Integral Exchange: Applying Integration By Substitution
Class 14: Friday February 28

1. $\int (x + e^x)^9 (1 + e^x)\, dx =$

Let $u =$

Then $\frac{du}{dx} =$

Multiplying both sides by dx gives: $du =$

Now substitute into the original integral, so that everything is in terms of u instead of x.

$$\int (x + e^x)^9 (1 + e^x)\, dx = \int$$

This new integral should be easier than before. Solve it.

Now "convert back to x".

Examples

2. $\int \frac{t^2}{5 + t^3}\, dt =$

Let $u =$

Then $\frac{du}{dt} =$

So $du =$

So $(\quad) \cdot du = t^2\, dt$

3. Substitute, then evaluate:

$\int \frac{t^2}{5 + t^3}\, dt =$

Convert back:

4. $\displaystyle\int_2^5 \frac{t^2}{5+t^3}\,dt =$

Question: Can I do the following shortcut?

$$\int_2^5 \frac{t^2}{5+t^3}\,dt = \frac{1}{3}\int_2^5 \frac{du}{u} = \frac{1}{3}[\ln(5) - \ln(2)].$$

Answer:

Because:
When $t = 2$, $u =$
and when $t = 5$, $u =$
So

$$\int_{t=2}^{t=5} \frac{t^2}{5+t^3}\,dt = \quad \frac{1}{3}\int_{u=}^{u=} \quad \frac{du}{u} = \quad \frac{1}{3}[\ln(\quad) - \ln(\quad)].$$

Application: Integral of $\tan(x)$

5. $\displaystyle\int \frac{\sin(x)}{\cos(x)}dx$

GroupWork

6. $\displaystyle\int \ln(x)\frac{1}{x}dx$

7. $\displaystyle\int_1^4 \frac{e^{\sqrt{x}}}{\sqrt{x}}\,dx =$