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MATRIC NO: 19/ENG02/040

COURSE CODE: MAT 104

COURSE SUBJECT: CALCULUS

SOLUTION TO ASSIGNMENT

1a) d/dx⎡⎣√x−2(x+1) ^2(x+3)3/2(2x−1) ⎤⎦

=d/dx[√x−2(x+1)^2]⋅(x+3)^3/2(2x−1)−√x−2(x+1)^2⋅d/dx[(x+3)^3/2(2x−1)]/[(x+3)^3/2(2x−1)^2

=(d/dx[√x−2]⋅(x+1)^2+√x−2⋅d/dx[(x+1)^2])(x+3)^3/2(2x−1)−√x−2(x+1)^2(d/dx[(x+3)^3/2]⋅(2x−1)+(x+3)^3/2⋅d/dx[2x−1]/[(x+3)^3(2x−1)^2]

=(1/2(x−2)1/2−1⋅d/dx[x−2]⋅(x+1)^2+√x−2⋅2(x+1)⋅d/dx[x+1])(x+3)^3/2(2x−1)−√x−2(x+1)2(3/2(x+3)^3/2−1⋅d/dx[x+3]⋅(2x−1)+(x+3)^3/2(2⋅d/dx[x]+d/dx[−1]))/[x+3)3(2x−1)2

=[(d/dx[x]+d/dx[−2])(x+1)^22√x−2+√x−2⋅2(x+1)(d/dx[x]+d/dx[1])](x+3)^3/2(2x−1)−√x−2(x+1)^2[3(d/dx[x]+d/dx[3])√x+3(2x−1^)2+(x+3)^3/2(2⋅1+0)]/[(x+3)^3(2x−1)^2]

=((1+0)(x+1)^22√x−2+√x−2⋅2(x+1)(1+0))(x+3)^3/2(2x−1)−√x−2(x+1)^2(2(x+3)^3/2+3(1+0)√x+3(2x−1)^2)/(x+3)^3(2x−1)^2

=(x+3)^3/2(2x−1)((x+1)^2.2√x−2+2√x−2(x+1))−√x−2(x+1)^2(2(x+3)^3/2+3√x+3(2x−1)^2)/(x+3)^3(2x−1)^2

=(x+1)^2.2√x−2(x+3)^3/2(2x−1)+2√x−2(x+1)(x+3)^3/2(2x−1)−3√x−2(x+1)^22(x+3)^5/2(2x−1)−2√x−2(x+1)^2/(x+3)^3/2(2x−1)^2

**Simplify/rewrite:**

[3(x+1) (4x2−7x+13)2√x−2]/[(x+3)5^2(2x−1) ^2

1b) d/dx[3e^sin(2x) x^5/2]

=3⋅d/dx[e^xsin(2x) x^5/2]

=3⋅d/dx[e^sin(2x)] ⋅x^5/2−e^sin(2x) ⋅d/dx[x^5/2] (x^5/2) ^2

=3((d/dx[ex]⋅sin(2x) +e^x⋅d/dx[sin(2x)]) x^5/2−5/2x5/2−1e^sin(2x)) x^5

=3((e^x.sin(2x) +e^x\*cos(2x) ⋅d/dx[2x]) x^5/2−5x3^/2e^x\*sin(2x) ^2) x^5

=3((e^x\*sin(2x) +e^x\*cos(2x) ⋅2⋅d/dx[x]) x^5/2−5x^3/2e^x\*sin(2x) ^2) x^5

=3((e^x\*sin(2x) +2e^x/cos(2x) ⋅1) x^5/2−5x^3/2e^x\*sin(2x)2) x^5

=3(x^5/2(e^x\*sin(2x) +2excos(2x)) −5x3/2e^x\*sin(2x)2) x^5

**Alternative result:**

=3e^x\*sin(2x) x^5/2−15e^x\*sin(2x)2x^7/2+6e^x\*cos(2x) x^5/2

**Simplify/rewrite:**

3e^x((2x−5) sin(2x) +4xcos(2x))2x^7/2

2a) ∫4sec2(3m+1)dm

Substitute u=3m+1 ⟶ dudm=3 ([steps](https://www.derivative-calculator.net/#expr=3*m%2B1&diffvar=m&showsteps=1)) ⟶ dm=13du:

=43∫sec2(u)du

Now solving:

∫sec2(u)du

This is a standard integral:

=tan(u)

Plug in solved integrals:

43∫sec2(u)du

=4tan(u)3

Undo substitution u=3m+1:

=4tan(3m+1)3

The problem is solved:

∫4sec2(3m+1)dm

=4tan(3m+1)3+C

2b) ∫4sec2(3m+1)dm

Substitute u=3m+1 ⟶ dudm=3 ([steps](https://www.derivative-calculator.net/#expr=3*m%2B1&diffvar=m&showsteps=1)) ⟶ dm=13du:

=43∫sec2(u)du

Now solving:

∫sec2(u)du

This is a standard integral:

=tan(u)

Plug in solved integrals:

43∫sec2(u)du

=4tan(u)3

Undo substitution u=3m+1:

=4tan(3m+1)3

The problem is solved:

∫4sec2(3m+1)dm

=4tan(3m+1)3+C

2c) ∫2x√4x2−1dx

Substitute u=4x2−1 ⟶ dudx=8x ([steps](https://www.derivative-calculator.net/#expr=4*x%5E2-1&showsteps=1)) ⟶ dx=18xdu:

=14∫1√udu

Now solving:

∫1√udu

Apply power rule:

∫undu=un+1n+1 with n=−12:

=2√u

Plug in solved integrals:

14∫1√udu

=√u2

Undo substitution u=4x2−1:

=√4x2−12

The problem is solved:

∫2x√4x2−1dx

=√4x2−12+C