Calculus 3 Workbook

Cross products

krista king MATH

CROSS PRODUCT OF TWO VECTORS

■ 1. Find the vector $\vec{a}$ given that $\vec{a} \times \vec{b} = \vec{c}$, where $\vec{a} = \langle 1, a_2, a_3 \rangle$, $\vec{b} = \langle 3,1,1 \rangle$, and $\vec{c} = \langle 1,2,-5 \rangle$.

■ 2. Find the cross product $\vec{a} \times \vec{a}$ for an arbitrary vector $\vec{a}$.

■ 3. Find the cross product $\vec{a} \times \text{proj}_{xy}\vec{a}$, where $\vec{a} = \langle 4,5,-3 \rangle$ and $\text{proj}_{xy}\vec{a}$ is the vector projection of the vector $\vec{a}$ onto the xy-plane.

© Krista King Math

VECTOR ORTHOGONAL TO THE PLANE

1. Find the vector orthogonal to the plane which passes through the point $A(2,3,1)$ and the z-axis.

2. Find the equation of the plane that passes through the point D and is parallel to the plane ABC, if $A(1,2,-2)$, $B(1,4,3)$, $C(-5,3,-1)$, and $D(2,-4,7)$.

3. Find the equation of the line that passes through the point $A(-2,3,4)$ and is orthogonal to the plane that includes the vectors $\vec{a} = \langle 2,4,0 \rangle$ and $\vec{b} = \langle -1,1,2 \rangle$.

VOLUME OF THE PARALLELEPIPED FROM VECTORS

■ 1. Find the height of the parallelepiped given that its volume is 670, and that the vectors $\vec{a}=\langle 1,0,-1\rangle$ and $\vec{b}=\langle 2,3,5\rangle$ are the adjacent edges of its base.

■ 2. Find the volume of the tetrahedron whose adjacent edges are the vectors $\vec{a}=\langle 0,0,3\rangle$, $\vec{b}=\langle 2,1,4\rangle$, and $\vec{c}=\langle -1,-2,1\rangle$.

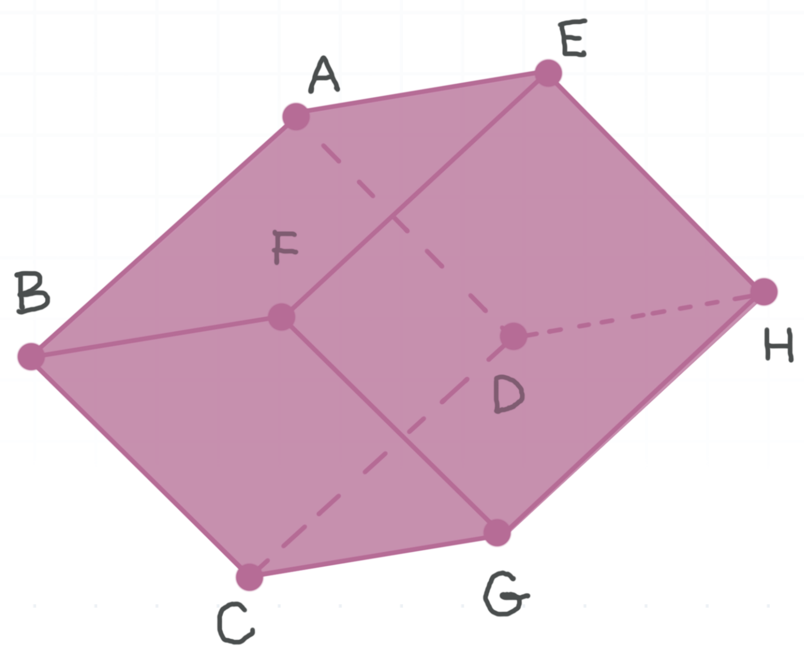
■ 3. Find the value of p such that the volume of the parallelepiped with adjacent edges $\vec{a}=\langle 0,2,3\rangle$, $\vec{b}=\langle 1,-2,1\rangle$, and $\vec{c}=\langle p,p,p\rangle$ is equal to 63.

© Krista King Math

VOLUME OF THE PARALLELEPIPED FROM ADJACENT EDGES

■ 1. Find the volume of tetrahedron $ABCD$, given $A(2,0,3)$, $B(-1,1,3)$, $C(4,5,-2)$, and $D(2,2,3)$.

■ 2. Find the volume of parallelepiped $ABCDEFGH$, given $A(1,2,2)$, $B(-1,-2,0)$, $F(4,3,-1)$, and $G(5,6,-4)$.



■ 3. Find the volume of the parallelepiped with base $ABCD$ and height 5, if $A(3,3,3)$, $B(0,-2,-2)$, and $C(-3,1,0)$.

SCALAR TRIPLE PRODUCT TO PROVE VECTORS ARE COPLANAR

■ 1. Find the value of the parameter p such that the vectors $\vec{a} = \langle 1,3,-1 \rangle$, $\vec{b} = \langle 2,2,2 \rangle$, and $\vec{c} = \langle 0,-1,p \rangle$ are coplanar.

■ 2. Check if the vectors $\vec{a} = \langle 1,1,0 \rangle$, $\vec{b} = \langle 0,1,1 \rangle$, and $\vec{c} = \langle 1,0,-1 \rangle$ are coplanar. If they are, find the equation of the plane, assuming that the initial point of the vectors is the origin.

■ 3. Check if the points $A(0,0,1)$, $B(2,0,3)$, $C(2,3,0)$, and $D(3,2,2)$ lie in the same plane.

© Krista King Math

W W W . K R I S T A K I N G M A T H . C O M