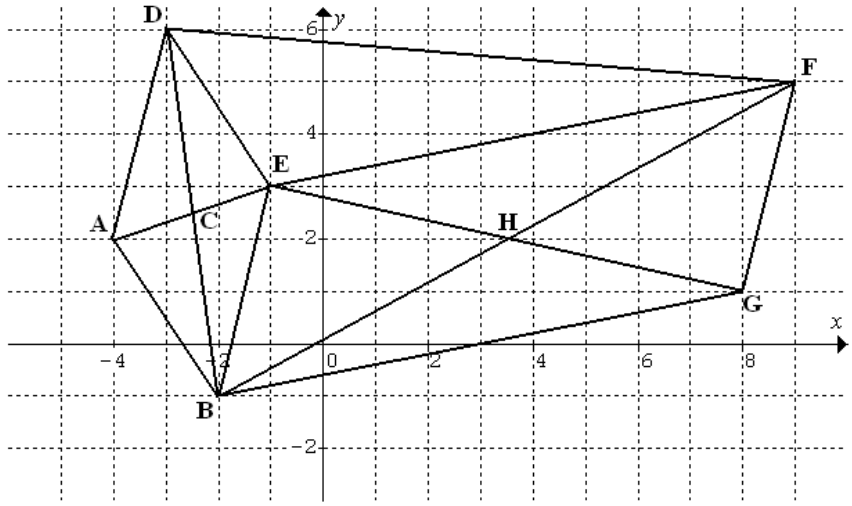
Vector Basics name: ____

[1 – 7] Use the diagram at the right.



[1] Write each of the following in component form as an ordered pair and using unit vectors $\mathbf{i}$ and $\mathbf{j}$.

[a] $\mathbf{BE} = \langle \quad , \quad \rangle =$ _______________

[b] $\mathbf{EB} = \langle \quad , \quad \rangle =$ _______________

[c] $\mathbf{FD} = \langle \quad , \quad \rangle =$ _______________

[d] $\mathbf{AE} = \langle \quad , \quad \rangle =$ _______________

[2] Evaluate each of the following. Give the exact answer and an approximation to the nearest tenth.

[a] the length of **AE**

[b] the norm of **DF**

[c] $\|\mathbf{AB}\|$

[d] $\|\mathbf{AC}\|$

[e] $\|\mathbf{EF}\|$

[f] $\|\mathbf{CD}\|$

[5] Find each sum or difference. Some answers may be vectors that are not shown in the diagram.

[a] **BA** + **BE** = _______ [b] **BA** – **BE** = _______ [c] **FE** + **FG** = _______ [d] **FE** – **FG** = _______

[e] **DE** + **EF** = _______ [f] **FE** – **DE** = _______ [g] **DF** – **DE** = _______ [h] **AC** – **DC** = _______

[i] **BG** + **BE** = _______ [j] **BG** – **BE** = _______ [k] **BE** – **BG** = _______ [l] **EF** + **FG** = _______

[m] **BH** – **EH** – **DE** = ______ [n] **AB** + **GH** – **GB** = ______ [o] **FD** – **ED** – **FE** = ______

[p] **HE** + **EF** + **FH** = ______ [q] **EF** + **FE** = ______ [r] **AE** + **HG** + **GB** – **HE** = ______

[s] **DA** – **BC** + ½**AE** – **GB** = ______ [t] **GB** + ½**BF** – **EH** – **FE** + **FG** = ______

[6] Evaluate.

[a] $\mathbf{BG} \cdot \mathbf{BE}$

[b] $\mathbf{GF} \cdot \mathbf{FD}$

[c] $\mathbf{GF} \cdot \mathbf{GF}$

[d] $\|\mathbf{GF}\|^2$

[e] $\mathbf{BG} \cdot (\mathbf{BA} + \mathbf{BE})$

[f] $\mathbf{BG} \cdot \mathbf{BA} + \mathbf{BG} \cdot \mathbf{BE}$ (PEMDAS still applies)

[g] What can you generalize from [c] & [d]? What about [e] & [f]?

[7] Find the angle between each pair of vectors to the nearest tenth of a degree.

[a] **BG** and **BE** [b] **GF** and **FD**

[c] **BG** and **BA** [d] **EF** and **EG**

[8 – 12] Consider the following points in the plane.

A = (-3, -1), B = (-5, 2), C = (4, 8), D = (6, 5), E = (3, -1), and F = (12, 5).

[8] Write each of the following in component form as an ordered pair and using unit vectors $\mathbf{i}$ and $\mathbf{j}$.

[a] $\mathbf{AB} = \langle \quad , \quad \rangle =$ ________ [b] $\mathbf{AD} = \langle \quad , \quad \rangle =$ ________ [c] $\mathbf{AC} = \langle \quad , \quad \rangle =$ ________

[d] $\mathbf{AE} = \langle \quad , \quad \rangle =$ ________ [e] $\mathbf{AF} = \langle \quad , \quad \rangle =$ ________ [f] $\mathbf{ED} = \langle \quad , \quad \rangle =$ ________

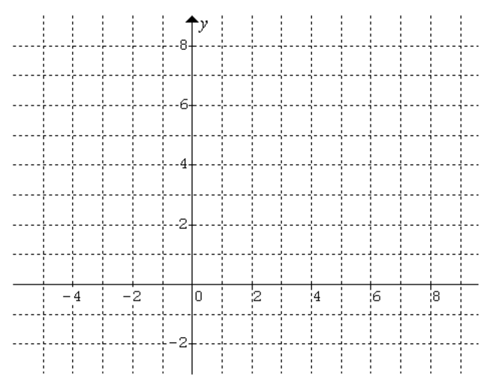
[9] Find each sum or difference. Express the answers in component form.

[a] $\mathbf{AB} + \mathbf{AD} = \langle \quad , \quad \rangle =$ ________ [b] $\mathbf{AB} - \mathbf{AD} = \langle \quad , \quad \rangle =$ ________

[c] $\mathbf{AE} + \mathbf{AD} = \langle \quad , \quad \rangle =$ ________ [d] $\mathbf{AE} - \mathbf{AD} = \langle \quad , \quad \rangle =$ ________

[10] Sketch and label the vectors **AB**, **AD**, $\mathbf{AB} + \mathbf{AD}$, and $\mathbf{AB} - \mathbf{AD}$ on the grid provided. Use the following labels:

$\mathbf{u} = \mathbf{AB}$, $\mathbf{v} = \mathbf{AD}$, $\mathbf{w} = \mathbf{AB} + \mathbf{AD}$, and $\mathbf{y} = \mathbf{AB} - \mathbf{AD}$



[11] Compute the dot products.

[a] $\mathbf{AB} \cdot \mathbf{AD}$ [b] $\mathbf{AB} \cdot \mathbf{AC}$ [c] $\mathbf{AC} \cdot \mathbf{AD}$

[12] Find the angle between each pair of vectors to the nearest thousandth of a degree.

[a] **AB** and **AD** [b] **AB** and **AC** [c] **AC** and **AD**

On another sheet of paper…

[13] Prove: $\mathbf{u} \cdot \mathbf{v} = \mathbf{v} \cdot \mathbf{u}$ (The dot product is commutative.)

[14] Use the diagram at the right and the Law of Cosines to prove that

$\cos\theta = \dfrac{\mathbf{u} \cdot \mathbf{v}}{\|\mathbf{u}\| \, \|\mathbf{v}\|}$. (You will also need to use the generalizations from [6g] above.)