Name: Richard

QUIZ 1

MATH 201
January 16, 2025

Use substitution to find the following integrals. State clearly what your substitution is. Show all steps.

1. $\int \frac{\sin(x)}{\sqrt{\cos(x)}}\,dx = \int (\cos(x))^{-1/2} \sin(x)\,dx$

$u = \cos(x)$
$\frac{du}{dx} = -\sin(x)$
$du = -\sin(x)\,dx$
$(-1)\,du = \sin(x)\,dx$

$= \int u^{-1/2}(-1)\,du = -\int u^{-1/2}\,du$

$= -\frac{u^{-1/2+1}}{-1/2+1} + C$

$= -\frac{u^{1/2}}{1/2} + C = -2\sqrt{u} + C$

$= \boxed{-2\sqrt{\cos(x)} + C}$

2. $\int_0^{\ln(2)} \frac{e^x}{5+e^x}\,dx = \int_0^{\ln(2)} \frac{1}{5+e^x} e^x\,dx = \int_{5+e^0}^{5+e^{\ln(2)}} \frac{1}{u}\,du$

$u = 5 + e^x$
$\frac{du}{dx} = e^x$
$du = e^x\,dx$

$= \int_6^7 \frac{1}{u}\,du = \left[\ln|u|\right]_6^7$

$= \ln|7| - \ln|6|$

$= \boxed{\ln\left|\frac{7}{6}\right|}$

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Use substitution to find the following integrals. State clearly what your substitution is. Show all steps.

1. $\int \frac{(3+2\ln|x|)^7}{x}\,dx = \int (3+2\ln|x|)^7 \frac{1}{x}\,dx = \int u^7 \frac{1}{2}\,du$

$u = 3+2\ln|x|$

$\frac{du}{dx} = 2\cdot\frac{1}{x}$

$du = \frac{2}{x}\,dx$

$\frac{1}{2}\,du = \frac{1}{x}\,dx$

$= \frac{1}{2}\int u^7\,du = \frac{1}{2}\frac{u^8}{8} + C$

$= \boxed{\frac{(3+2\ln|x|)^8}{16} + C}$

2. $\int_0^{\ln\sqrt{3}} \frac{e^x}{1+(e^x)^2}\,dx = \int_0^{\ln\sqrt{3}} \frac{1}{1+(e^x)^2} e^x\,dx = \int_{e^0}^{e^{\ln\sqrt{3}}} \frac{1}{1+u^2}\,du$

$u = e^x$

$\frac{du}{dx} = e^x$

$du = e^x\,dx$

$= \int_1^{\sqrt{3}} \frac{1}{1+u^2}\,du = \left[\tan^{-1}(u)\right]_1^{\sqrt{3}}$

$= \tan^{-1}(\sqrt{3}) - \tan^{-1}(1)$

$= \frac{\pi}{3} - \frac{\pi}{4} = \frac{4\pi}{12} - \frac{3\pi}{12} = \boxed{\frac{\pi}{12}}$