$$a^x = e^{\ln a^x} = e^{x \ln a}$$

Derivatives and Integrals

$\frac{d}{dx}\left[a^u\right] =$	$a^u \ \ln a \ u'$		$\frac{d}{dx} \ \log_a u \ =$	$\frac{1}{u \ln a} u'$
⇨ $\frac{d}{dx}\left[e^u\right] =$	$e^u u'$		⇨ $\frac{d}{dx} \ \ln u \ =$	$\frac{1}{u} u'$
⇨ $\frac{d}{dx}\left[a^x\right] =$	$a^x \ln a$	*	⇨ $\frac{d}{dx} \ \log_a x \ =$	$\frac{1}{x \ln a}$
$\frac{d}{dx} \ \tan u \ =$	$\sec^2 u \ \ u'$		$\frac{d}{dx} \ \cot u \ =$	$- \ \csc^2 u \ \ u'$
$\frac{d}{dx} \ \sec u \ =$	$\sec u \tan u \ \ u'$		$\frac{d}{dx} \ \csc u \ =$	$- \ \csc u \cot u \ \ u'$
$\frac{d}{dx} \ \arcsin u \ =$	$\frac{u'}{\sqrt{1-u^2}}$		$\frac{d}{dx} \ \arccos u \ =$	$\frac{-u'}{\sqrt{1-u^2}}$
$\frac{d}{dx} \ \arctan u \ =$	$\frac{u'}{1+u^2}$		$\frac{d}{dx} \ \operatorname{arc}\cot u \ =$	$\frac{-u'}{1+u^2}$
$\frac{d}{dx} \ \operatorname{arc}\sec u \ =$	$\frac{u'}{\lvert u \rvert \sqrt{u^2-1}}$		$\frac{d}{dx} \ \operatorname{arc}\csc u \ =$	$\frac{-u'}{\lvert u \rvert \sqrt{u^2-1}}$
Definition of the natural log function			$\ln x =$	$\int_1^x \frac{1}{t}\, dt$
Definition of *e*			$\int_1^e \frac{1}{t}\, dt = 1$	
Log Rule for Integration			$\int \frac{1}{u}\, du =$	$\ln\lvert u \rvert + C$
Log Rule for Integration (2)			$\int \frac{1}{u} u'\, dx =$	$\ln\lvert u \rvert + C$
Derivative of the natural log function			$\frac{d}{dx} \ \ln x \ = \frac{1}{x}$;	$\frac{d}{dx} \ \ln u \ = \frac{1}{u} \bullet u'$
Derivative of an inverse function $g \ x \ = f^{-1}(x)$			$g' \ x \ =$	$\frac{1}{f' \ g \ x}$

Integration Rules for Exponential Functions				
$\int a^u du =$	$a^u \frac{1}{\ln a} + C$	*	$\int e^u du =$	$e^u + C$
$\int e^x dx =$	$e^x + C$		$\int \frac{1}{u} du =$	$\ln\|u\| + C$
$\int \tan u \ du =$	$-\ln\|\cos u\| + C$		$\int \cot u \ du =$	$\ln\|\sin u\| + C$
$\int \sec u \ du =$	$\ln\|\sec u + \tan u\| + C$		$\int \csc u \ du =$	$-\ln\|\csc u + \cot u\| + C$
$\int \sec^2 u \ du =$	$\tan u + C$		$\int \csc^2 u \ du =$	$-\cot u + C$
$\int \sec u \tan u \ du =$	$\sec u + C$		$\int \csc u \cot u \ du =$	$-\csc u + C$
$\int \frac{1}{\sqrt{a^2 - u^2}} du =$	$\arcsin \frac{u}{a} + C$		$\int \frac{1}{a^2 + u^2} du =$	$\frac{1}{a} \arctan \frac{u}{a} + C$
$\int \frac{1}{u\sqrt{u^2 - a^2}} du =$	$\frac{1}{a} \operatorname{arcsec} \frac{\|u\|}{a} + C$	3 8 5	Unusual Examples -- Possible?	

Unusual Examples -- Possible?		
$\int \frac{dx}{x \ln x} =$	$\int \frac{\ln x}{x} dx =$	$\int \ln x \ dx =$

Unusual Examples -- Possible?		
$\int \frac{4 \bullet dx}{x^2 + 9} =$	$\int \frac{4x \bullet dx}{x^2 + 9} =$	$\int \frac{4x^2 \bullet dx}{x^2 + 9} =$

Unusual Examples -- Possible?		
$\int \frac{dx}{x\sqrt{x^2 - 1}}$	$\int \frac{xdx}{\sqrt{x^2 - 1}}$	$\int \frac{dx}{\sqrt{x^2 - 1}}$

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Notes:
(A) Atop page one is a "ground-of-all-being" statement, based on definition of logarithm and a theorem: $a^x = e^{\ln a^x} = e^{x \ln a}$

(B) The top row of page one has general formulas. The next two lines have particular cases of these. A student *learning* the top row should be able to *develop* the next two lines easily.