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ELECT /ELECT ENGINEERING
19/ENG04/055
MAT 104 ASSIGNMENT

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

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

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

when $x = -3$ when $x = 1$

$-4B = 11+9$ $4A = 8$

$B = -5$ $A = 2$

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

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

$= 2\int du/u = 2\ln u$

$\int \frac{-5dx}{x+3}$ let $u = x+3$ $du = dx$

$-5\int du/u = -5\ln u$

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

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

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

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

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

$A+B+C=2 \cdots$ (i)

$A+4B-C=-9 \cdots$ (ii)

$3B-6A-2C=-35 \cdots$ (iii)

$A=2-B-C \cdots$ (iv) , $-2C=-35-3B+6A \cdots$ (v)

substitute (iv) into (ii)

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

$=3B-2C=-11 \cdots$ (vi)

substitute (v) into (vi)

$3B-35-3B+6A=-11$

$6A=24$

$A=4$

$B+C=-2$

$C=-B-2$, substitute into (ii)

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

$5B=-15$

$B=-3$

$C=2-1$

$C=1$

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

$$= 4\ln(x+1) - 3\ln(x-2) + \ln(x+3) + C$$

(3) $$\int \frac{dx}{x^2+121} = \int \frac{dx}{x^2+11^2}$$

$x = 11\tan\theta$

$\frac{dx}{d\theta} = 11\sec^2\theta \quad dx = 11\sec^2\theta\, d\theta$

$x^2 + 11^2 = 11^2\tan^2\theta + 11^2 = 11^2(\tan^2\theta - 1)$

$= 121\sec^2\theta$

$$= \int \frac{11\sec^2\theta\, d\theta}{121\sec^2\theta}$$

$$= \frac{1}{11}\int d\theta = \frac{1}{11}[\theta] + C$$

$$= \frac{1}{11}\tan^{-1}x/11 + C$$