4.5 Integration with Substitution
Part 2

Change of plans...

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47, 49, 55, 61, 63, 79,
82, 85, 95

1) Today is the last lesson of Chapter 4

2) The quiz will be Friday; the test will be Tuesday

#1 $\displaystyle\int x\sin(x^2)\,dx$ $u=x^2$
$du=2x\,dx$
$\dfrac{du}{2x}=dx$

$\displaystyle\int (\sin x^2)\cdot x\,(dx)$

$\displaystyle\int \sin u \cdot x\,\dfrac{du}{2x}$

$\dfrac{1}{2}\displaystyle\int \sin u\,du = -\dfrac{1}{2}\cos u + C$

$\quad\quad = -\dfrac{1}{2}\cos x^2 + C$

#2 $\displaystyle\int_0^{\pi/6} \cos 3x\,dx$ $u=3x$
$du=3\,dx$
$\dfrac{du}{3}=dx$

$\displaystyle\int \cos u\,\dfrac{du}{3}$

$\dfrac{1}{3}\displaystyle\int \cos u\,du$

$\dfrac{1}{3}\sin u = \dfrac{1}{3}\sin 3x \Big|_0^{\pi/6}$

$\dfrac{1}{3}(1)-\dfrac{1}{3}(0)=\boxed{\dfrac{1}{3}}$

#3 $\int \tan x \sec^2 x \, dx$ #4 $\int \sin^4 x \cos x \, dx$

$u = \tan x$
$du = \sec^2 x \, dx$

$\int \sin^4 x \cos x \, dx$

$\int u \, du$

$\int (\sin x)^4 \cos x \, dx$

$\frac{1}{2} u^2 + C$

$u = \sin x$
$du = \cos x \, dx$

$\frac{1}{2} \tan^2 x + C$

$\int u^4 \, du$

$\frac{1}{5} u^5 + C$

$\frac{1}{5} (\sin x)^5 + C = \frac{1}{5} \sin^5 x + C$

#5 $\displaystyle\int_{\pi/4}^{\pi/3} \sec^2(3x)\,dx$

$u = 3x$
$du = 3dx$
$\dfrac{du}{3} = dx$

$\dfrac{1}{3}\displaystyle\int \sec^2 u\,du = \dfrac{1}{3}\tan u + c$

$\dfrac{1}{3}\tan 3x + c \Big|_{\pi/4}^{\pi/3}$

$\dfrac{1}{3}\left(\tan\pi - \tan\dfrac{3\pi}{4}\right)$

$\dfrac{1}{3}(0 - -1) = \boxed{\dfrac{1}{3}}$