

Instructions: Show all work. Give exact answers unless specifically asked to round. Be sure to answer all parts of each question.

1. If $A = \begin{bmatrix} 2 & -3 \\ 4 & 7 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -4 \\ 5 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 2+i & 3i \\ -i & 4-5i \end{bmatrix}$, find:

a. $A + B$

$$\begin{bmatrix} 5 & -7 \\ 9 & 8 \end{bmatrix}$$

b. $(2+i)C$

$$\begin{bmatrix} 3+4i & -3+6i \\ 1-2i & 13-6i \end{bmatrix}$$

c. $2B - 3A$

$$\begin{bmatrix} 0 & 1 \\ -2 & -19 \end{bmatrix}$$

2. Integrate $\int x^3 e^{x^2} dx$

$$u = x^2 \quad dv = x e^{x^2} dx$$

$$du = 2x dx \quad v = \frac{1}{2} e^{x^2}$$

$$\frac{1}{2} x^2 e^{x^2} - \int x e^{x^2} dx =$$

$$\frac{1}{2} x^2 e^{x^2} - \frac{1}{2} e^{x^2} + C$$

3. Find all real and complex roots of $x^4 - 8x = 0$.

$$x(x^3 - 8) = 0$$

$$x(x-2)(x^2 + 2x + 4) = 0$$

$$x = 0$$

$$x = 2$$

$$x = \frac{-2 \pm \sqrt{4 - 16}}{2}$$

$$= \frac{-2 \pm \sqrt{-12}}{2} = \frac{-2 \pm 2\sqrt{3}i}{2} = -1 \pm \sqrt{3}i$$

4. Differentiate $y = te^t \cos(\ln 2t)$.

$$\begin{aligned} y' &= e^t \cos(\ln 2t) + t e^t \cos(\ln 2t) - \cancel{t} e^t \sin(\ln 2t) \cdot \frac{2}{2t} \\ &= e^t \cos(\ln 2t) + t e^t \cos(\ln 2t) - e^t \sin(\ln 2t) \end{aligned}$$