

Vector Basics

name: _____

[1 – 7] Use the diagram at the right.

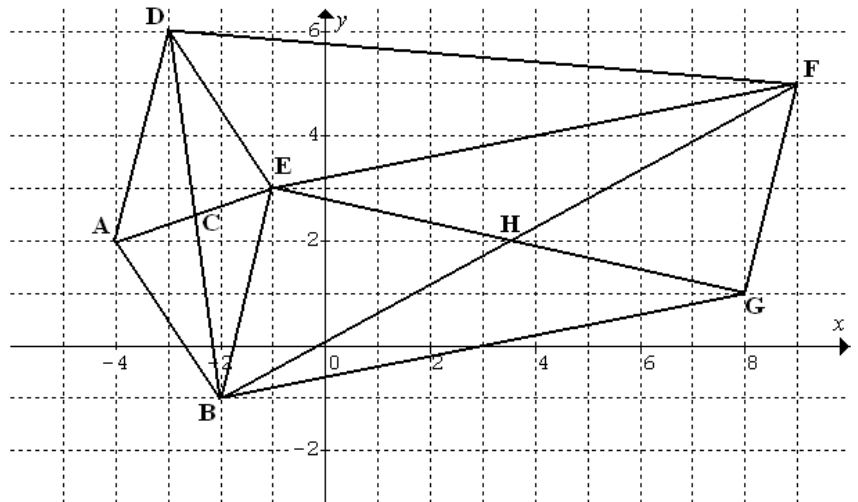
[1] Write each of the following in component form as an ordered pair and using unit vectors **i** and **j**.

[a] $\mathbf{BE} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$

[b] $\mathbf{EB} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$

[c] $\mathbf{FD} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$

[d] $\mathbf{AE} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$



[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] the magnitude of **AB**

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

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

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

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

[a] $\mathbf{BA} + \mathbf{BE} = \underline{\hspace{2cm}}$ [b] $\mathbf{BA} - \mathbf{BE} = \underline{\hspace{2cm}}$ [c] $\mathbf{FE} + \mathbf{FG} = \underline{\hspace{2cm}}$ [d] $\mathbf{FE} - \mathbf{FG} = \underline{\hspace{2cm}}$

[e] $\mathbf{DE} + \mathbf{EF} = \underline{\hspace{2cm}}$ [f] $\mathbf{FE} - \mathbf{DE} = \underline{\hspace{2cm}}$ [g] $\mathbf{DF} - \mathbf{DE} = \underline{\hspace{2cm}}$ [h] $\mathbf{AC} - \mathbf{DC} = \underline{\hspace{2cm}}$

[i] $\mathbf{BG} + \mathbf{BE} = \underline{\hspace{2cm}}$ [j] $\mathbf{BG} - \mathbf{BE} = \underline{\hspace{2cm}}$ [k] $\mathbf{BE} - \mathbf{BG} = \underline{\hspace{2cm}}$ [l] $\mathbf{EF} + \mathbf{FG} = \underline{\hspace{2cm}}$

[m] $\mathbf{BH} - \mathbf{EH} - \mathbf{DE} = \underline{\hspace{2cm}}$ [n] $\mathbf{AB} + \mathbf{GH} - \mathbf{GB} = \underline{\hspace{2cm}}$ [o] $\mathbf{FD} - \mathbf{ED} - \mathbf{FE} = \underline{\hspace{2cm}}$

[p] $\mathbf{HE} + \mathbf{EF} + \mathbf{FH} = \underline{\hspace{2cm}}$ [q] $\mathbf{EF} + \mathbf{FE} = \underline{\hspace{2cm}}$ [r] $\mathbf{AE} + \mathbf{HG} + \mathbf{GB} - \mathbf{HE} = \underline{\hspace{2cm}}$

[s] $\mathbf{DA} - \mathbf{BC} + \frac{1}{2}\mathbf{AE} - \mathbf{GB} = \underline{\hspace{2cm}}$ [t] $\mathbf{GB} + \frac{1}{2}\mathbf{BF} - \mathbf{EH} - \mathbf{FE} + \mathbf{FG} = \underline{\hspace{2cm}}$

[4] 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]?

[5] 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**

[6 – 10] 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).

[6] Write each of the following in component form as an ordered pair and using unit vectors **i** and **j**.

[a] $\mathbf{AB} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$ [b] $\mathbf{AD} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$ [c] $\mathbf{AC} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$

[d] $\mathbf{AE} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$ [e] $\mathbf{AF} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$ [f] $\mathbf{ED} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$

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

[a] $\mathbf{AB} + \mathbf{AD} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$ [b] $\mathbf{AB} - \mathbf{AD} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$

[c] $\mathbf{AE} + \mathbf{AD} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$ [d] $\mathbf{AE} - \mathbf{AD} = \begin{pmatrix} \\ \end{pmatrix} = \underline{\hspace{2cm}}$

[8] Sketch and label the vectors **AB**, **AD**, **AB + AD**, and **AB - AD** on the grid provided. Use the following labels:

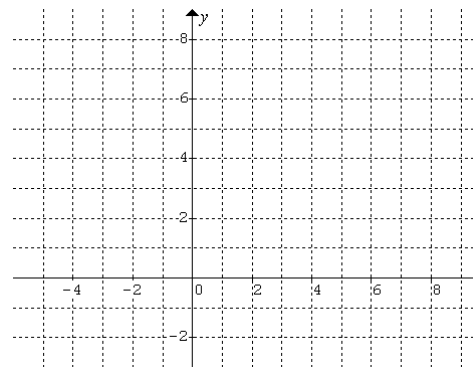
u = AB, **v = AD**, **w = AB + AD**, and **y = AB - AD**

[9] Compute the dot products.

[a] $\mathbf{AB} \cdot \mathbf{AD}$

[b] $\mathbf{AB} \cdot \mathbf{AC}$

[c] $\mathbf{AC} \cdot \mathbf{AD}$



[10] 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...

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

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

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

