17}}{2}$	$\frac{\sqrt{17}}{6}$	$2\sqrt{17}$
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FBISE model paper | Section A Q21 | 0.75 marks

21.	At which angle the work done is zero?	0°	45°	90°	180°
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FBISE model paper | Section A Q22 | 0.75 marks

22.	In navigation the velocity of the air-plane is calculated using:	Dot product	Vector addition	Vector subtraction	Cross product
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FBISE model paper | Section A Q23 | 0.75 marks

23.	If $\vec{a} = \hat{i} + 2\hat{j} - 2\hat{k}$ and $\vec{b} = 2\hat{i} + 3\hat{j} - 3\hat{k}$ then $\hat{i} \cdot \vec{a} + \hat{j} \cdot \vec{b} = ?$	1	-2	2	4
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FBISE model paper | Section A Q53 | 0.75 marks

Scenario for MCQs (53-56)		A drone is flying in space. Its motion is represented by the vectors $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$. An engineer wants to analyze the relationship between these two directions using dot and cross products.			
53.	The engineer computes $\vec{a} \cdot \vec{b}$. What does this quantity help to determine?	The area of parallelogram formed by the vectors	The angle between the vectors	Law of sines	The area of a triangle

FBISE model paper | Section A Q54 | 0.75 marks

Scenario for MCQs (53-56)		A drone is flying in space. Its motion is represented by the vectors $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$. An engineer wants to analyze the relationship between these two directions using dot and cross products.			
54.	In terms of vectors $\vec{a}$ and $\vec{b}$, how would you express the work done on the drone?	$ \vec{a} + \vec{b} $	$ \vec{a} - \vec{b} $	$\vec{a} \times \vec{b}$	$\vec{a} \cdot \vec{b}$

Scenario for MCQs (53-56)		A drone is flying in space. Its motion is represented by the vectors $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$. An engineer wants to analyze the relationship between these two directions using dot and cross products.			
55.	If $\vec{a} \times \vec{b} = 0$. What can be concluded about the drone's angle of direction?	0°	45°	60°	90°

Scenario for MCQs (53-56)		A drone is flying in space. Its motion is represented by the vectors $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} + \hat{k}$. An engineer wants to analyze the relationship between these two directions using dot and cross products.			
56.	An engineer wants to position a communication antenna perpendicular to both $\vec{a}$ and $\vec{b}$. Which vector gives its orientation?	$-3\hat{i} + 3\hat{k}$	$3\hat{i} + 3\hat{k}$	$-3\hat{i} - 3\hat{k}$	$3\hat{i} - 3\hat{k}$

3.	If the vectors $\vec{u} = p\hat{i} + \hat{j} + \hat{k}$, $\vec{v} = \hat{i} + q\hat{j} + \hat{k}$ and $\vec{w} = \hat{i} + \hat{j} + r\hat{k}$ are coplanar, then prove that $\frac{1}{1-p} + \frac{1}{1-q} + \frac{1}{1-r} = 1$	4
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OR	Express the vector $\vec{a} = 3\hat{i} + 7\hat{j} + 2\hat{k}$ as a sum of two vectors one of which is parallel and other is perpendicular to the vector $\vec{b} = 5\hat{i} + \hat{j} + 8\hat{k}$.	4
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Q10	If $\vec{a} = 3\hat{i} - \hat{j} + 5\hat{k}$, $\vec{b} = 4\hat{i} + 3\hat{j} - 2\hat{k}$ and $\vec{c} = 2\hat{i} + 5\hat{j} + \hat{k}$, then verify that $\vec{a} \cdot \vec{b} \times \vec{c} = \vec{b} \cdot \vec{c} \times \vec{a} = \vec{c} \cdot \vec{a} \times \vec{b}.$	8
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A triangular park has its three corners located at points A (2, 3, 1), B (5, 7, 2), and C (1, 4, 3). Find area of the park using cross product of vectors.	04
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Find the value of p such that vectors $\hat{i} + 2\hat{j} + p\hat{k}$, $3\hat{i} + p\hat{j} + 4\hat{k}$ and $2\hat{i} + 3\hat{j} + 4\hat{k}$ are coplanar.	04
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A force $\vec{F} = 6\hat{i} + 8\hat{j} + 4\hat{k}$ acts on an object. The object moves from A (1,2,3) to point B(4,6,5). (a) Find the displacement vector $\vec{d}$. (b) Calculate work done by the force $\vec{F}$.	04
Solve $x + y + z = 3$: $y + z = 2$: $z = 2$ using Cramer's	

If $\vec{a} = 3\hat{i} - 2\hat{j} + 4\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - \hat{k}$, then (a) Find $\vec{a} \times \vec{b}$. (b) Find $(\vec{a} \times \vec{b}) \cdot \vec{a}$ and verify that $\vec{a} \times \vec{b} \perp \vec{a}$. (c) Find $(\vec{a} \times \vec{b}) \cdot \vec{b}$ and verify that $\vec{a} \times \vec{b} \perp \vec{b}$	08
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A mechanic applies a force $\vec{F} = 3\hat{i} + 4\hat{j} + 5\hat{k}$ at point A (14, -3, 6) to turn a bolt with pivot at P (2, -2, 1). Find: (a) the moment arm $\vec{r}$ and (b) the moment vector $\vec{M}$ about the bolt.	
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(iii) Find the value of λ such that vectors $\hat{i} + 4\hat{j} + 2\hat{k}$, $2\hat{i} - \hat{j} + 3\hat{k}$ and $\lambda\hat{i} + 3\hat{j} + 5\hat{k}$ are coplanar.	04
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A force $\vec{F} = 5\hat{i} + 3\hat{j} + 4\hat{k}$ is applied to move an object from A(2,3,1) to B(5,7,4). Find work done by the force.	
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A boat is sailing north at 10 km/h but is also being pushed east by ocean currents at 5 km/h. Find: (a) actual speed (V) of the boat. (b) direction angle (θ) of the boat relative to due north.	
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If $\vec{a} = 5\hat{i} - 3\hat{j} + \hat{k}$ and $\vec{b} = -2\hat{i} + 6\hat{j} + 4\hat{k}$, then	
(a) Find $\vec{a} \times \vec{b}$	08
(b) Find $(\vec{a} \times \vec{b}) \cdot \vec{a}$ and verify that $\vec{a} \times \vec{b} \perp \vec{a}$	
(c) Find $(\vec{a} \times \vec{b}) \cdot \vec{b}$ and verify that $\vec{a} \times \vec{b} \perp \vec{b}$	

inverse of given matrix using row operations.			Find the value of m if vectors $\underline{a} = \hat{i} + m\hat{j} + 2\hat{k}$, $\underline{b} = 2\hat{i} - \hat{j} + 3\hat{k}$, $\underline{c} = 3\hat{i} + 2\hat{j} + \hat{k}$ are coplanar.	
$\begin{bmatrix} 1 & 0 \\ 1 & 0 \\ 0 & 1 \end{bmatrix}$	04	OR		04

OR	If $\underline{a} = 5\hat{i} - 2\hat{j} + \hat{k}$ and $\underline{b} = \hat{i} + 2\hat{j} + 2\hat{k}$, then find projection of $\underline{a}$ along $\underline{b}$ and projection of $\underline{b}$ along $\underline{a}$.	04
A geometric sequence has first term $a = 2$ and		

OR	Apply cross product to find angle between two vectors $\underline{a} = \hat{i}$ and $\underline{b} = \frac{1}{2}\hat{i} + \frac{\sqrt{3}}{2}\hat{j}$	04
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The vertices of a tetrahedron are $A(1,2,3)$, $B(2,3,1)$, $C(3,1,2)$ and $D(4,2,1)$	
a. Find volume of the tetrahedron $ABCD$	08
b. Using same vectors, find the volume of the parallelepiped formed by $\vec{AB}$, $\vec{AC}$ and $\vec{AD}$.	

OR	A force $\vec{F} = 3\hat{i} - 2\hat{j} + \hat{k}$ acts at point $(1,2,3)$. Find the moment about the origin.	04
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OR	Find the value of " λ " so that vectors $\vec{v} = \hat{i} - \hat{j} + \hat{k}$, $\vec{u} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{w} = -\hat{i} + \lambda\hat{j} + 2\hat{k}$ are coplanar.	04
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A force $\vec{F} = 2\hat{i} + 3\hat{j} + \hat{k}$ moves an object through displacement $\vec{d} = \hat{i} + 2\hat{j} + 2\hat{k}$. find the work done.	04
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(iii)	Find the volume of a tetrahedron formed by vectors: $\vec{a} = 2\vec{i} + \vec{j}, \vec{b} = \vec{i} + 3\vec{j} + \vec{k}, \vec{c} = \vec{j} + \vec{k}$	04
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	Find the angle between vectors: $\vec{a} = 4\vec{i} + \vec{j} - 8\vec{k}, \vec{b} = \vec{i} + 4\vec{j} + \vec{k}$	04
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xi.	If the dot product of vector $\vec{a} = \vec{i} - 2\vec{j} + \vec{k}$ and $\vec{b} = \alpha \vec{i} - \vec{j} + 2\vec{k}$ is 10 then value of α is:	0	1	2	3
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xii.	If $\vec{a} = \vec{i} - 2\vec{j}$ and $\vec{b} = 2\vec{j} + \vec{k}$, then $\vec{a} \times \vec{b}$ is:	$-2\vec{i} - \vec{j} - 2\vec{k}$	$-2\vec{i} + \vec{j} - 2\vec{k}$	$2\vec{i} - \vec{j} + 2\vec{k}$	$-2\vec{i} - \vec{j} + 2\vec{k}$
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xiii.	Which of the vector pairs is orthogonal?	$\vec{i} + 2\vec{j} - \vec{k}$ and $\vec{i} + \vec{j} + \vec{k}$	$\vec{i} - 2\vec{j} - \vec{k}$ and $\vec{i} + \vec{j} - \vec{k}$	$-\vec{i} + 2\vec{j} + \vec{k}$ and $\vec{i} + \vec{j} + \vec{k}$	$-\vec{i} + 2\vec{j} - \vec{k}$ and $-\vec{i} + \vec{j} + \vec{k}$
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	If the angle between two vectors $\vec{a} = 2\vec{i} - 3\vec{j} + 4\vec{k}$ and $\vec{b} = \vec{i} + 2\vec{j} + 2\vec{k}$ is θ , then find the values of $\cos \theta$ and $\sin \theta$.	4
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iii.	Find volume of the tetrahedron if $\vec{a} = 2\vec{i} - 3\vec{j} + \vec{k}$, $\vec{b} = \vec{i} + 2\vec{j} - \vec{k}$ and $\vec{c} = -3\vec{i} - \vec{j} + 5\vec{k}$ are its coterminal edges.	4
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	A force $\vec{F} = 3\vec{i} - 2\vec{j} + 5\vec{k}$ acts on a particle at point $P(3, -4, 2)$. Find moment of the force about origin and a point $(1, -1, -1)$.	4
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If $\underline{a} = 2\underline{i} - \underline{j} + 3\underline{k}$, $\underline{b} = 3\underline{i} + 2\underline{j} + 4\underline{k}$ and $\underline{c} = \underline{i} + 3\underline{j} - 5\underline{k}$, then verify that $\underline{a} \cdot \underline{b} \times \underline{c} = \underline{b} \cdot \underline{c} \times \underline{a} = \underline{c} \cdot \underline{a} \times \underline{b}$.	8
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(iii)	Find projection of vector $\vec{a} = 9\hat{i} - \hat{j} + \hat{k}$ along the vector $\vec{b} = 3\hat{i} + 2\hat{j} + \hat{k}$.	04
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OR	Find $\cos \theta$ if: $\vec{a} = \hat{i} - 2\hat{j} + \hat{k}$ $\vec{b} = 4\hat{i} - 4\hat{j} + 7\hat{k}$	04
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Q.4	Find the volume of parallelepiped whose vertices are the following points by fixing point "A". $A(2, 3, 1), B(-1, -2, 0), C(0, 2, -5), D(0, 1, -2)$	08
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OR	Find the value of λ for which vectors $\underline{a} = \underline{i} + 2\underline{j} + 3\underline{k}$, $\underline{b} = 2\underline{i} - \underline{j} + \underline{k}$ and $\underline{c} = 3\underline{i} + 2\underline{j} + 5\underline{k}$ are coplanar.	04
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OR	Find angle between two vectors $\underline{a} = 2\hat{i}$ and $\underline{b} = \hat{i} + \sqrt{3}\hat{j}$ using cross product method.	04
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OR	In triangle OPR , M is the mid-point of PR . If $\vec{OP} = p$, $\vec{OR} = r$ then find the following in terms of p and r . a. $\vec{PR}$ b. $\vec{PM}$ c. $\vec{OM}$	04
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(iii)	For $A = \begin{bmatrix} -1 \\ 2 \\ 3 \end{bmatrix}$ and $B = [-2 -1 -4]$, verify that	04	OR	For what value of λ , the vectors $\underline{a} = \underline{i} + 3\underline{j} + \underline{k}$, $\underline{b} = 2\underline{i} - \underline{j} - \underline{k}$ and $\underline{c} = \lambda\underline{j} + 3\underline{k}$ are coplanar.
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OR	Find length of the vector $\vec{AB}$ from $A(-3, 5)$ to $B(7, 9)$. Also find a unit vector in the direction of $\vec{AB}$ with magnitude 4.	04
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