AP Calculus AB Derivative & Integral Rules Formula Patterns

I. Derivative Rules

A. Trig Derivatives

1) $\frac{d}{dx}\sin u = \cos u * u'$	2) $\frac{d}{dx}\cos u = -\sin u * u'$
3) $\frac{d}{dx}\tan u = sec^2 u * u'$	4) $\frac{d}{dx}\cot\ u = -csc^2 u * u'$
5) $\frac{d}{dx}\sec u = \sec u \tan u * u'$	6) $\frac{d}{dx}\csc u = -\csc u \cot u * u'$

B. Logs and Exponential Derivatives

7) $\frac{d}{dx}\ln u = \frac{u'}{u}$	8) $\frac{d}{dx}\ e^u = e^u * u'$
9) $\frac{d}{dx} log_a u = \left(\frac{1}{\ln a}\right)\frac{u'}{u}$	10) $\frac{d}{dx}\ a^u = (\ln a)\ a^u * u'$

C. ArcTrig Derivatives

11) $\frac{d}{dx}\arcsin u = \frac{u'}{\sqrt{1-u^2}}$	12) $\frac{d}{dx}\arccos u = -\frac{u'}{\sqrt{1-u^2}}$
13) $\frac{d}{dx}\arctan u = \frac{u'}{1+u^2}$	14) $\frac{d}{dx}\operatorname{arccot} u = -\frac{u'}{1+u^2}$
15) $\frac{d}{dx}\operatorname{arcsec} u = \frac{u'}{\lvert u\rvert\sqrt{u^2-1}}$	16) $\frac{d}{dx}\operatorname{arccsc} u = -\frac{u'}{\lvert u\rvert\sqrt{u^2-1}}$

II. Integral Rules

A. Basic Trig Integrals

1) $\int \sin u \, du = -\cos u + C$	2) $\int \cos u \, du = \sin u + C$
3) $\int sec^2 u \, du = \tan u + C$	4) $\int \sec u \tan u \, du = \sec u + C$
5) $\int csc^2 u \, du = -\cot u + C$	6) $\int \csc u \cot u \, du = -\csc u + C$

B. Trig Integrals involving Natural Logs

7) $\int \tan u \, du = -\ln\lvert\cos u\rvert + C$	8) $\int \cot u \, du = \ln\lvert\sin u\rvert + C$
9) $\int \sec u \, du = \ln\lvert\sec u + \tan u\rvert + C$	10) $\int \csc u \, du = -\ln\lvert\csc u + \cot u\rvert + C$

C. Power Rule, Logs and Exponentials

11) $\int u^n du = \frac{u^{n+1}}{n+1} + C$	12) $\int \frac{1}{u} du = ln\lvert u\rvert + C$
13) $\int e^u du = e^u + C$	14) $\int a^u du = \left(\frac{1}{\ln a}\right) a^u + C$

D. Inverse Trig Integrals

15) $\frac{1}{\sqrt{a^2-u^2}} du = \arcsin\left(\frac{u}{a}\right) + C$	16) $\frac{1}{a^2+u^2} du = \frac{1}{a}\arctan\left(\frac{u}{a}\right) + C$
17) $\frac{1}{u\sqrt{u^2-a^2}} du = \frac{1}{a}\operatorname{arcsec}\left(\frac{\lvert u\rvert}{a}\right) + C$	

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