

Maths Assignment 2
13/05/2021

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Q1. Differentiate:

a. $y = e^x \cos x$ $\frac{dy}{dx} = e^x - \sin x$

b. $y = \cos x \sin x$
 $\hookrightarrow \frac{dy}{dx} = -\sin x \cos x$

c. $y = \frac{\cos x}{\sin x}$
 $\frac{dy}{dx} = \frac{\cancel{\cos x} + \sin x \cancel{\cos x}}{\sin^2 x} = \frac{\sin x - \sin x - \cos x}{\sin^2 x}$

d. $y = \frac{3x^2}{\cos x}$ $\frac{dy}{dx} = \frac{\cos x \cdot 3 \cdot 2x}{\cos^2 x}$
 $= \frac{\cos x \cdot 6x}{\cos^2 x}$

e. $z = (3x + 2y)(4x - 5y)$

$$z = 12x^2 - 3 \times 5y + 2y \cdot 4x - 10y^2$$

$$z = 12x^2 + x(7y) - 10y^2$$

$$z = 12x^2 + 7xy - 10y^2$$

$$\frac{dy}{dx} =$$

$$g_2: z = x(12x + 7y - 10y^2)$$

$$\frac{z}{x} = 12x + 7y - 10y^2$$

$$\frac{z}{x} - 12x = 7y - 10y^2$$

Q2. a) calculate area under $y = 2x^2 + 4x + 3$
between $x=2$ and $x=5$

$$\int_2^5 (2x^2 + 4x + 3) dx = \left[\frac{2x^3}{3} + \frac{4x^2}{2} + 3x \right]_2^5$$

$$= \left[\frac{2(5)^3}{3} + \frac{4(5)^2}{2} \right] - \left[\frac{2(2)^3}{3} + \frac{4(2)^2}{2} \right]$$

$$= \frac{368}{3} \text{ units}^2 \text{ or } 122.\dot{6} \text{ units}^2$$

$$= 120 \text{ units}^2$$

b) Vectors $\overset{(a)}{\overset{x \ y \ z}{(6, 8, 0)}}$ and $\overset{(b)}{\overset{x \ y \ z}{(12, 9, 0)}}$

Cross product

$$C_x = \cancel{8 \times 0} - 0 \times 9 = 0$$

$$C_y = 0 \times 12 - 6 \times 0 = 0$$

$$C_z = 6 \times 9 - 8 \times 12 = -42$$

Dot Product

$$a \cdot b = a_x b_x + a_y b_y + a_z b_z$$

$$= 6 \times 12 + 8 \times 9 + 0 \times 0$$

$$= 144$$

$$03. a) (3+j5) - (5-4j) - (-2-3j)$$

$$= 0 - j2$$

$$b) (5+j7) + (3-j4) - (6-j3)$$

$$= 2$$

$$c) (4-j3)(4+j3)$$

$$= 16 + j12 - j12 - \cancel{j^2} 9$$

$$= 16 + 9$$

$$= 25$$

$$d) (4+j7)(4-j7)$$

$$= 16 - j28 + j28 - j^2 49$$

$$= 16 + 49$$

$$= 65$$

$$e) \frac{4-j5}{2-j} \Rightarrow \frac{\cancel{4}}{\cancel{2}} - \frac{(4-j5)(2+j)}{(2-j)(2+j)}$$

$$= \frac{8+j4-j10-j^2 5}{4+j2-j2-j^2}$$

$$= \frac{8-j6-(-5)}{4-(-1)}$$

94

$$= \frac{13-j6}{5}$$

3.
contd.

f)

$$\frac{(2+j3)(1-j2)}{3+j4}$$

$$= \frac{2-j4+j3-j^2 6}{3+j4}$$

$$= \frac{2-j+6}{3+j4}$$

$$= \frac{8+j}{3+j4}$$

$\Rightarrow$

$$\frac{(8+j)(3-j4)}{(3+j4)(3-j4)}$$

$$= \frac{24-j32+j3-j^2 4}{9-j12+j12-j^2 16}$$

$$= \frac{28-j29}{15}$$

$$= \frac{28}{15} - \frac{j29}{15}$$

PS

$$Q 4. a) A+B = \begin{vmatrix} 7 & -3 \\ -8 & 3 \end{vmatrix}$$

$$A = \begin{pmatrix} 4 & -4 \\ -7 & 1 \end{pmatrix}$$

$$b) A-B = \begin{vmatrix} 1 & -5 \\ -6 & -1 \end{vmatrix}$$

$$B = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix}$$

$$c) A \times B \begin{vmatrix} 4 \times 3 + (-4) \times (-7) & 4 \times \cancel{1} + (-4) \times 2 \\ (-7) \times \cancel{4} + 1 \times (-1) & (-7) \times (-4) + 1 \times 2 \end{vmatrix}$$

$$= \begin{vmatrix} 40 & -4 \\ -29 & 30 \end{vmatrix}$$

$$d) \text{ Determinant of } A = ad - bc \\ = \cancel{4 \times 1} - (-4) \times (-7) \\ = -24$$

e) -

$$f) \text{ Inverse of } A = A^{-1}$$

$$A^{-1} = \frac{1}{-24} \begin{vmatrix} 1 & 4 \\ 7 & 4 \end{vmatrix}$$

$$= \begin{vmatrix} \frac{1}{-24} & -\frac{1}{6} \\ -\frac{7}{24} & -\frac{1}{6} \end{vmatrix}$$