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QUESTION 1

$$\int \frac{11-3x}{x^2+2x-3}$$

$$\frac{11-3x}{x^2+2x-3} = \frac{11-3x}{(x+3)(x-1)} = \frac{A}{(x+3)} + \frac{B}{(x-1)}$$

$$\frac{11-3x}{x^2+2x-3} = \frac{A(x-1)+B(x+3)}{(x+3)(x-1)}$$

$$11-3x = A(x-1)+B(x+3)$$

At $x=1$, We have:

$$11-3(1) = A(1-1)+B(1+3)$$

$$11-3 = B(4)$$

$$8 = 4B$$

$$B = 2$$

At $x=-3$, We have

$$11-3(-3) = A(-3-1)+B(-3+3)$$

$$11+9 = A(-4)$$

$$20 = -4A$$

$$A = -5$$

$$\int \frac{11-3x}{x^2+2x-3} = \int \frac{2}{(x-1)}\,dx - \int \frac{5}{(x+3)}\,dx$$

$$\int \frac{11-3x}{x^2+2x-3} = 2\int \frac{dx}{(x-1)} - 5\int \frac{dx}{(x+3)}$$

$$\therefore \int \frac{11-3x}{x^2+2x-3} = 2\ln(x-1) - 5\ln(x+3)$$

QUESTION 2

$$\int \frac{4x-16}{x^2-2x-3}\,dx$$

SOLUTION

$$\frac{4x-16}{x^2-2x-3} = \frac{4x-16}{(x-3)(x+1)} = \frac{A}{(x-3)} + \frac{B}{(x+1)}$$

$$\frac{4x-16}{x^2-2x-3} = \frac{A(x+1)+B(x-3)}{(x-3)(x+1)}$$

$$4x-16 = A(x+1)+B(x-3)$$

At $x=-1$, we have

$$4(-1)-16 = A(-1+1)+B(-1-3)$$

$$-4-16 = B(-4)$$

$$-20 = -4B$$

$$B = 5$$

At $x=3$, we have

$$4(3)-16 = A(3+1)+B(3-3)$$

$$12-16 = A(4)$$

$$-4 = 4A$$

$$A = -1$$

$$\int \frac{4x-16}{x^2-2x-3} = \int \frac{5\,dx}{(x+1)} - \int \frac{1\,dx}{(x-3)}$$

$$\int \frac{4x-16}{x^2-2x-3} = 5\int \frac{dx}{(x+1)} - \int \frac{dx}{x-3}$$

$$\therefore \int \frac{4x-16}{x^2-2x-3} = 5\ln(x+1) - 1\ln(x-3)$$

QUESTION 3

$$\int \frac{2x^2-9x-35}{(x+1)(x-2)(x+3)}$$

$$\frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} = \frac{A}{(x+1)} + \frac{B}{(x-2)} + \frac{C}{x+3}$$

$$\frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} = \frac{A(x-2)(x+3) + B(x+1)(x+3) + C(x+1)(x-2)}{(x+1)(x-2)(x+3)}$$

$$2x^2-9x-35 = A(x-2)(x+3) + B(x+1)(x+3) + C(x+1)(x-2)$$

At $x = -1$, we have

$$2(1) - 9(-1) - 35 = A(-1-2)(-1+3)$$

$$2 + 9 - 35 = A(-3)(2)$$

$$-24 = -6A$$

$$A = 4$$

At $x = 2$, we have

$$2(4) - 9(2) - 35 = B(2+1)(2+3)$$

$$8 - 18 - 35 = B(3)(5)$$

$$-45 = 15B$$

$$B = -3$$

At $x = -3$, we have

$$2(9) - 9(-3) - 35 = C(-3+1)(-3-2)$$

$$18 + 27 - 35 = C(-2)(-5)$$

$$10 = 10C$$

$$C = 1$$

$$\int \frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} = \int \frac{4}{(x+1)}\,dx - \int \frac{3}{(x-2)}\,dx + \int \frac{dx}{(x+3)}$$

$$\int \frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} = 4\int \frac{dx}{(x+1)} - 3\int \frac{dx}{(x-2)} + \int \frac{dx}{(x+3)}$$

$$\therefore \int \frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} = 4\ln(x+1) - 3\ln(x-2) + \ln(x+3)$$