

1. $f(x) = 5x^2(3 - 2x)$

a. Evaluate: $\frac{df}{dx}$

b. Evaluate: $\frac{d^2f}{dx^2}$

c. Evaluate: $\int_0^1 f(x) dx$

2. $g(t) = Ae^{-bt}$; $b > 0$

a. Evaluate: $\frac{dg}{dt}$

b. Evaluate: $\frac{d^2g}{dt^2}$

c. Evaluate: $\int_0^\infty g(t) dt$

3. What are the real and imaginary parts of $e^{i\phi}$?

4. $\vec{A} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{B} = \hat{i} + 3\hat{j} - 2\hat{k}$.

a. Evaluate: $\vec{A} + \vec{B}$

b. Evaluate: $\vec{A} - \vec{B}$

c. Evaluate: $\vec{A} \cdot \vec{B}$

d. Evaluate: $\vec{A} \times \vec{B}$

e. Evaluate: $|\vec{A}|$ and $|\vec{B}|$

f. Find the cosine of the angle between \vec{A} and \vec{B} .

5. $F(x,y) = 6x^2y^3 + 3y + 92$

a. Evaluate: $\frac{\partial F}{\partial x}$

b. Evaluate: $\frac{\partial F}{\partial y}$

c. Evaluate: $\frac{\partial^2 F}{\partial x \partial y}$

6. $\vec{E}(x,y,z) = xy\hat{i} + xz\hat{j} + yz\hat{k}$

a. Evaluate: $\vec{\nabla} \cdot \vec{E}$ (the divergence of \vec{E}).

b. Evaluate: $\vec{\nabla} \times \vec{E}$ (the curl of \vec{E}).

7. $V(x,y,z) = x^2 + xy + xz$

a. Evaluate: $\vec{\nabla} V$ (the gradient of V).

b. Evaluate: $\nabla^2 V$ (the Laplacian of V).

8. $\frac{\partial^2 U}{\partial \mathbf{x}^2} = \frac{1}{v^2} \frac{\partial^2 U}{\partial t^2}$ is a simple wave equation. Show that $U = \mathbf{A}e^{i(\mathbf{k}\mathbf{x} - \omega t)}$ is a solution if and only if $\mathbf{v} = \frac{\omega}{\mathbf{k}}$.

9. $G = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}; \quad H = \begin{bmatrix} 5 & 3 \\ 2 & 1 \end{bmatrix}; \quad V = \begin{bmatrix} 2 \\ 6 \end{bmatrix}$

a. Evaluate: GH

b. Evaluate: HG

c. Evaluate: GV

d. Evaluate: G^T (the transpose of G)

e. Evaluate: $\det [G]$ (the determinant of G)