Homework: Lecture 4

Asen Markov

4.2

a) $A \times B = (3.5, 0, 0) \times (1.75, 3.5, 0) = \begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ 3.5 & 0 & 0 \\ 1.75 & 3.5 & 0 \end{vmatrix} = (0, 0, 12.25)$

b) $A \times B = (3, -3, 1) \times (4, 9, 3) = \begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ 3 & -3 & 1 \\ 4 & 9 & 3 \end{vmatrix} = (-18, -5, 39)$

c) *Area* = $\|A \times B\| = \|(3, -3, 1) \times (4, 9, 3)\| = \| \begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ 3 & -3 & 1 \\ 4 & 9 & 3 \end{vmatrix} \| =$
$\|(-18, -5, 39)\| = \sqrt{1870} \approx 43.243$

d) *Area* = $\|A \times B\| = \|(3, -3, 1) \times (-12, 12, 4)\| = \| \begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ 3 & -3 & 1 \\ -12 & 12 & 4 \end{vmatrix} \| =$
$\|(0, 0, 0)\| = 0$

4.3

a)

- $A = (-1.75, -1.75, -3)$
- $B = (1.75, -1.75, -3)$
- $C = (0, 1.75, -3)$

$\Rightarrow E_0 = B - A = (3.5, 0, 0)$

$\Rightarrow E_1 = C - A = (1.75, 3.5, 0)$

$N = E_0 \times E_1 = (0, 0, 12.25)$

$\hat{N} = (0, 0, 1)$

Area = $\frac{\|E_0 \times E_1\|}{2} = \frac{12.25}{2} = 6.125$

b)

- $A = (0, 0, -1)$
- $B = (1, 0, 1)$
- $C = (-1, 0, 1)$

$\Rightarrow E_0 = B - A = (1, 0, 2)$

$\Rightarrow E_1 = C - A = (-1, 0, 2)$

$$N = E_0 \times E_1 = \begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ 1 & 0 & 2 \\ -1 & 0 & 2 \end{vmatrix} = (0, -4, 0)$$

$\hat{N} = (0, -1, 0)$

Area = $\frac{\|E_0 \times E_1\|}{2} = \frac{4}{2} = 2$

c)

- $A = (0.56, 1.11, 1.23)$
- $B = (0.44, -2.368, -0.54)$
- $C = (-1.56, 0.15, -1.92)$

$\Rightarrow E_0 = B - A = (-0.12, -3.478, -1.77)$

$\Rightarrow E_1 = C - A = (-2.12, -0.96, -3.15)$

$$N = E_0 \times E_1 = \begin{vmatrix} \hat{\mathbf{i}} & \hat{\mathbf{j}} & \hat{\mathbf{k}} \\ 0.12 & -3.478 & -1.77 \\ 2.12 & -0.96 & -3.15 \end{vmatrix} = (9.2565, 3.3744, -7.25816)$$

$\hat{N} \approx (0.7564, 0.2757, -0.5931)$

Area = $\frac{\|E_0 \times E_1\|}{2} \approx \frac{12.2372}{2} = 6.1186$