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Matric No: 19/141501090

DEPARTMENT: Medicine and Surgery

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

Firstly, factorize the denominator.

$$x^2+2x-3 = (x+3)(x-1)$$

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

H-B Multiply both sides by  $(x+3)(x-1)$

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

To find A let  $x = -3$

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

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

$$20 = -4A$$

$$-20 = -4A$$

$$-4 = -4A$$

$$A = 1$$

To find B, let  $f(x) = 1$

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

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

$$8 = 4B$$

$$2 = B$$

$$4$$

$$B = 2$$

Now input these values in eqn. \*

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

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

$$\text{For } \int \frac{1}{x+3} dx$$

$$\text{let } x+3 = u$$

$$\frac{du}{dx} = 1$$

$$du = dx$$

$$\int \frac{1}{x+3} dx = \int \frac{1}{u} du = \ln|u| + C = \ln|x+3| + C$$

$$\text{For } \int \frac{2}{x-1} dx$$

$$\text{let } x-1 = u$$

$$\frac{du}{dx} = 1$$

$$du = dx$$

$$\int \frac{2}{x-1} dx = 2 \int \frac{1}{u} du = 2 \ln|u|$$

$$= 2 \ln|x-1|$$

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

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MATRIC NO: 19/MHS01/090

DEPARTMENT: Medicine and Surgery

Input these values into eqn \*

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

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

Firstly, factorize the denominator.

$$x^2-2x-3 = (x+1)(x-3).$$

$$\frac{4x-16}{(x+1)(x-3)} = \frac{A}{x+1} + \frac{B}{x-3} \quad \text{... eqn *}$$

Multiply both sides by  $(x+1)(x-3)$

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

To find A let  $f(x) = -1$

$$= 5 \ln(x+3) \quad 4(-1) - 16 = A(-1-3)$$

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

$$-20 = -4A$$

$$-20 = A$$

$$-4$$

$$A = 5$$

To find B, let  $f(x) = 3$

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

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

$$-4 = 4B$$

$$-4 = B$$

$$4$$

$$B = -1$$

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

$$\text{For } \int \frac{5}{x+1} dx$$

$$\text{let } x+1 = u$$

$$\frac{du}{dx} = 1, \quad du = dx$$

$$\int \frac{5}{x+1} dx = 5 \int \frac{1}{u} du = 5 \ln u$$

$$\int \frac{5}{x+1} dx = 5 \ln(x+1)$$

$$\text{For } \int \frac{-1}{x-3} dx$$

$$\text{let } x-3 = u$$

$$\frac{du}{dx} = 1, \quad du = dx$$

$$\int \frac{-1}{x-3} dx = - \int \frac{1}{u} du = - \ln u = - \ln(x-3)$$

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

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DEPARTMENT: Medicine and Surgery

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

Factorise above

$$2x^2 - 9x - 35 = (2x+5)(x-7)$$

$$\frac{(2x+5)(x-7)}{(x+1)(x-2)(x+3)} = \frac{A}{x+1} + \frac{B}{x-2} + \frac{C}{x+3}$$

Multiply both sides by  $(x+1)(x-2)(x+3)$

$$(2x+5)(x-7) = A(x-2)(x+3) + B(x+1)(x+3) + C(x+1)(x-2)$$

$$(2x+5)(x-7) = A(x^2+x-6) + B(x^2+4x+3) + C(x^2-x-2)$$

To find A, let  $x = -1$

$$(-2+5)(-1-7) = A(-1-1-6)$$

$$(3)(-8) = A(-6)$$

$$-24 = -6A$$

$$-24 = A$$

$$-8$$

$$A = 8$$

To find B, let  $x = 2$

$$(4+5)(2-7) = B(4+8+3)$$

$$(9)(-5) = B(15)$$

$$-45 = 15B$$

$$-45 = B$$

$$15$$

$$B = -3$$

To find C, let  $x = -3$

$$(-6+5)(-3-7) = C(9+3-2)$$

$$(-1)(-10) = C(10)$$

$$-10 = 10C$$

$$C = 1$$

$$\therefore \frac{(2x+5)(x-7)}{(x+1)(x-2)(x+3)} = \frac{8}{x+1} + \frac{-3}{x-2} + \frac{1}{x+3}$$

$$\int \frac{(2x+5)(x-7)}{(x+1)(x-2)(x+3)} dx = \int \frac{8}{x+1} dx - \int \frac{3}{x-2} dx + \int \frac{1}{x+3} dx$$

$$\text{For } \int \frac{4}{x+1} dx$$

$$u = x+1$$

$$\frac{du}{dx} = 1, du = dx$$

$$\int \frac{4}{x+1} dx = 4 \int \frac{1}{u} du = 4 \ln u$$

$$= 4 \ln(x+1)$$

$$c) = 2 \\ -8+3)$$

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$$\text{For } \int \frac{3}{x-2} dx$$

$$\text{let } u = x-2$$

$$\frac{du}{dx} = 1, du = dx$$

$$) = -3.$$

$$+3-2)$$

$$\int \frac{3}{x-2} dx = 3 \int \frac{1}{u} du = 3 \ln |u| \\ = 3 \ln(x-2).$$

$$\text{For } \int \frac{1}{x+3} dx$$

$$\text{let } u = x+3$$

$$\frac{du}{dx} = 1, du = dx.$$

$$\frac{-3}{x-2} + \frac{1}{x+3}$$

$$dx - \int \frac{3}{x-2} dx$$

$$\int \frac{1}{x+3} dx = \int \frac{1}{u} du = \ln |u|$$

$$\frac{dx}{+3}$$

$$= \ln(x+3).$$

$$\therefore \int \frac{(x+5)(x-7)}{(x+1)(x-2)(x+3)} dx = 4 \ln(x+1) - 3 \ln(x-2) \\ + \ln(x+3).$$

$$= 4 \ln u$$