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Department: Computer Engineering

Course: MAT 104

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

$$11-3x = a(x-1) + b(x+3)$$

when $x = 1$

$$11-3 = 4b$$

$$8 = 4b$$

$$b = 2$$

when $x = -3$

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

$$20 = -4a$$

$$a = -5$$

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

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

$$= -5 \ln|x+3| + 2 \ln|x-1| + C$$

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

$$2x^2-9x-35 = a(x-2)(x+3) + b(x+1)(x+3) + c(x+1)(x-2)$$

when $x = 1$

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

$$-24 = -6a$$

$$-4 = -a$$

$$a = 4$$

when $x = 2$

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

$$-45 = 15b$$

$$b = -3$$

when $x = -3$

$$2(-3)^2-9(-3)-35 = c(-3+1)(-3-2)$$

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

$$10 = 10c$$

$$c = 1$$

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$$\therefore 2x^2 - 9x - 35 = 4 + 3 + 1$$

$$(x+1)(x-2)(x+3) \quad x-1 \quad x-2 \quad x+3$$

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

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

$$\textcircled{3} \int \frac{1}{\sqrt{x^2+121}} dx = \int \frac{1}{\sqrt{x^2+11^2}}$$

$$\text{Let } x = 11 \tan \theta ; \theta = \tan^{-1} \frac{x}{11}$$

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

$$dx = 11 \sec^2 \theta d\theta$$

$$11^2 + x^2 = 11^2 + 11^2 \tan^2 \theta$$

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

Recall $1 + \tan^2 \theta = \sec^2 \theta$ (trig. identities)

$$11^2 + x^2 = 11^2 \sec^2 \theta$$

$$\int \frac{11 \sec^2 \theta d\theta}{11^2 \sec^2 \theta} = \frac{1}{11} \int d\theta$$

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

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$$\text{and } \theta = \tan^{-1} \frac{x}{11}$$

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