

9.4 – The Cross Product

Torque and the Cross Product

Definition of the Cross Product

If \vec{a} and \vec{b} are nonzero three dimensional vectors, the **cross product** of \vec{a} and \vec{b} is...

Parallel Vectors

Example 1

A bolt is tightened by applying a 30-N force to a 0.2 m wrench at an angle of 70° . Find the magnitude of the torque.

Example 2

Find $\vec{i} \times \vec{j}$.

Properties of the Cross Product

Cross Product in Component Form

Determinants

Cross Product in Determinant Form

Example 3

Find $\langle 2, -1, 5 \rangle \times \langle 3, 2, -1 \rangle$

Example 4

A plane is uniquely determined by 3 points $P(2, -1, 5)$, $Q(3, 1, 5)$, and $R(-1, 2, 3)$. Find a vector perpendicular to this plane.

Example 5

Find the area of the triangle determined by the points $P(2, -1, 5)$, $Q(3, 1, 5)$, and $R(-1, 2, 3)$.

Triple Products

Example 6

Use the scalar triple product to show that the vectors $\vec{a} = \langle 1, 4, -7 \rangle$, $\vec{b} = \langle 2, -1, 4 \rangle$, and $\vec{c} = \langle 0, -9, 18 \rangle$ are coplanar.

HW 9.4 # 1, 2, 3, 5, 7, 9, 13, 17, 21, 27