#3 Scalar and Vector Multiplication of Vectors Pre-class

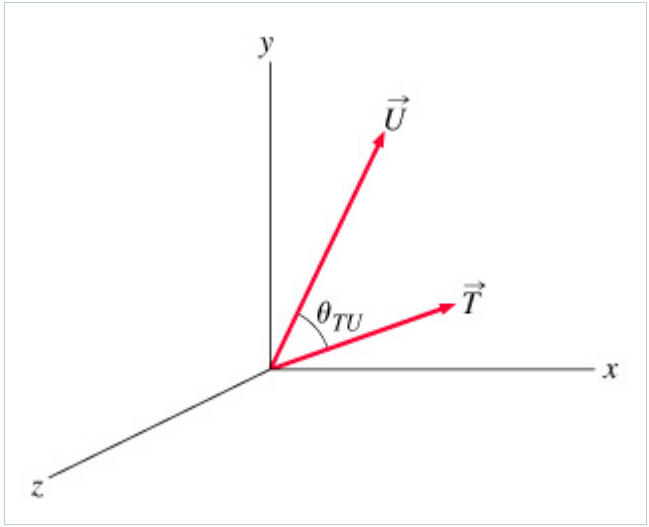
Due: 11:00am on Monday, August 27, 2012

Note: You will receive no credit for late submissions. To learn more, read your instructor's Grading Policy

Finding the Cross Product

The figure shows two vectors $\vec{T}$ and $\vec{U}$ separated by an angle θ_{TU}.

You are given that $\vec{T} = (3, 1, 0)$, $\vec{U} = (2, 4, 0)$, and $\vec{T} \times \vec{U} = \vec{V}$.



Part A

Express $\vec{V}$ as an ordered triplet of values, separated by commas.

ANSWER:

$\vec{V}$ = 0,0,10

Correct

Part B

Find the magnitude of $\vec{V}$.

ANSWER:

$|\vec{V}|$ = 10

Correct

Part C

Find the sine of the angle between $\vec{T}$ and $\vec{U}$.

ANSWER:

$\sin(\theta_{TU})$ = 0.707

Correct

Vector Cross Product

Let vectors $\vec{A} = (1, 0, -3)$, $\vec{B} = (-2, 5, 1)$, and $\vec{C} = (3, 1, 1)$.

Calculate the following, expressing your answers as ordered triples (three comma-separated numbers).

Part A

Hint 1. The cross product

If $\vec{M} = (M_x, M_y, M_z)$ and $\vec{N} = (N_x, N_y, N_z)$, then

$$\vec{M} \times \vec{N} = (M_y N_z - M_z N_y, M_z N_x - M_x N_z, M_x N_y - M_y N_x).$$

ANSWER:

$\vec{B} \times \vec{C}$ = 4,5,-17

Correct

Part B

ANSWER:

$\vec{C} \times \vec{B}$ = -4,-5,17

Correct

Part C

ANSWER:

$(2\vec{B}) \times (3\vec{C})$ = 24,30,-102

Correct

Part D

ANSWER:

$\vec{A} \times (\vec{B} \times \vec{C})$ = 15,5,5

Correct

Part E

ANSWER:

$\vec{A} \cdot (\vec{B} \times \vec{C})$ = 55

Correct

$\vec{V}_1$ and $\vec{V}_2$ are different vectors with lengths V_1 and V_2 respectively. Find the following, expressing your answers in terms of given quantities.

Part F

If $\vec{V}_1$ and $\vec{V}_2$ are perpendicular,

Hint 1. What is the angle between perpendicular vectors?

The angle between vectors that are perpendicular is equal to $\pi/2$ radians or 90 degrees.

Hint 2. Magnitude of the cross product

$|\vec{A} \times \vec{B}| = |\vec{A}|\,|\vec{B}| \sin(\theta)$, where θ is the angle between $\vec{A}$ and $\vec{B}$.

ANSWER:

$|\vec{V}_1 \times \vec{V}_2|$ = $V_1 V_2$

Correct

Part G

If $\vec{V}_1$ and $\vec{V}_2$ are parallel,

Hint 1. What is the angle between two parallel vectors?

The angle between vectors that are parallel is equal to 0.

ANSWER:

$|\vec{V}_1 \times \vec{V}_2|$ = 0

Correct

± Vector Dot Product

Let vectors $\vec{A} = (2, 1, -4)$, $\vec{B} = (-3, 0, 1)$, and $\vec{C} = (-1, -1, 2)$.

Calculate the following:

Part A

Hint 1. Remember the dot product equation

If $\vec{M} = (M_x, M_y, M_z)$ and $\vec{N} = (N_x, N_y, N_z)$, then

$$\vec{M} \cdot \vec{N} = M_x N_x + M_y N_y + M_z N_z.$$

ANSWER:

$\vec{A} \cdot \vec{B}$ = -10

Correct

Part B

What is the angle θ_{AB} between $\vec{A}$ and $\vec{B}$?

Express your answer using one significant figure.

Hint 1. Remember the definition of dot products

$\vec{A} \cdot \vec{B} = |\vec{A}|\,|\vec{B}|\cos(\theta)$, where θ is the angle between $\vec{A}$ and $\vec{B}$.

ANSWER:

θ_{AB} = 2 radians

Correct

Part C

ANSWER:

$2\vec{B} \cdot 3\vec{C}$ = 30

Correct

Part D

ANSWER:

$2(\vec{B} \cdot 3\vec{C})$ = 30

Correct

Part E

Which of the following can be computed?

Hint 1. Dot product operator

The dot product operates only on two vectors. The dot product of a vector and a scalar is not defined.

ANSWER:

- $\vec{A} \cdot \vec{B} \cdot \vec{C}$
- $\vec{A} \cdot (\vec{B} \cdot \vec{C})$
- $\vec{A} \cdot (\vec{B} + \vec{C})$
- $3 \cdot \vec{A}$

Correct

$\vec{V}_1$ and $\vec{V}_2$ are different vectors with lengths V_1 and V_2 respectively. Find the following:

Part F

Express your answer in terms of V_1

Hint 1. What is the angle between a vector and itself?

The angle between a vector and itself is 0.

Hint 2. Remember the definition of dot products

$\vec{A} \cdot \vec{B} = |\vec{A}|\,|\vec{B}|\cos(\theta)$, where θ is the angle between $\vec{A}$ and $\vec{B}$.

ANSWER:

$\vec{V}_1 \cdot \vec{V}_1 = V_1^2$

Correct

Part G

If $\vec{V}_1$ and $\vec{V}_2$ are perpendicular,

Hint 1. What is the angle between perpendicular vectors?

The angle between vectors that are perpendicular is equal to $\pi/2$ radians or 90 degrees.

ANSWER:

$\vec{V}_1 \cdot \vec{V}_2 = 0$

Correct

Part H

If $\vec{V}_1$ and $\vec{V}_2$ are parallel,

Express your answer in terms of V_1 and V_2.

Hint 1. What is the angle between parallel vectors?

The angle between vectors that are parallel is equal to 0.

ANSWER:

$\vec{V}_1 \cdot \vec{V}_2 = |V_1||V_2|$

Correct

Score Summary:

Your score on this assignment is 100.3%.
You received 15.05 out of a possible total of 15 points.