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**MATRIC NO: 19/ENG02/040**

**COURSE TITLE: MAT 104**

**COURSE CODE: GENERAL MATHEMATICS III**

**QUESTION: INTEGRATE THE FOLLOWING WITH RESPECT TO THEIR VARIABLE**

1. (11-3x) / x2+2x-3

2. (2x2-9x-35) / (x+1) (x-2) (x+3)

3. 1/(x2+121)

**ANSWER:**

**1.11−3x)/x2+2x−3dx**

**Apply linearity:**

**=−∫3x−11/x2+2x−3dx**

**Now solving:**

**∫3x−11/x2+2x−3dx**

**=∫(3(2x+2)/2(x2+2x−3)) −(14/x2+2x−3) dx**

**Apply linearity:**

**=3∫x+1/x2+2x−3dx − 14∫1/x2+2x−3dx**

**Now solving:**

**∫x+1/x2+2x−3dx**

**Substitute u=x2+2x−3 ⟶ du/dx=2x+2 ⟶ dx=1/2x+2du:**

**=∫1/2u du**

**Simplify:**

**=12∫1/u du**

**Now solving:**

**∫1/udu**

**This is a standard integral:**

**=ln(u)**

**Plug in solved integrals:**

**1/2∫1/udu**

**=ln(u)/2**

**Undo substitution u=x2+2x−3:**

**=ln(x2+2x−3)/2**

**Now solving:**

**∫1/x2+2x−3dx**

**Factor the denominator:**

**=∫1/(x−1) (x+3) dx**

**Perform partial fraction decomposition:**

**=∫(1/4(x−1)) –(1/4(x+3)) dx**

**Apply linearity:**

**=1/4∫1/x−1 dx−(1/4∫1/x+3 dx)**

**Now solving:**

**∫1/x−1 dx**

**Substitute u=x−1 ⟶ du/dx=1⟶ dx=du:**

**=∫1/udu**

**Use previous result:**

**=ln(u)**

**Undo substitution u=x−1:**

**=ln(x−1)**

**Now solving:**

**∫1/x+3 dx**

**Substitute u=x+3 ⟶ du/dx=1 ⟶ dx=du:**

**=∫1/udu**

**Use previous result:**

**=ln(u)**

**Undo substitution u=x+3:**

**=ln(x+3)**

**Plug in solved integrals:**

**(1/4∫1/x−1dx) −(1/4∫1/x+3dx)**

**=ln(x−1)4−ln(x+3)4**

**Plug in solved integrals:**

**3∫x+1x2+2x−3dx−14∫1x2+2x−3dx**

**=3ln(x2+2x−3)/2+7ln(x+3)/2−7ln(x−1)/2**

**Plug in solved integrals:**

**−∫3x−11x2+2x−3dx**

**=−3ln(x2+2x−3)/2−7ln(x+3)/2+7ln(x−1)/2**

**2.** **∫(2x2−9x−35)/(x−2) (x+1) (x+3) dx**

**Perform partial fraction decomposition:**

**=∫(1/(x+3) + 4/(x+1) – 3/(x−2)) dx**

**Apply linearity:**

**=∫1/x+3dx + 4∫1/x+1dx − 3∫1/x−2dx**

**Now solving:**

**∫1/x+3dx**

**Substitute u=x+3 ⟶ du/dx=1⟶ dx=du:**

**=∫1/udu**

**This is a standard integral:**

**=ln(u)**

**Undo substitution u=x+3:**

**=ln(x+3)**

**Now solving:**

**∫1/x+1dx**

**Substitute u=x+1 ⟶ du/dx=1 ⟶ dx=du:**

**=∫1/udu**

**Use previous result:**

**=ln(u)**

**Undo substitution u=x+1:**

**=ln(x+1)**

**Now solving:**

**∫1/x−2dx**

**Substitute u=x−2 ⟶ du/dx=1 ⟶ dx=du:**

**=∫1/udu**

**Use previous result:**

**=ln(u)**

**Undo substitution u=x−2:**

**=ln(x−2)**

**Plug in solved integrals:**

**∫1/x+3dx + 4∫1/x+1dx − 3∫1/x−2dx**

**=ln(x+3) + 4ln(x+1) − 3ln(x−2)**

**3. Problem:**

**∫1/x2+121dx**

**Substitute u=x11 ⟶ du/dx=1/11 ⟶ dx=11du:**

**=∫11/121u2 + 121du**

**Simplify:**

**=1/11∫1/u2+1du**

**Now solving:**

**∫1/u2+1du**

**This is a standard integral:**

**=arctan(u)**

**Plug in solved integrals:**

**1/11∫1/u2+1du**

**=arctan(u)/11**

**Undo substitution u=x/11:**

**=arctan(x/11)/11**