5.6 Applications of Dot and Cross Product Worksheet

This document was composed and formatted by Annie Bernatchez.

The course material originated from www.jensenmath.ca

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

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

a) $\vec{F} = [200, 150, 75]$, $\vec{s} = [2, -1, 8]$	b) $\vec{F} = -3\vec{i} + 9\vec{j} + 5\vec{k}$, $\vec{s} = 2\vec{i} + 5\vec{j} + 3\vec{k}$

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.

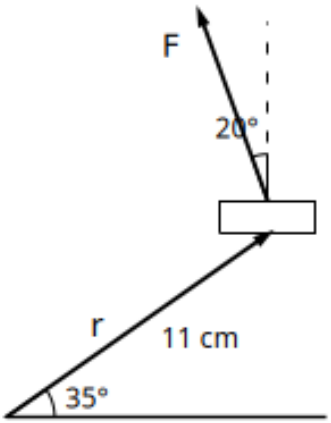
a) $A(0, 2, 4)$, $B(3, -2, 1)$, $C(4, -2, 5)$	b) $A(-2, 4, 5)$, $B(1, 4, 2)$, $C(7, 4, 9)$

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

a) $\vec{a} = [2, 5, -8]$, $\vec{b} = [7, -2, 3]$, and $\vec{c} = [8, 2, -1]$	b) $\vec{a} = [1, -5, 9]$, $\vec{b} = [3, 4, -7]$, and $\vec{c} = [1, 0, 2]$

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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) $\sqrt{26}$ units^2 b) $\sqrt{706}$ units^2

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

6. a) 93 units^3 b) 37 units^3

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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

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