National University

of Computer & Emerging Sciences

Applied Physics (NS-1001) | **Quiz # 1** | **Fall 2025**

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Name: | **Roll #:**

Section: BCS-A | **CLO1** | **Date: 03-09-2025**

Q.1: Three vectors $\vec{a}$, $\vec{b}$, and $\vec{c}$ each have a magnitude of 50 m and lie in an xy plane. Their directions relative to the positive direction of the x axis are 30°, 195°, and 315°, respectively. What are (a) the magnitude and (b) the angle of the vector $\vec{a}+\vec{b}+\vec{c}$? Draw the vector diagram as well. (6M)

$|\vec{a}| = |\vec{b}| = |\vec{c}| = 50m$

$\theta_a = 30°, \ \theta_b = 195°, \ \theta_c = 315°$

$\vec{R} = \vec{a} + \vec{b} + \vec{C}$

$\vec{R} = R_x\hat{i} + R_y\hat{j}$

(1) $a_x = a\cos 30° = 50\cos 30° = 43.3$
$a_y = a\sin 30° = 50\sin 30° = 25$

(1) $b_x = b\cos 195° = 50\cos 195° = -48.2$
$b_y = b\sin 195° = 50\sin 195° = -12.94$

(1) $c_x = c\cos 315° = 50\cos 315° = 35.4$
$c_y = c\sin 315° = 50\sin 315° = -35.4$

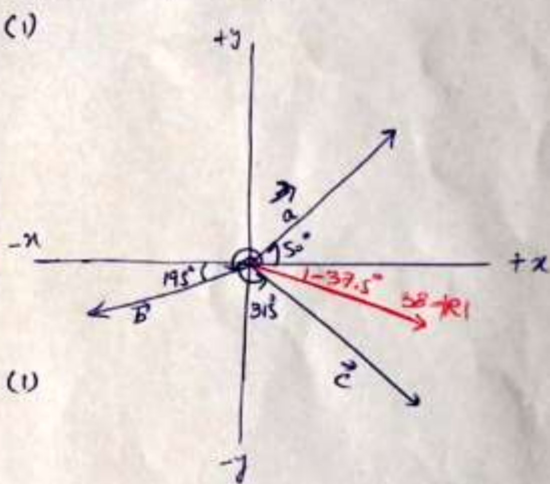
$\vec{R} = (30.4m)\hat{i} - (23.3m)\hat{j}$

$|\vec{R}| = \sqrt{(30.4m)^2 + (23.3m)^2}$

(1.0) $\boxed{|\vec{R}| = 38m}$

$\theta_R = \tan^{-1}\left(\frac{-23.3}{30.4}\right) = -37.5°$ or $322.5°$

(1)



(1)

Q.2: Find the divergence of the following function (4M)

$$\vec{F} = (x^2 - y^2 + x)\hat{i} - (2xy + y)\hat{j}$$

Solution:

$$\vec{\nabla}\cdot\vec{F} = \text{div}\,\vec{F} = \left(\frac{\partial}{\partial x}\hat{i} + \frac{\partial}{\partial y}\hat{j} + \frac{\partial}{\partial z}\hat{k}\right)\cdot\left((x^2-y^2+x)\hat{i} - (2xy+y)\hat{j}\right)$$

$$\vec{\nabla}\cdot\vec{F} = \frac{\partial}{\partial x}(x^2-y^2+x) - \frac{\partial}{\partial y}(2xy+y)$$

$$= 2x + 1 - \cancel{2x} - \cancel{1}$$

$$\boxed{\vec{\nabla}\cdot\vec{F} = 0}$$