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MATRIC NO: 19/MH501/306

DEPARTMENT: Medicine and Surgery

COURSE: Mathematics 104

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

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

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

Divide all through by  $(x-1)(x+3)$

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

when  $x = -3$

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

$$11+9 = B(-3-1)$$

$$11+9 = -4B$$

$$B = \frac{20}{-4}$$

$$B = -5$$

when  $x = 1$

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

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

$$8 = 4A$$

$$A = \frac{8}{4}$$

$$A = 2$$

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

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

NAME: OJELADE OLUWAPELUMI DEBORAH

MATRIC NO: 191MHS011306

DEPARTMENT: Medicine and Surgery

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

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

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

Multiply all by  $(x-3)(x+1)$

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

When  $x = -1$

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

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

$$-20 = B(-4)$$

$$-20 = -4B$$

$$B = \frac{-20}{-4}$$

$$B = 5$$

When  $x = 3$

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

$$12 - 16 = A(3+1)$$

$$-4 = 4A$$

$$A = \frac{-4}{4}$$

$$A = -1$$

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

Let  $u = x-3$

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

Let  $u = x+1$

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

NAME: OJCLADE OLUWAPELUMI DEBORAH

MATRIC NO: 19/MHS011306

DEPARTMENT: Medicine and Surgery.

$$2) \therefore \frac{-1 dx}{4} + \frac{5 dx}{4}$$

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

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

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

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

$$\frac{A[(x-2)(x+3)] + B[(x+1)(x+3)] + C[(x+1)(x-2)]}{(x+1)(x-2)(x+3)}$$

$$\frac{A[x^2+3x-2x-6] + B[x^2+3x+x+3] + C[x^2-2x+x-2]}{(x+1)(x-2)(x+3)}$$

$$\frac{Ax^2 + Ax - 6A + Bx^2 + 4Bx + 3B + Cx^2 - 2Cx - 2C}{(x+1)(x-2)(x+3)}$$

$$\frac{x^2[A+B+C] + x[A+4B-C] + [-6A+3B-2C]}{(x+1)(x-2)(x+3)}$$

$$\frac{2x^2-9x-35}{(x+1)(x-2)(x+3)} = \frac{x^2[A+B+C] + x[A+4B-C] + [-6A+3B-2C]}{(x+1)(x-2)(x+3)}$$

Multiply through by  $(x+1)(x-2)(x+3)$

$$2x^2-9x-35 = x^2[A+B+C] + x[A+4B-C] + [-6A+3B-2C]$$

$$A+B+C = 2 \quad \dots (1)$$

$$A+4B-C = -9 \quad \dots (2)$$

$$-6A+3B-2C = -35 \quad \dots (3)$$

NAME: OJELADE OLUWAPELUMI DEBORAH

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DEPARTMENT: Medicine and Surgery.

3) ~~A~~  $A = 2 - B - C \dots\dots (4)$

Put equation 4 in equ 2 & 3

$$2 - B - C + 4B - C = -9$$

$$2 - B + 4B - C - C = -9$$

$$2 + 3B - 2C = -9$$

$$3B - 2C = -9 - 2$$

$$3B - 2C = -11 \dots\dots (5)$$

$$-6A + 3B - 2C = -35$$

$$-6[2 - B - C] + 3B - 2C = -35$$

$$-12 + 6B + 6C + 3B - 2C = -35$$

$$6B + 3B + 6C - 2C = -35 + 12$$

$$9B + 4C = -23 \dots\dots (6)$$

Solve equ 5 & 6 Simultaneously

$$3B - 2C = -11 \dots (5)$$

$$9B - 4C = -23 \dots (6)$$

Multiply equ (5) by 4 and equ (6) by 2 to "x"

$$12B - 8C = -44$$

$$18B + 8C = -46$$

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$$30B = -90$$

$$B = -90/30$$

$$B = -3 \dots\dots (7)$$

Put equ (7) in equ in (5)

$$3B - 2C = -11$$

NAME: OJELADE OLUWAPELUMI DEBORAH

MATRIC NO: 19/MH501/306

DEPARTMENT: Medicine and Surgery

$$3) \quad 3B - 2C = -11$$

$$3C - 3) - 2C = -11$$

$$-9 - 2C = -11$$

$$-2C = -11 + 9$$

$$-2C = -2$$

$$C = 1 \quad \dots \quad (8)$$

Put equ (7) & (8) in equ (1)

$$A = 2 - B - C$$

$$A = 2 - (-3) - 1$$

$$A = 2 + 3 - 1$$

$$A = 4$$

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

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

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