National University

of Computer & Emerging Sciences

Assignment: 1 **Fall 2025** **NS 1001 Applied physics**

Due Date: 03-09-2025 (For Sections have Classes on Wednesday)

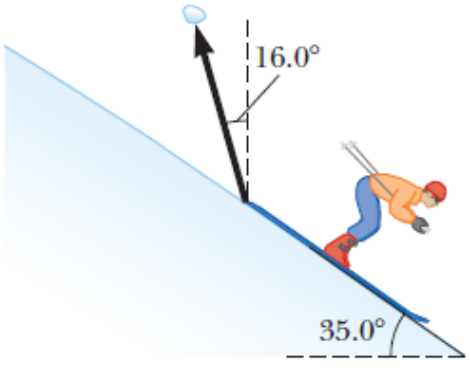
Due Date: 04-09-2025 (For Sections have Classes on Thursday)

Dear students you do not need to submit the assignment at GCR, only hard submission in handwriting is required. You will have assignment-based quiz from this assignment in your respective classes according to your timetable on campus. No late submission will be accepted.

CLO: 1 Use knowledge of scalars and vectors quantities along with operation of basic operators on it to help them in computer graphics.

Q.1. A snow-covered ski slope makes an angle of 35.0° with the horizontal. When a ski jumper plummets onto the hill, a parcel of splashed snow is thrown up to a maximum displacement of 1.50 m at 16.0° from the vertical in the uphill direction as shown in Figure. Find the components of its maximum displacement

(a) parallel to the surface and (b) perpendicular to the surface.



Q.2. Consider the three displacement vectors $\vec{A} = (3\hat{\imath} - 3\hat{\jmath})m$ $\vec{B} = (\hat{\imath} - 4\hat{\jmath})m$, and $\vec{C} = (-2\hat{\imath} + 5\hat{\jmath})m$. Use the component method to determine **(a)** the magnitude and direction of $\vec{D} = \vec{A} + \vec{B} + \vec{C}$ and **(b)** the magnitude and direction of $\vec{E} = -\vec{A} - \vec{B} + \vec{C}$.

Q.3. Vector A has a negative x component of 3.00 units in length and a positive y component 2.00 units in length. **(a)** Determine an expression for A in unit-vector notation. **(b)** Determine the magnitude and direction of A **(c)** What vector B when added to A gives a resultant vector with no x component and a negative y component 4.00 units in length?

Q.4. The height of a certain hill (in feet) is given by

$$h(x, y) = 10(2xy - 3x^2 - 4y^2 - 18x + 28y + 12)$$

Where y is the distance (in miles) North and x is the distance to east.

(a) Where is the top of a hill located?

(b) How high is the hill?

Q.5. For given vectors, calculate the divergence.

$$\mathbf{v}_a = \mathbf{r} = x\,\hat{\mathbf{x}} + y\,\hat{\mathbf{y}} + z\,\hat{\mathbf{z}},\ \mathbf{v}_b = \hat{\mathbf{z}},\ \text{and}\ \mathbf{v}_c = z\,\hat{\mathbf{z}}.$$

Q.6. For given vectors, calculate the curl.

$$\mathbf{v}_a = -y\hat{\mathbf{x}} + x\hat{\mathbf{y}},\quad \mathbf{v}_b = x\hat{\mathbf{y}}.$$

Q.7. For given vectors, calculate the gradient.

(a) $f(x, y, z) = x^2 + y^3 + z^4$.

(b) $f(x, y, z) = x^2 y^3 z^4$.

(c) $f(x, y, z) = e^x \sin(y) \ln(z)$.

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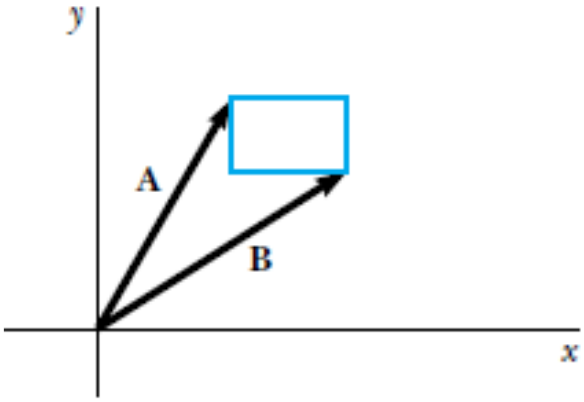
Q.8. Find the directional derivative of the function $\emptyset = x^2 - y^2 + 2z^2$ at point P (1,2,3) in the direction of the line PQ where Q is the point (5, 0, 4).

Q.9. The rectangle shown in Figure has sides parallel to the x and y-axes. The position vectors of two corners are A = 10.0 m at 50.0° and B = 12.0 m at 30.0°. **(a)** Find the perimeter of the rectangle. **(b)** Find the magnitude and direction of the vector from the origin to the upper right corner of the rectangle.



Q.10. Vectors **A** and **B** have equal magnitudes of 5.00. The sum of **A** and **B** is the vector 6.00 j^. Determine the angle between **A** and **B**.