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MATRIC NO: 19/MHS01/133

DEPARTMENT: MEDICINE AND ~~SURGERY~~.

COURSE: MAT 104.

ANSWER TO THE ASSIGNMENT

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

Solution

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

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

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

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

At $x=-3$, we have

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

$B(-4) = 20$

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

$B = 5$

At $x=1$, we have

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

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

$A(4) = 11-3$

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

$A = 2,$

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

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

let $u = x-1$, $u = x+3$

$du = dx$ $du = dx$

$dx = du$ $\Rightarrow -5\int \frac{du}{u}$

$\Rightarrow 2\int \frac{du}{u}$

$= 2\ln u$ $= -5\ln u$

$\Rightarrow 2\ln(x-1) - 5\ln(x+3)$

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

Solution

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

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

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

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

At $x = 3$, we have

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

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

At $x = -1$, we have

$A(x-3) = 4x-16$

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

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$B(4) = 12 - 16$ $\quad A(-4) = -4 - 16$

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

$B = -1$ $\quad A = 5$

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

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

let $u = x+1$ $\quad$ let $u = x-3$

$du = dx$ $\quad du = dx$

$dx = du$ $\quad dx = du$

$\Rightarrow 5\int \frac{du}{u}$ $\quad -1\int \frac{du}{u} = -1\ln u$

$= 5\ln u$

$\Rightarrow 5\ln(x+1) - \ln(x-3)$

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

solution

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

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

$$2x^2-9x-35 = A(x^2+3x-2x-6)+B(x^2+3x+x+3)+C(x^2-2x+x-2)$$

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

$2x^2-9x-35 = Ax^2+Ax-6A+Bx^2+4Bx+3B+Cx^2+Cx-2C$

$2x^2-9x-35 = (A+B+C)x^2+x(A+4B-C)+(-6A+3B-2C)$

$A+B+C=2$ --①

$A+4B-C=-9$ --②

$-6A+3B-2C=-35$ --③

from ① $A=2-B-C$ --④

Put ④ in ② & ③

$*\ 2-B-C+4B-C=-9 \Rightarrow 2+3B-2C=-9 \Rightarrow 3B-2C=-11$

$*\ -6(2-B-C)+3B-2C=-35 \Rightarrow -12+6B+6C+3B-2C=-35$

$\Rightarrow -12+9B+4C=-35 \Rightarrow 9B+4C=-23$

$3B-2C=-11 \times 4$

$9B+4C=-23 \times 2$

$12B-8C=-44$

$18B+8C=-46$

$30B=-90$

$\frac{30B}{30}=\frac{-90}{30}$

$B=-3$

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

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

$-9-2C=-11$

$-2C=-11+9$

$\frac{-2C}{-2}=\frac{-2}{-2}$

$C=1$

$\therefore A=2-B-C$

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

$A=4$

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

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

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