

W6 – Applications of Dot and Cross Product

Unit 5

MCV4U

Jensen

1) Given $\vec{a} = [2, 4, -5]$, $\vec{b} = [-1, 3, 7]$, and $\vec{c} = [-2, 7, 3]$, evaluate each expression.

a) $\vec{a} \times \vec{b} \cdot \vec{c}$

b) $\vec{a} \times \vec{c} \cdot \vec{b}$

2) Determine the projection, and its magnitude of \vec{u} on \vec{v} .

a) $\vec{u} = [2, 1, 7]$, $\vec{v} = [-7, 2, 6]$

b) $\vec{u} = 7\hat{i} - 6\hat{j} + 5\hat{k}$, $\vec{v} = 3\hat{i} - 2\hat{j} + \hat{k}$

3) Determine the work done in the direction of travel.

a) $\vec{F} = [200, 150, 75]$, $\vec{s} = [2, -1, 8]$

b) $\vec{F} = -3\hat{i} + 9\hat{j} + 5\hat{k}$, $\vec{s} = 2\hat{i} + 5\hat{j} + 3\hat{k}$

4) Find the area of the parallelogram with sides consisting of the vectors.

a) $\vec{a} = [-4, 5, -8], \vec{b} = [1, -2, 3]$

b) $\vec{a} = [9, -5, 7], \vec{b} = [3, -2, 5]$

5) Find the area of the triangle with the given vertices.

a) $A(0, 2, 4), B(3, -2, 1), C(4, -2, 5)$

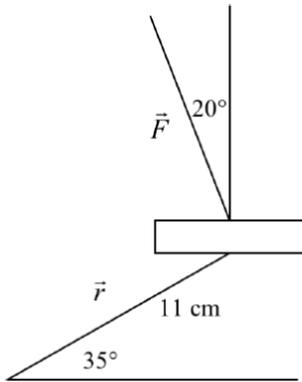
b) $A(-2, 4, 5), B(1, 4, 2), C(7, 4, 9)$

6) Determine the volume of the parallelepiped determined by the vectors.

a) $\vec{a} = [2, 5, -8], \vec{b} = [7, -2, 3], \text{ and } \vec{c} = [8, 2, -1]$

b) $\vec{a} = [1, -5, 9], \vec{b} = [3, 4, -7], \text{ and } \vec{c} = [1, 0, 2]$

- 7) Find the torque produced by a cyclist exerting a force of 85 N on the pedal in the position shown in the diagram, if the shaft of the pedal is 11 cm long.



- 8) A woman pushes her baby stroller a distance of 1500 m by a force of 89 N applied at an angle of 35° to the roadway. Calculate the work done.

- 9) Determine the work done by gravity in causing a 45 kg child to slide down a 55 m slope, which has an angle of 47° to the horizontal.

10) A force of 75 N is applied to a wrench in a clockwise direction at 52° to the handle, 17 cm from the centre of the bolt.

a) Calculate the magnitude of the torque.

b) In what direction does the bolt move?

ANSWER KEY:

1. a) -119 b) 119

2. a) $\frac{30}{89} [-7, 2, 6]$; $\frac{30}{\sqrt{89}}$ b) $\frac{38}{14} [3, -2, 1]$; $\frac{38}{\sqrt{14}}$

3. a) 850 J b) 54 J

4. a) $\sqrt{26}$ units² b) $\sqrt{706}$ units²

5. a) $\frac{\sqrt{497}}{2}$ units² b) $\frac{39}{2}$ units²

6. a) 93 units³ b) 37 units³

7. 9.03 N•m

8. 109 356.8 J

9. 17 738.98 J

10. a) 10.05 N•m b) The bolt is being tightened into the material