NT2B-CCT4: ADDING TWO VECTORS—MAGNITUDE OF THE RESULTANT

Three students are discussing the magnitude of the resultant of the addition of the vectors $\vec{A}$ and $\vec{B}$. Vector $\vec{A}$ has a magnitude of 5 centimeters, and vector $\vec{B}$ has a magnitude of 3 centimeters.

Alexis: *"We'd have to know the directions of the vectors to know how big the resultant is going to be."*

Bert: *"Since we are only asked about the magnitude, we don't have to worry about the directions. The magnitude is just the size, so to find the magnitude of the resultant we just have to add the sizes of the vectors. The magnitude of the resultant in this case is 8 centimeters."*

Cara: *"No, these are vectors, and to find the magnitude you have to use the Pythagorean theorem. In this case the magnitude is the square root of 34, a little less than 6 centimeters."*

Dacia: *"The resultant is the vector that you have to add to the first vector to get the second vector. In this case the resultant is 2."*

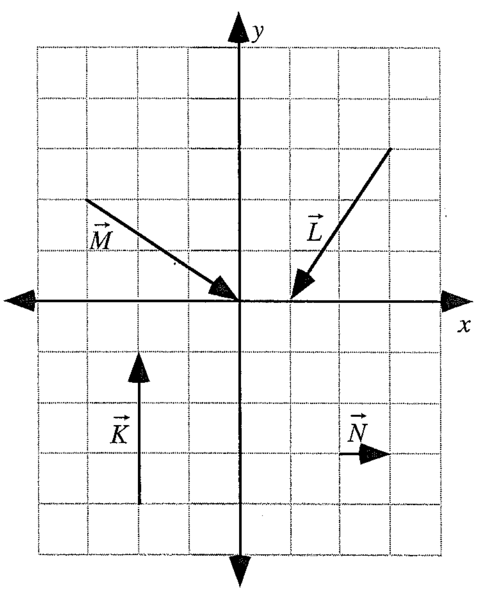
Which, if any, of these students do you agree with?

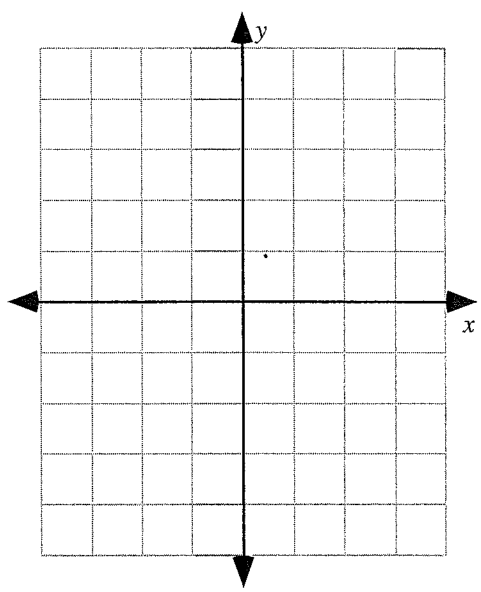
Alexis _____ Bert _____ Cara _____ Dacia_____ None of them______

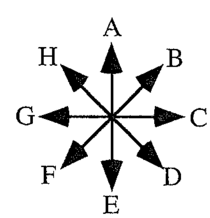
Please explain your reasoning.

NT2B-QRT5: VECTORS ON A GRID III—GRAPHICAL REPRESENTATION OF SUM

Shown below are four scaled vectors labeled $\vec{K}$, $\vec{L}$, $\vec{M}$, and $\vec{N}$ with lengths in arbitrary units.



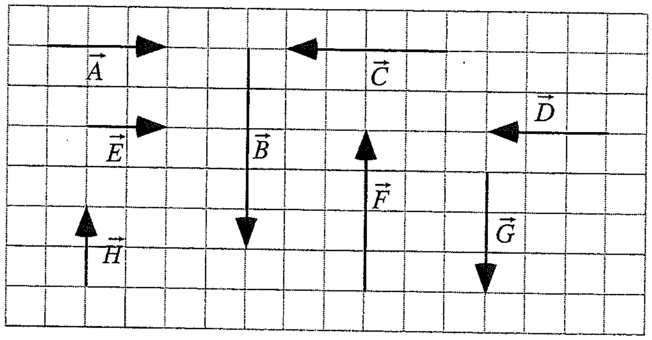




On the right, construct a graphical representation on the right of $\vec{J} = \vec{K} + \vec{L} + \vec{M} + \vec{N}$ with labels for each vector, and indicate the direction of $\vec{J}$ ____________ (closest to one of the directions listed in the direction rosette above).

NT2B-RT6: VECTORS I—RESULTANT MAGNITUDES OF ADDING TWO VECTORS

Eight vectors are shown superimposed on a grid.



Rank the magnitude of the vector resulting from adding vector $\vec{A}$ to each vector ($\vec{A}+\vec{A}$, $\vec{B}+\vec{A}$, $\vec{C}+\vec{A}$, etc).

Greatest 1______ 2______ 3______ 4______ 5______ 6______ 7______ 8______ Least

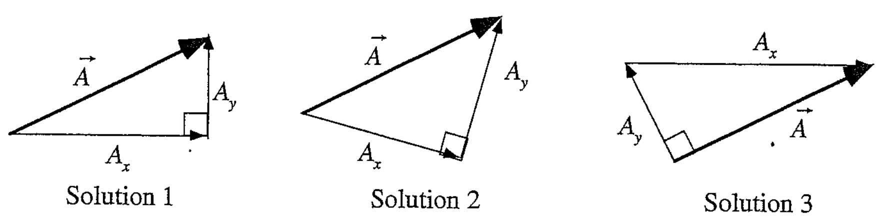
OR, All of these resulting vectors have the same magnitude. ____

OR, We cannot determine the ranking for the magnitudes of the resulting vectors. ____

Please explain your reasoning.

NT2D-CCT18: VECTOR—RESOLUTION INTO COMPONENTS

Three students are looking at three different solutions to a problem that includes the resolution of vector $\vec{A}$ into components as shown.



Ayesha: *"Only Solution 1 is right. When we resolve a vector, we have to break it up into its x- and y-components so that the components add up to the original vector."*

Bashir: *"Solution 3 is right as well. The components still add to vector A, and the vectors still form a right triangle."*

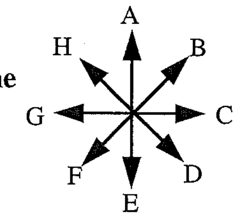
Claudio: *"All three are right. The only difference is the choice of coordinate axes, and that will depend on what is most convenient for the problem solution."*

Which, if any, of these students do you agree with?

Ayesha _____ Bashir _____ Claudio _____ None of them______

Please explain your reasoning.

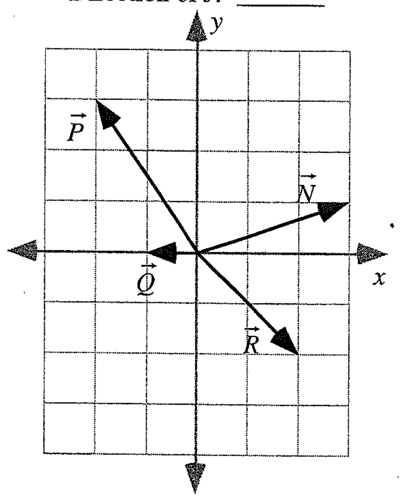
NT2B-QRT9: VECTOR COMBINATION II—DIRECTION OF RESULTANT



For each situation below, combine the vectors as indicated and determine the direction of the resultant vector. Then select the closest direction to the resultant from the direction rosette at the right.

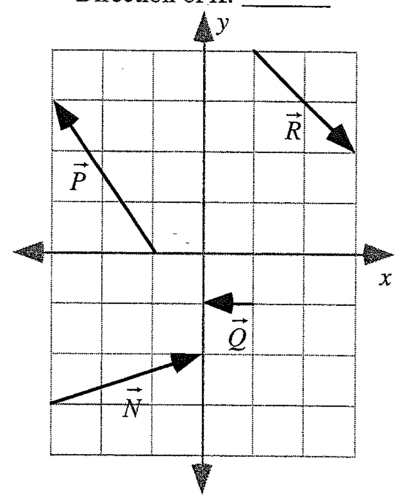
$\vec{J} = \vec{N} + \vec{P} + \vec{Q} + \vec{R}$

Direction of $\vec{J}$: _______



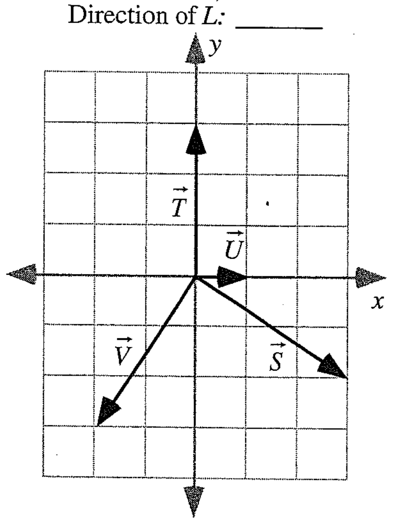
$\vec{K} = \vec{P} + \vec{R} + \vec{N} + \vec{Q}$

Direction of $\vec{K}$: _______



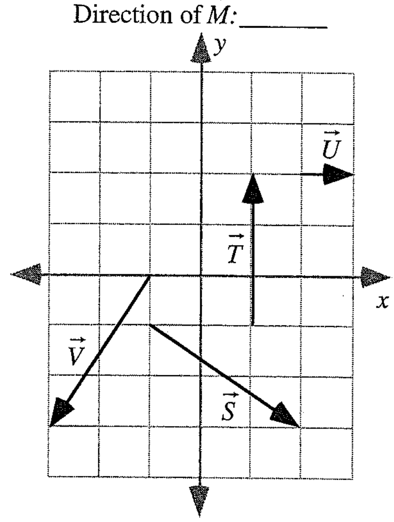
$\vec{L} = -\vec{S} - \vec{T} + \vec{U} - \vec{V}$

Direction of $\vec{L}$: _______



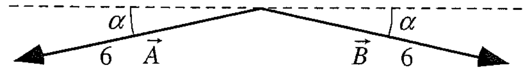
$\vec{M} = \vec{U} - \vec{T} - \vec{V} - \vec{S}$

Direction of $\vec{M}$: _______



NT2C-CCT10: TWO VECTORS—VECTOR DIFFERENCE

Two vectors labeled $\vec{A}$ and $\vec{B}$, each having a length of 6 meters, make a small angle α with the horizontal as shown. Four students are arguing about the vector difference $\vec{C} = \vec{A} - \vec{B}$.



Arlo: *"Since we're subtracting vector B, we flip it around so it points in the same direction as vector A. The difference will be 12 meters long and will point in the same direction as vector A."*

Bob: *"We're subtracting, so the resultant will be smaller than six. Both vectors point down, so the difference will point down as well."*

Celine: *"When you flip vector B around to get negative B, it points up and to the left. Then we add it to vector A, we get a long vector pointing horizontally to the right."*

Delbert: *"Both vectors are 6 meters long, so the difference is zero. It doesn't point in any direction."*

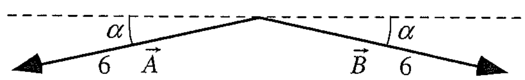
Which, if any, of these students do you agree with?

Arlo _____ Bob _____ Celine _____ Delbert _____ None of them_____

Please explain your reasoning.

NT2C-CT11: TWO VECTORS—Vector SUM AND DIFFERENCE

Two vectors labeled $\vec{A}$ and $\vec{B}$ each have a magnitude of 6 meters, and each makes a small angle α with the horizontal as shown. Let $\vec{C} = \vec{A} + \vec{B}$ and $\vec{D} = \vec{A} - \vec{B}$.

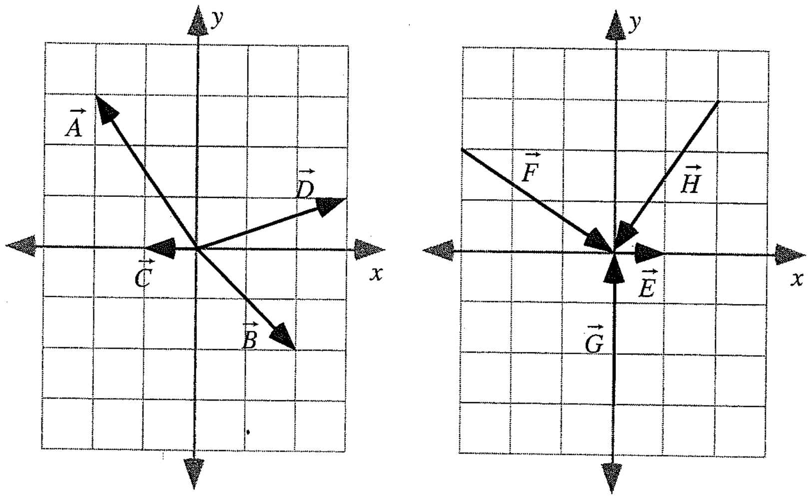


Is the magnitude of $\vec{C}$ *greater than, less than,* or *equal to* the magnitude of $\vec{D}$?

Please explain your reasoning.

NT2D-QRT16: FORCE VECTORS—PROPERTIES OF COMPONENTS

Shown below are vector diagrams representing two sets of forces.



1. List all the forces that have a zero *x*-component:

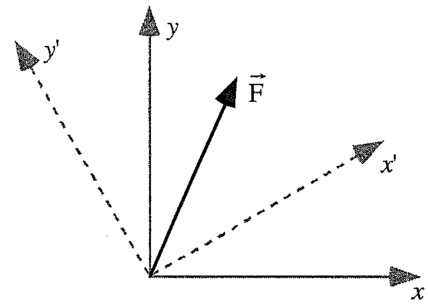
2. List all the forces that have a zero *y*-component:

3. List all the forces that have an *x*-component pointing in the positive *x*-direction:

4. List all the forces that have a *y*-component pointing in the negative *y*-direction:

NT2D-CT19: Vector on Rotated Axes—Components

Shown below is a vector $\vec{F}$ and two sets of axes that are at some angle relative to each other.



(a) Is the magnitude of $\vec{F}_x$ (the x-component of $\vec{F}$) *greater than, less than,* or *equal to* $\vec{F}_{x'}$ (the x'-component of $\vec{F}$)?
Explain.

(b) Is the magnitude of $\vec{F}_y$ (the y-component of $\vec{F}$) *greater than, less than,* or *equal to* $\vec{F}_{y'}$ (the y'-component of $\vec{F}$)?
Explain.

NT2D-CCT20: Vector Components—Resultant Vectors

Two vectors have components (A_x, A_y) and (B_x, B_y) where A_x is equal to B_y and A_y is equal to B_x. Three students make the following contentions:

Antonio: *"I think since these two vectors have components that are equal to each other the two vectors have to be equal also."*

Benito: *"No, I don't think we can say anything about how these two vectors compare because the same components are not equal for the two of them."*

Carlito: *"Well I disagree with both of you. The two vectors do have the same magnitude, but they do not have the same direction."*

Which, if any, of these three students do you agree with and think is correct?

Antonio _____ Benito _____ Carlito _____ None of them______

Please explain your reasoning.