Find $\int \sec^2 \sqrt{x}\, dx$ by first making a substitution, then using integration by parts. **SCORE: ___ / 6 POINTS**

$u = \sqrt{x}$

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

$dx = 2\sqrt{x}\, du = 2u\, du$

$2\ \underbrace{\int \sec^2 u \cdot 2u\, du}$ BY PARTS

$= \underbrace{2u \tan u}_{1}\ \underbrace{-2\ln|\sec u|}_{1\frac{1}{2}} + C$

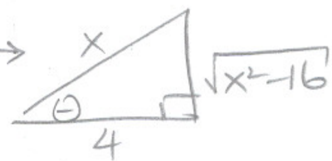
$= \underbrace{2\sqrt{x} \tan\sqrt{x} - 2\ln|\sec\sqrt{x}|}_{1}\ \underbrace{+C}_{\frac{1}{2}}$

u		dv
$2u$	$+$	$\sec^2 u$
2	$-$	$\tan u$
0		$\ln|\sec u|$

Find $\int \frac{\sqrt{x^2-16}}{x^2}\, dx$. **SCORE: ___ / 7 POINTS**

$1\ \underbrace{x = 4\sec\theta}$

$dx = 4\sec\theta\tan\theta\, d\theta$



$\int \underbrace{\frac{4\tan\theta}{16\sec^2\theta}}_{1}\ \underbrace{4\sec\theta\tan\theta\, d\theta}_{1}$

$= \int \frac{\tan^2\theta}{\sec\theta}\, d\theta$

$= \int \frac{\sec^2\theta - 1}{\sec\theta}\, d\theta$

$= \underbrace{\int (\sec\theta - \cos\theta)}_{\frac{1}{2}}\, d\theta$

$= \underbrace{\ln|\sec\theta + \tan\theta|}_{1}\ \underbrace{-\sin\theta}_{\frac{1}{2}} + C$

$1\ = \underbrace{\ln\left|\frac{x}{4} + \frac{\sqrt{x^2-16}}{4}\right| - \frac{\sqrt{x^2-16}}{x}} + C$

$= \underbrace{\ln\left|x + \sqrt{x^2-16}\right| - \frac{\sqrt{x^2-16}}{x}}_{\frac{1}{2}}\ \underbrace{+C}_{\frac{1}{2}}$

Find $\int \sec^3 x \tan^5 x \, dx$. **SCORE: ___ / 5 POINTS**

1 $\underline{u = \sec x}$

$du = \sec x \tan x \, dx$

$\int \sec^2 x \tan^4 x \cdot \sec x \tan x \, dx$

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

$= \int (u^6 - 2u^4 + u^2) \, du$ $\frac{1}{2}$

$= \frac{1}{7}u^7 - \frac{2}{5}u^5 + \frac{1}{3}u^3 + C$ 1

$= \frac{1}{7}\sec^7 x - \frac{2}{5}\sec^5 x + \frac{1}{3}\sec^3 x + C$ 1 $\frac{1}{2}$

Find $\int \frac{(\ln x)^2}{x^3} \, dx$. **SCORE: ___ / 5 POINTS**

u	dv
$(\ln x)^2$	x^{-3}
$\frac{2\ln x}{x}$ (+)	$-\frac{1}{2}x^{-2}$
$2\ln x$	$-\frac{1}{2}x^{-3}$
$\frac{2}{x}$ (−)	$\frac{1}{4}x^{-2}$
2	$\frac{1}{4}x^{-3}$
0 (+)	$-\frac{1}{8}x^{-2}$

$\underbrace{-\frac{1}{2}x^{-2}(\ln x)^2}_{1\frac{1}{2}} \underbrace{- \frac{1}{2}x^{-2}\ln x}_{1\frac{1}{2}} \underbrace{- \frac{1}{4}x^{-2}}_{1\frac{1}{2}} \underbrace{+ C}_{\frac{1}{2}}$

Find $\int e^{-2x} \sin 4x \, dx$. **SCORE: ___ / 5 POINTS**

u	dv
$\sin 4x$	e^{-2x}
$4\cos 4x$ (+)	$-\frac{1}{2}e^{-2x}$
$-16\sin 4x$ (−) (±)	$\frac{1}{4}e^{-2x}$

$\int e^{-2x}\sin 4x \, dx = \underline{-\frac{1}{2}e^{-2x}\sin 4x} - \underline{e^{-2x}\cos 4x}$ 1 1

$\underline{-4\int e^{-2x}\sin 4x \, dx}$ 1

$5\int e^{-2x}\sin 4x \, dx = -\frac{1}{2}e^{-2x}\sin 4x - e^{-2x}\cos 4x$ $\frac{1}{2}$

$\int e^{-2x}\sin 4x \, dx = \underbrace{-\frac{1}{10}e^{-2x}\sin 4x - \frac{1}{5}e^{-2x}\cos 4x}_{1} \underbrace{+ C}_{\frac{1}{2}}$

OR

Find $\int e^{-2x} \sin 4x \, dx$.

SCORE: ___ / 5 POINTS

u		dv
e^{-2x}	$+$	$\sin 4x$
$-2e^{-2x}$	$-$	$-\frac{1}{4}\cos 4x$
$4e^{-2x}$	$+$	$-\frac{1}{16}\sin 4x$

$$\int e^{-2x}\sin 4x\,dx = \underbrace{-\frac{1}{4}e^{-2x}\cos 4x}_{1}\ \underbrace{-\frac{1}{8}e^{-2x}\sin 4x}_{1}$$

$$\underbrace{-\frac{1}{4}\int e^{-2x}\sin 4x\,dx}_{1}$$

$$\underbrace{\frac{5}{4}\int e^{-2x}\sin 4x\,dx = -\frac{1}{4}e^{-2x}\cos 4x - \frac{1}{8}e^{-2x}\sin 4x}_{\frac{1}{2}}$$

$$\int e^{-2x}\sin 4x\,dx = \underbrace{-\frac{1}{5}e^{-2x}\cos 4x - \frac{1}{10}e^{-2x}\sin 4x}_{1} \underbrace{+C}_{\frac{1}{2}}$$