2 08-28-2025

Relevant Textbook Sections: 2.3, 2.4

2.1 Checkpoint 2.23: Finding the Angle between Two Vectors

Find the measure of the angle, in radians, formed by vectors $a = \langle 1, 2, 0 \rangle$ and $b = \langle 2, 4, 1 \rangle$. Round to the nearest hundredth.

2.2 Checkpoint 2.24: Identifying Orthogonal Vectors

For which value of x is $p = \langle 2, 8, -1 \rangle$ orthogonal to $q = \langle x, -1, 2 \rangle$?

2.3 Checkpoint 2.27: Resolving Vectors into Components

Express $v = 5i - j$ as a sum of orthogonal vectors such that one of the vectors has the same direction as $u = 4i + 2j$.

Properties of the Cross Product

Let $\mathbf{u}$, $\mathbf{v}$, and $\mathbf{w}$ be vectors in space, and let c be a scalar.

i.	$\mathbf{u} \times \mathbf{v} = -(\mathbf{v} \times \mathbf{u})$		Anticommutative property
ii.	$\mathbf{u} \times (\mathbf{v} + \mathbf{w}) = \mathbf{u} \times \mathbf{v} + \mathbf{u} \times \mathbf{w}$		Distributive property
iii.	$c(\mathbf{u} \times \mathbf{v}) = (c\mathbf{u}) \times \mathbf{v} = \mathbf{u} \times (c\mathbf{v})$		Multiplication by a constant
iv.	$\mathbf{u} \times \mathbf{0} = \mathbf{0} \times \mathbf{u} = \mathbf{0}$		Cross product of the zero vector
v.	$\mathbf{v} \times \mathbf{v} = \mathbf{0}$		Cross product of a vector with itself
vi.	$\mathbf{u} \cdot (\mathbf{v} \times \mathbf{w}) = (\mathbf{u} \times \mathbf{v}) \cdot \mathbf{w}$		Scalar triple product

2.4 Checkpoint 2.33 (quick)

Use the properties of the cross product to calculate $(i \times k) \times (k \times j)$.

2.5 Checkpoint 2.38

Find the area of the parallelogram $PQRS$ with vertices $P(1, 1, 0), Q(7, 1, 0), R(9, 4, 2)$, and $S(3, 4, 2)$.

2.6 Example 2.44: Evaluating Torque

A bolt is tightened by applying a force of 6 N to a 0.15-m wrench (Figure 2.62). The angle between the wrench and the force vector is 40°. Find the magnitude of the torque about the center of the bolt. Round the answer to two decimal places.

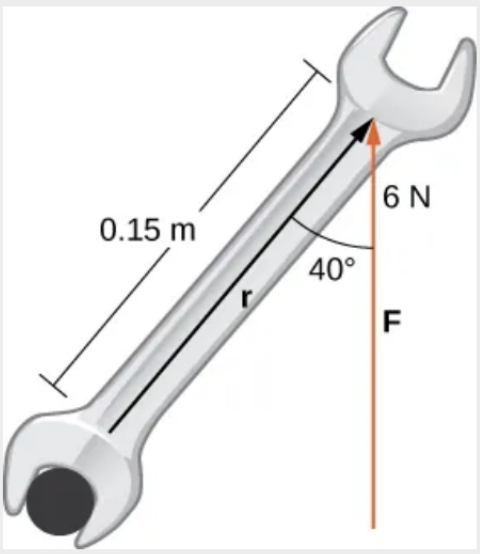

Figure 2.62 Torque describes the twisting action of the wrench.