Mathematics Review Course
Summer 2023
Problem Set 06
Solutions

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Dot Product

1. Find $u \cdot v$ given $u = (4, 5, -6)$ and $v = (0, -2, -3)$.

Solution:

$$u \cdot v = 0$$

2. Find $a \cdot b$ given $a = (6, -1, 3)$ and $b = (4, 18, -2)$.

Solution:

$$a \cdot b = 0$$

Cross Product

3. Cross product of $u = (2, 0, 0) \times v = (2, 2, 0)$.

Solution:

$$u \times v = (0, 0, 4)$$

4. Cross product of $u \times v$ given $u = 2\vec{i} + 3\vec{j}$ and $v = \vec{j} + 2\vec{k}$.

Solution:

$$u \times v = 6\vec{i} - 4\vec{j} + 2\vec{k}$$

Matrix Multiplication

5. Find the matrix AB given $A = \begin{bmatrix} 1 & 2 \\ 0 & 4 \\ 1 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 0 & 8 & 1 \\ 5 & 3 & -9 & 0 \end{bmatrix}$.

Solution:

$$AB = \begin{bmatrix} 9 & 6 & -10 & 1 \\ 20 & 12 & -36 & 0 \\ -1 & 0 & 8 & 1 \end{bmatrix}$$

6. Find the vector $(a - 2b) \times c$ given $a = \begin{vmatrix} i & j & k \\ 2 & -1 & 5 \\ 0 & 1 & 8 \end{vmatrix}$ and $b = \begin{vmatrix} i & j & k \\ 0 & 1 & 1 \\ 2 & -1 & -2 \end{vmatrix}$ and $c = i + j + k$.

Solution:

$$(a - 2b) \times c = -26\vec{i} + 17\vec{j} + 9\vec{k}$$

Determinants

7. $det \begin{pmatrix} 2 & 3 & 1 \\ -1 & 2 & 3 \\ 3 & 2 & -1 \end{pmatrix}$.

Solution:

$$det(\cdot) = 0$$

8. $det \begin{pmatrix} 15 & 4 & 8 \\ -12 & -7 & 5 \\ 0 & -5 & 15 \end{pmatrix}$.

Solution:

$$det(\cdot) = 0$$

9. $det \begin{pmatrix} 0 & 0 & 3 & 3 \\ 3 & 0 & 1 & 2 \\ 1 & 0 & 2 & 4 \\ 2 & 1 & 3 & 2 \end{pmatrix}$.

Solution:

$$det(\cdot) = -15$$