

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. Write  $\sin(2 + N)$  in terms of  $\sin 2$ ,  $\sin N$ ,  $\cos 2$ ,  $\cos N$ .

4.  $\vec{A} = 2\hat{i} - \hat{j} + \hat{k}$  and  $\vec{B} = \hat{i} + 3\hat{j} - 2\hat{k}$ .
- Evaluate:  $\vec{A} + \vec{B}$
  - Evaluate:  $\vec{A} - \vec{B}$
  - Evaluate:  $\vec{A} \cdot \vec{B}$
  - Evaluate:  $\vec{A} \times \vec{B}$
  - Evaluate:  $|\vec{A}|$  and  $|\vec{B}|$
  - Find the cosine of the angle between  $\vec{A}$  and  $\vec{B}$ .

5.  $\vec{E}(t) = 2t\hat{i} - t^3\hat{j} + t^2\hat{k}$  and  $\vec{F}(t) = t^2\hat{i} + 3t\hat{j} - 2t^4\hat{k}$ .

- Evaluate:  $\frac{d\vec{E}}{dt}$
- Evaluate:  $\frac{d^2\vec{E}}{dt^2}$
- Evaluate:  $\frac{d}{dt} (\vec{E} \cdot \vec{F})$
- Evaluate:  $\int_{\vec{F}(0)}^{\vec{F}(t)} \vec{E} \cdot d\vec{F}$

6.  $\frac{d^2x}{dt^2} + k \frac{dx}{dt} = 0$  is a differential equation.

- a. Verify that  $x = 1$  is a solution.
- b. Verify that  $e^{-kt}$  is a solution.
- c. Use the above (linearly independent) special solutions to construct a general solution.
- d. Construct a solution subject to the initial conditions:

$$x = 0 \text{ at } t = 0 \text{ and } \frac{dx}{dt} = v_0 \text{ at } t = 0.$$

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

- a. Evaluate:  $GH$
- b. Evaluate:  $HG$
- c. Evaluate:  $GV$
- d. Evaluate:  $G^T$  (the transpose of  $G$ )
- e. Evaluate:  $\det [G]$  (the determinant of  $G$ )