PHYS 1211, QUIZ 1, September 8, 2017

NAME: ID:

Consider 3 vectors: $\vec{A}\left(A=2.0,\theta=60^\circ\right)$; $\vec{B}\left(B=4.0,\theta=150^\circ\right)$; $\vec{C}\left(C=2.366,\theta=90^\circ\right)$

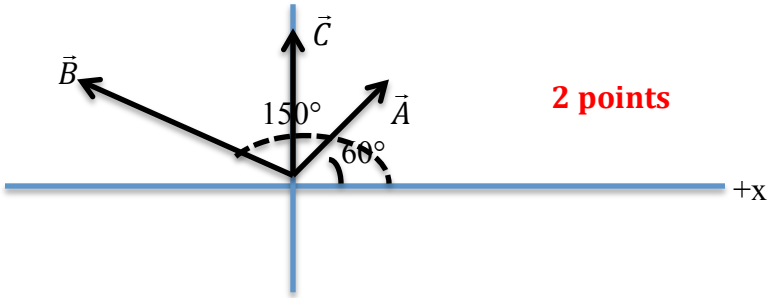
A) Express $\vec{A}$, $\vec{B}$ and $\vec{C}$ in **2D unit vector** ($\hat{i}$, $\hat{j}$) **form**. Plot them on an x-y graph.

$A_x=2.0\cos 60^\circ=1.0$ and $A_y=2.0\sin 60^\circ=1.732$, 1st quadrant, $\vec{A}=\hat{i}+1.732\hat{j}$ **1 point**

$B_x=4.0\cos 150^\circ=-3.464$ and $B_y=4.0\sin 150^\circ=2.0$, 2nd quadrant, $\vec{B}=-3.464\hat{i}+2.0\hat{j}$ **1 point**

$C_x=2.366\cos 90^\circ=0$ and $C_y=2.366\sin 90^\circ=2.366$, $\vec{C}=2.366\hat{j}$ **1 point**

NOTE that full grade only if answer is in **unit vector form**: $\vec{A}=\hat{i}+1.732\hat{j}$; $\vec{B}=-3.464\hat{i}+2.0\hat{j}$; $\vec{C}=2.366\hat{j}$.



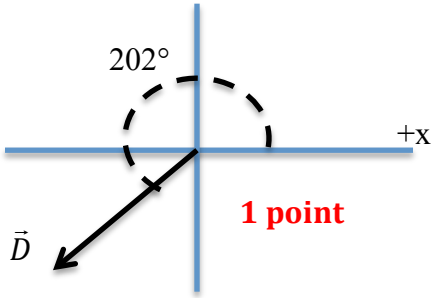
2 points

B) Using the results of part A, calculate $\vec{D}=\vec{A}+\vec{B}-2\vec{C}$, in 2D unit vector ($\hat{i}$, $\hat{j}$) form. Find the **magnitude**, $D=\left|\vec{D}\right|$ and **angle** θ of $\vec{D}$. Plot $\vec{D}$ on an x-y graph.

$D_x=A_x+B_x-2C_x=1.0-3.464-2\times 0=-2.464$ **1 point**

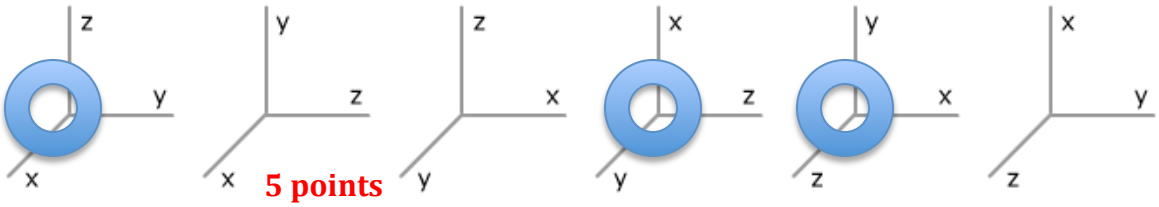
$D_y=A_y+B_y-2C_y=1.732+2.0-2\left(2.366\right)=-1.0$ **1 point**

$D=\sqrt{D_x^2+D_y^2}=2.659$, angle $\tan^{-1}\dfrac{D_y}{D_x}=22.08^\circ$, but since $D_x<0$ and $D_y<0$, $\vec{D}$ is in the 3rd quadrant, and the angle **counterclockwise** (ccw) **with respect to** (wrt) +x axis is $\theta=180^\circ+22.08^\circ=202.08^\circ$. The resultant vector is $\vec{D}\left(D=2.7,\theta=202^\circ\right)$, or in **unit vector form** $\vec{D}=-2.464\hat{i}-\hat{j}$. **1 point** **1 point**



1 point

C) Which of the Cartesian coordinate system below are **right handed**? **Circle them**!



5 points

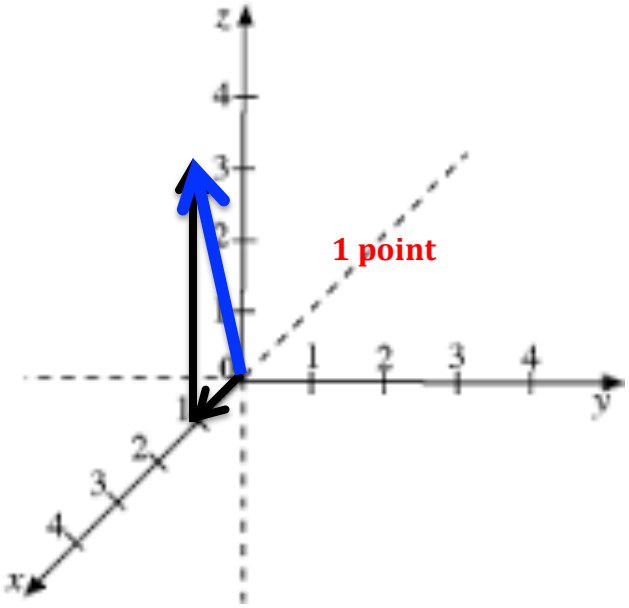
D) Given $\vec{A}=-2\hat{i}+3\hat{k}$, $\vec{B}=-5\hat{i}+3\hat{k}$, $\vec{C}=11.2\hat{i}-77\hat{j}+12\hat{k}$. Find $\vec{D}=2\vec{A}-\vec{B}+0\times\vec{C}$ in **unit vector form**. Find the **magnitude**, $D=\left|\vec{D}\right|$. **Plot** $\vec{D}$ on the right-handed Cartesian coordinate below.

Note $\vec{D}=2\vec{A}-\vec{B}+0\times\vec{C}=2\vec{A}-\vec{B}=2\left(-2\hat{i}+3\hat{k}\right)-\left(-5\hat{i}+3\hat{k}\right)$

$\vec{D}=-4\hat{i}+6\hat{k}+5\hat{i}-3\hat{k}=\hat{i}+3\hat{k}$, **3 points**

$D=\left|\vec{D}\right|=\sqrt{D_x^2+D_y^2+D_z^2}=\sqrt{1^2+0^2+3^2}=3.16=3.$ **1 point**

$\vec{D}$ is the **blue arrow**



1 point