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**COURSE CODE: MAT 104**

**COURSE TITLE: GENERAL MATHEMATICS III**

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

**QUESTION**: Integrate the following with respect to their variable

1. 3te2t

2. x2sinx

3. sin7xcos2x

4. (2x-3x2) / 1-x

**SOLUTION:**

1. 3te2t

∫ 3te2t dt

Apply linearity: = 3∫ te2t dt

Solving ∫ te2t dt

Using integration by part, we have

 ∫fg′ = fg − ∫f′g

f = t f′ = 1

g′ = e2t g =

t - ∫1 dt

= −∫ dt

Solving:

∫ dt

Let u = 2t, du/dt=2

dt =1/2 du

= 1/4 ∫ eu du

∫ eu du

Apply exponential rule: ∫au du = with a = e: = eu

Put in the solved integra, we have:

1/4∫ eu du

=

Since u = 2t

Therefore

 =

Put in the solved integra in the initial

=

We have

=

Therefore,

∫ 3te2t dt

 = 3 (+c

 = +c

 =

2. x2sinx

=∫ x2 sin(x) dx

Integrate by parts: ∫fg′ = fg − ∫f′g

 f= x2 g= -cos(x)

f′= 2x g′= sin(x)

Now, fg − ∫f′g

= x2 -cos(x) - ∫2x cos(x) dx

= -x2 cos(x) − ∫−2xcos(x) dx

Now solving

 ∫−2xcos(x) dx

Apply linearity

 = −2∫xcos(x) dx

Now solving

 ∫xcos(x) dx

Integrate by parts: ∫fg′ = fg − ∫f′g

 f= x g=sin(x)

f′= 1 g′= cos(x)

= xsin(x) −∫sin(x) dx

Now solving

 ∫sin(x) dx

This is a standard integral: = −cos(x)

Plug in solved integrals

 xsin(x) −∫ sin(x) dx

= xsin(x) + cos(x)

Plug in solved integrals

 −2∫xcos(x) dx

= −2xsin(x) − 2cos(x)

Plug in solved integrals

 = −x2 cos(x) −∫−2xcos(x) dx

= −x2 cos(x) +2xsin(x) +2cos(x)

= 2xsin(x) − x2 cos(x) + 2cos(x)

Therefore,

∫ x2 sin(x) dx

= 2xsin(x) – x2cos(x) + 2cos(x)

3. sin7xcos2x

= ∫cos(2x) sin(7x) dx

Apply product-to-sum formulas

 sin(x)sin(y)

= (cos (y − x) – cos (y + x)), sin2(x)

= (1 − cos(2x)), cos(x)cos(y)

= (cos (y + x) + cos (y − x)), cos2(x)

= (cos (2x) + 1), sin(x)cos(y)

= (sin (y + x) – sin (y − x)), cos(x)sin(x)

= sin(2x).

=∫ dx

Apply linearity

 =1/2∫sin(9x) dx + 1/2∫ sin(5x) dx

Now solving

 ∫ sin(9x) dx

Substitute u = 9x

 = 9

 dx =du:

=1/9∫sin(u)du

Now solving

 ∫sin(u)du

This is a standard integral

 = −cos(u)

Plug in solved integrals

1/9∫sin(u)du

= −

 Since u = 9x, then

= −

Now solving

 ∫ sin(5x) dx

Substitute u = 5x

 = 5

dx = du:

=1/5 ∫ sin(u)du

Now solving

 ∫sin(u)du

 = −cos(u)

Plug in solved integrals

 1/5∫ sin(u)du

= −

Since u = 5x

= −

Plug in solved integrals

 1/2∫ sin(9x) dx + 1/2∫ sin(5x) dx

= − +c

Therefore sin7xcos2x

=

4. (2x-3x2) / 1-x

= ∫ dx

Rewrite/simplify

 =∫ dx

Substitute u = x − 1

 = 1

dx = du

=∫ du

Expand: =∫(3u +1/u+ 4) du

Apply linearity

 = -3∫ u du +∫1/2 du + 4∫1du

Now solving

 ∫ u du

=

Now solving: ∫1/2du

This is a standard integral

= ln(u)

Now solving

∫1du

Apply constant rule

= u

Plug in solved integrals

 3∫u du +∫1/u du + 4∫1du

= ln(u) + + 4u

Undo substitution u = x − 1

= 4(x − 1) + + ln (x − 1) +c

Therefore (2x-3x2) / 1-x

= + ln(x-1) + c