Unit 2: Coordinate Geometry Version A Name KEY

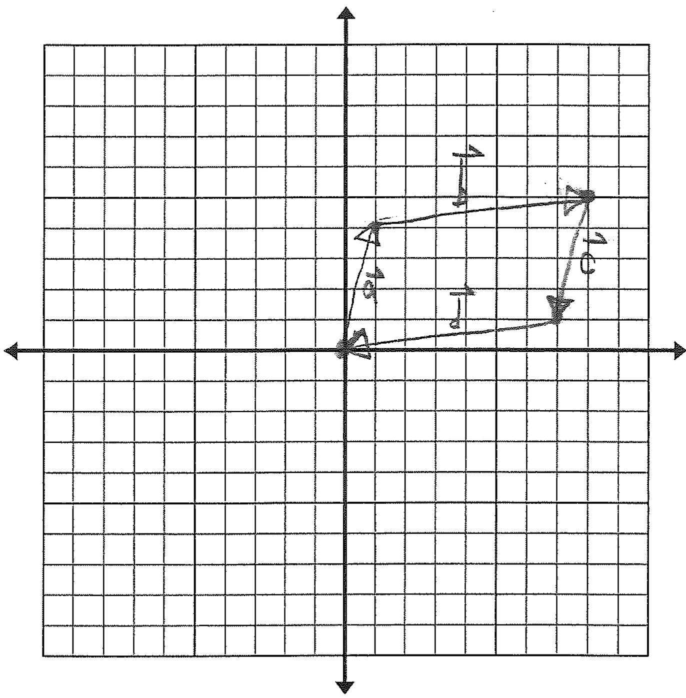
Learning Target: I can use coordinate geometry to measure and classify quadrilaterals.

SHOW ALL OF YOUR WORK.

a) Graph vectors ***A+B+C+D*** when $\vec{a}=\begin{pmatrix}1\\4\end{pmatrix}, \vec{b}=\begin{pmatrix}7\\1\end{pmatrix}, \vec{c}=\begin{pmatrix}-1\\-4\end{pmatrix}, \vec{d}=\begin{pmatrix}-7\\-1\end{pmatrix}$ on the graph below.

b) Identify any properties of the quadrilateral using magnitudes (distances) and parallel/perpendicular vectors.

c) Classify the type of quadrilateral.



After making calculations, identify properties below:

$\vec{a} \parallel \vec{c}$ and $\vec{b} \parallel \vec{d}$ • opposite vectors are parallel

$|\vec{a}| = |\vec{c}|$ and $|\vec{b}| = |\vec{d}|$ • opposite vectors have equal magnitude

• no orthogonal vectors

• not all 4 magnitudes are equal

Quadrilateral
parallelogram

Calculations

Magnitudes (lengths):

$|\vec{a}| = \sqrt{1^2+4^2}$

$|\vec{a}| = \sqrt{17}$

$|\vec{c}| = \sqrt{17}$

$|\vec{b}| = \sqrt{7^2+1^2}$

$|\vec{b}| = \sqrt{50}$

$|\vec{b}| = \sqrt{25 \cdot 2}$

$|\vec{b}| = 5\sqrt{2} = |\vec{d}|$

$\vec{a} \cdot \vec{b}$

$\begin{pmatrix}1\\4\end{pmatrix} \cdot \begin{pmatrix}7\\1\end{pmatrix} = 1(7) + 4(1) = 11$

so $\vec{a}$ is not orthogonal to $\vec{b}$

$\vec{d} \cdot \vec{c}$

$\begin{pmatrix}-7\\-1\end{pmatrix} \cdot \begin{pmatrix}-1\\-4\end{pmatrix} = -7(-1) + -1(-4) = 11$

so $\vec{d}$ is not orthogonal to $\vec{c}$

Parallel or Perpendicular Vectors:

$(-1)\vec{a} = \begin{pmatrix}1\\4\end{pmatrix}(-1) = \begin{pmatrix}-1\\-4\end{pmatrix} = \vec{c}$ so $\vec{a} \parallel \vec{c}$

$(-1)\vec{b} = \begin{pmatrix}7\\1\end{pmatrix}(-1) = \begin{pmatrix}-7\\-1\end{pmatrix} = \vec{d}$ so $\vec{b} \parallel \vec{d}$

Unit 2: Coordinate Geometry Version B Name KEY

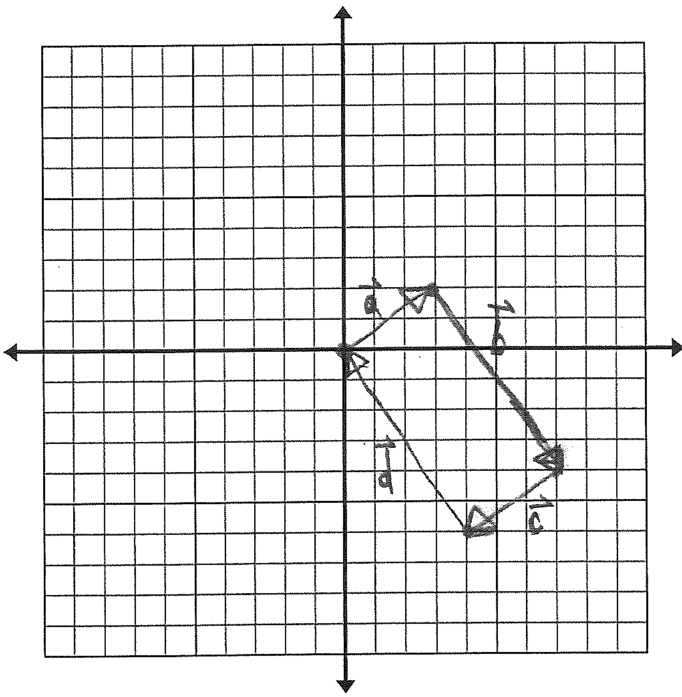
Learning Target: I can use coordinate geometry to measure and classify quadrilaterals.

SHOW ALL OF YOUR WORK.

a) Graph vectors ***A+B+C+D*** when $\vec{a}=\begin{pmatrix}3\\2\end{pmatrix},\vec{b}=\begin{pmatrix}4\\-6\end{pmatrix},\vec{c}=\begin{pmatrix}-3\\-2\end{pmatrix},\vec{d}=\begin{pmatrix}-4\\6\end{pmatrix}$ on the graph below.

b) Identify any properties of the quadrilateral using magnitudes (distances) and parallel/perpendicular vectors.

c) Classify the type of quadrilateral.



After making calculations, identify properties below: $|\vec{a}|=|\vec{c}|$ and $|\vec{b}|=|\vec{d}|$

- opposite vectors have equal magnitudes

$\vec{a}\parallel\vec{c}$ and $\vec{b}\parallel\vec{d}$

- opposite vectors are parallel

$\vec{a}\perp\vec{b}$, $\vec{b}\perp\vec{c}$, $\vec{c}\perp\vec{d}$, $\vec{d}\perp\vec{a}$

- all adjacent vectors are orthogonal so we have 4 90° angles

Quadrilateral

rectangle

Calculations

Magnitudes (lengths):

$|\vec{a}|=\sqrt{3^2+2^2}$

$|\vec{a}|=\sqrt{9+4}$

$|\vec{a}|=\sqrt{13}=|\vec{c}|$

$|\vec{b}|=\sqrt{4^2+(-6)^2}$

$|\vec{b}|=\sqrt{16+36}$

$|\vec{b}|=\sqrt{52}$

$|\vec{b}|=\sqrt{52}$

$|\vec{b}|=\sqrt{4\cdot 13}$

$|\vec{b}|=\sqrt{4}\cdot\sqrt{13}$

$|\vec{b}|=2\sqrt{13}=|\vec{d}|$

Parallel or Perpendicular Vectors:

$(-1)\vec{a}=(-1)\begin{pmatrix}3\\2\end{pmatrix}=\begin{pmatrix}-3\\-2\end{pmatrix}=\vec{c}$ so $\vec{a}\parallel\vec{c}$

$(-1)\vec{b}=(-1)\begin{pmatrix}4\\-6\end{pmatrix}=\begin{pmatrix}-4\\6\end{pmatrix}=\vec{d}$ so $\vec{b}\parallel\vec{d}$

$\vec{a}\cdot\vec{b}=\begin{pmatrix}3\\2\end{pmatrix}\cdot\begin{pmatrix}4\\-6\end{pmatrix}=3(4)+2(-6)=0$ so $\vec{a}\perp\vec{b}$

$\vec{c}\cdot\vec{d}=\begin{pmatrix}-3\\-2\end{pmatrix}\cdot\begin{pmatrix}-4\\6\end{pmatrix}=-3(-4)+-2(6)=0$ so $\vec{c}\perp\vec{d}$

$\vec{c}\cdot\vec{b}=\begin{pmatrix}-3\\-2\end{pmatrix}\cdot\begin{pmatrix}4\\-6\end{pmatrix}=-3(4)+(-2)(-6)=0$ so $\vec{c}\perp\vec{b}$

$\vec{a}\cdot\vec{d}=\begin{pmatrix}3\\2\end{pmatrix}\cdot\begin{pmatrix}-4\\6\end{pmatrix}=3(-4)+2(6)=0$ so $\vec{a}\perp\vec{d}$

Unit 2: Coordinate Geometry Version C Name KEY

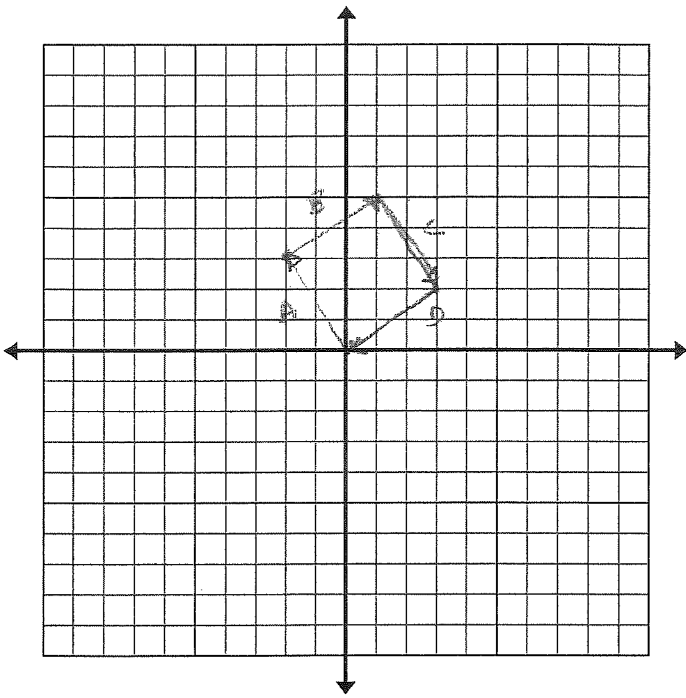
Learning Target: I can use coordinate geometry to measure and classify quadrilaterals.

SHOW ALL OF YOUR WORK.

a) Graph vectors ***A+B+C+D*** when $\vec{a} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}, \vec{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}, \vec{c} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}, \vec{d} = \begin{pmatrix} -3 \\ -2 \end{pmatrix}$ on the graph below.

b) Identify any properties of the quadrilateral using magnitudes (distances) and parallel/perpendicular vectors.

c) Classify the type of quadrilateral.



After making calculations, identify properties below:

Assume $A = \vec{a}$, $B = \vec{b}$, ETC.

- 4 equal magnitudes/lengths
- 2 sets of opposite, parallel vectors
- All adjacent vectors are orthogonal, all 90° angles

Quadrilateral Square (+ Rectangle)

Calculations

Magnitudes (lengths):

$\vec{a} = -\vec{c}$

$\vec{b} = -\vec{d}$

$|\vec{a}| = \sqrt{4+9} = \sqrt{13}$; $|\vec{c}| = \sqrt{4+9} = \sqrt{13}$

$|\vec{b}| = \sqrt{9+4} = \sqrt{13}$ $|\vec{d}| = \sqrt{9+4} = \sqrt{13}$

So $|\vec{a}| = |\vec{b}|$ and $|\vec{c}| = |\vec{d}|$

To determine ⊥ vectors their Dot product must equal zero

Parallel or Perpendicular Vectors:

$\vec{a} = (-1)(\vec{c})$; $\vec{a}$ & $\vec{c}$ are parallel vectors

$\vec{b} = (-1)(\vec{d})$; $\vec{b}$ & $\vec{d}$ are parallel vectors

(-1) is the scalar by which the vectors are multiplied

Perpendicular vectors

$\vec{a} \perp \vec{d}$; $\vec{a} \perp \vec{b}$; $\vec{b} \perp \vec{c}$, $\vec{c} \perp \vec{d}$

$\vec{a} \cdot \vec{d} = (-2)(-3) + (3)(-2) = 0$

$\vec{a} \cdot \vec{b} = (-2)(3) + (3)(2) = 0$

$\vec{b} \cdot \vec{c} = (3)(2) + (2)(-3) = 0$

$\vec{c} \cdot \vec{d} = (2)(-3) + (-3)(-2) = 0$

Unit 2: Coordinate Geometry Version D Name KEY

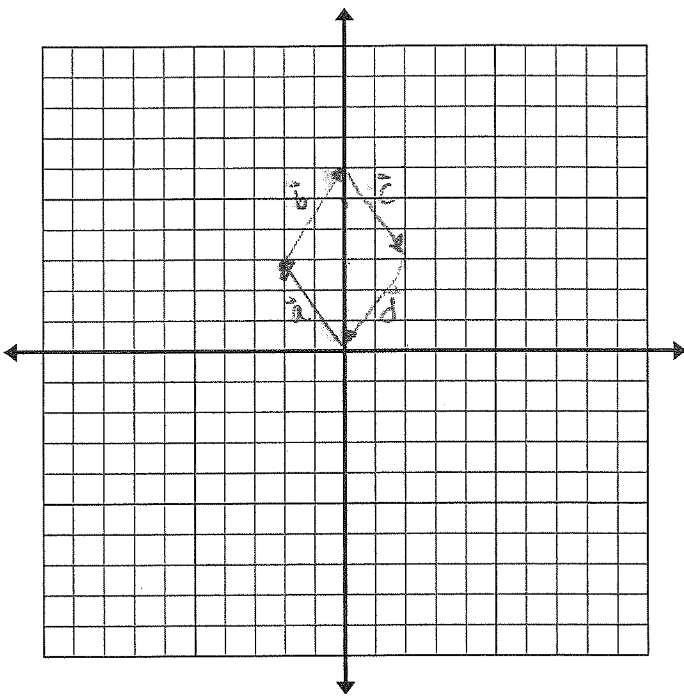
Learning Target: I can use coordinate geometry to measure and classify quadrilaterals.

SHOW ALL OF YOUR WORK.

a) Graph vectors ***A+B+C+D*** when $\vec{a}=\begin{pmatrix}-2\\3\end{pmatrix}, \vec{b}=\begin{pmatrix}2\\3\end{pmatrix}, \vec{c}=\begin{pmatrix}2\\-3\end{pmatrix}, \vec{d}=\begin{pmatrix}-2\\-3\end{pmatrix}$ on the graph below.

b) Identify any properties of the quadrilateral using magnitudes (distances) and parallel/perpendicular vectors.

c) Classify the type of quadrilateral.



After making calculations, identify properties below:

- 4 equal magnitudes/lengths
- 2 sets of opposite, parallel vectors
- No 90° angles, no orthogonal vectors

Quadrilateral

Rhombus

Calculations

Magnitudes (lengths):

$|\vec{a}| = |\vec{b}| = |\vec{c}| = |\vec{d}| = \sqrt{13}$

$|\vec{a}| = \sqrt{(-2)^2+3^2} = \sqrt{4+9} = \sqrt{13}$

Parallel or Perpendicular Vectors:

Parallel

$\vec{a} \parallel \vec{c} \Rightarrow \vec{a} = (-1)\vec{c}$

$\vec{b} \parallel \vec{d} \Rightarrow \vec{b} = (-1)\vec{d}$

No perpendicular vectors detected by the application of the Dot Product

$\vec{a}\cdot\vec{b} = \begin{pmatrix}-2\\3\end{pmatrix}\cdot\begin{pmatrix}2\\3\end{pmatrix} = -2(2)+3(3)=5$ not orthogonal

$\vec{b}\cdot\vec{c} = \begin{pmatrix}2\\3\end{pmatrix}\cdot\begin{pmatrix}2\\-3\end{pmatrix} = 2(2)+3(-3)=-5$ not orthogonal

Unit 2: Coordinate Geometry Version E Name KEY

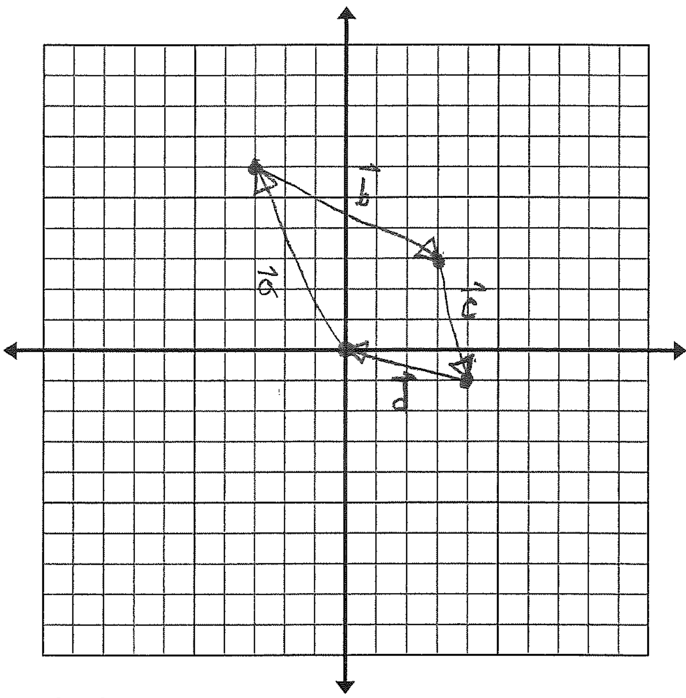
Learning Target: I can use coordinate geometry to measure and classify quadrilaterals.

SHOW ALL OF YOUR WORK.

a) Graph vectors ***A+B+C+D*** when $\vec{a}=\begin{pmatrix}-3\\6\end{pmatrix},\vec{b}=\begin{pmatrix}6\\-3\end{pmatrix},\vec{c}=\begin{pmatrix}1\\-4\end{pmatrix},\vec{d}=\begin{pmatrix}-4\\1\end{pmatrix}$ on the graph below.

b) Identify any properties of the quadrilateral using magnitudes (distances) and parallel/perpendicular vectors.

c) Classify the type of quadrilateral.



After making calculations, identify properties below: $|\vec{a}|=|\vec{b}|$ and $|\vec{c}|=|\vec{d}|$

- 2 sets of adjacent vectors with equal magnitudes/lengths
- No parallel vectors
- Orthogonal diagonals

Quadrilateral

Kite

Diagonal Vectors are orthogonal:

$\begin{pmatrix}-7\\7\end{pmatrix}\cdot\begin{pmatrix}3\\3\end{pmatrix}=-7(3)+7(3)$

$=0$

Calculations

Magnitudes (lengths):

$|\vec{a}|=\sqrt{(-3)^2+6^2}$

$|\vec{a}|=\sqrt{9+36}$

$|\vec{a}|=\sqrt{45}$

$|\vec{a}|=\sqrt{9\cdot5}$

$|\vec{a}|=3\sqrt{5}=|\vec{b}|$

$|\vec{c}|=\sqrt{1^2+(-4)^2}$

$|\vec{c}|=\sqrt{1+16}$

$|\vec{c}|=\sqrt{17}=|\vec{d}|$

Parallel or Perpendicular Vectors:

There are no scalar multiples of vectors so there are no parallel vectors.

$\vec{b}\cdot\vec{c}=\begin{pmatrix}6\\-3\end{pmatrix}\cdot\begin{pmatrix}1\\-4\end{pmatrix}=6(1)+-3(-4)=6+12=18 \Rightarrow$ not orthogonal

$\vec{a}\cdot\vec{b}=\begin{pmatrix}-3\\6\end{pmatrix}\cdot\begin{pmatrix}6\\-3\end{pmatrix}=-3(6)+6(-3)=-18+-18=-36 \Rightarrow$ not orthogonal

Unit 2: Coordinate Geometry Version F Name KEY

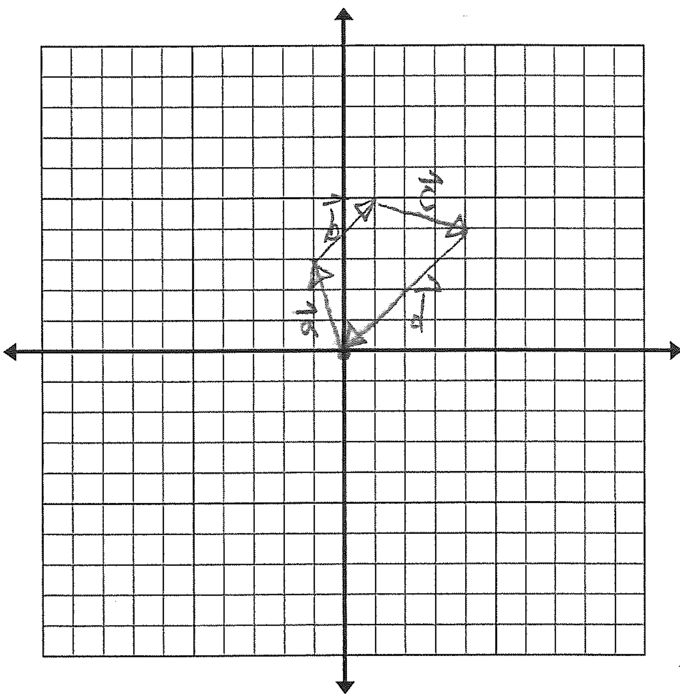
Learning Target: I can use coordinate geometry to measure and classify quadrilaterals.

SHOW ALL OF YOUR WORK.

a) Graph vectors ***A+B+C+D*** when $\vec{a}=\begin{pmatrix}-1\\3\end{pmatrix},\vec{b}=\begin{pmatrix}2\\2\end{pmatrix},\vec{c}=\begin{pmatrix}3\\-1\end{pmatrix},\vec{d}=\begin{pmatrix}-4\\-4\end{pmatrix}$ on the graph below.

b) Identify any properties of the quadrilateral using magnitudes (distances) and parallel/perpendicular vectors.

c) Classify the type of quadrilateral.



After making calculations, identify properties below:

- No orthogonal vectors, no 90° angles
- One set of opposite, parallel vectors (Trapezoid) $\vec{b} \parallel \vec{d}$
- One set of opposite vectors of equal magnitude/length $|\vec{a}| = |\vec{c}|$ (not parallel) (isosceles)

Quadrilateral

Isosceles Trapezoid

Calculations

Magnitudes (lengths):

$|\vec{a}| = \sqrt{(-1)^2+3^2}$

$|\vec{a}| = \sqrt{1+9}$

$|\vec{a}| = \sqrt{10} = |\vec{c}|$

$|\vec{b}| = \sqrt{2^2+2^2}$

$|\vec{b}| = \sqrt{4+4}$

$|\vec{b}|\ \sqrt{8} = \sqrt{4\cdot 2} = \sqrt{4}\cdot\sqrt{2}$

$|\vec{b}| = 2\sqrt{2}$

$|\vec{d}| = \sqrt{(-4)^2+(-4)^2}$

$|\vec{d}| = \sqrt{16+16}$

$|\vec{d}| = \sqrt{32} = \sqrt{16\cdot 2}$

$|\vec{d}| = 4\sqrt{2}$

Parallel or Perpendicular Vectors:

$\vec{b} \parallel \vec{d}$ since $-2\begin{pmatrix}2\\2\end{pmatrix} = \begin{pmatrix}-4\\-4\end{pmatrix}$

$-2\vec{b} = \vec{d}$

$\vec{b}\cdot\vec{c} = \begin{pmatrix}2\\2\end{pmatrix}\cdot\begin{pmatrix}3\\-1\end{pmatrix} = 2(3)+2(-1) = 4$ not orthogonal

$\vec{c}\cdot\vec{d} = \begin{pmatrix}3\\-1\end{pmatrix}\cdot\begin{pmatrix}-4\\-4\end{pmatrix} = 3(-4)+-1(-4) = -8$ not orthogonal