u is $u(x)$, v is $v(x)$

Calc BC: 8.0 Basic Differentiation Name: Block: Seat:

What do you need to work on?

1. $\frac{d}{dx}(x^n) = n \cdot x^{n-1}$

2. $\frac{d}{dx}(\sin x) = \cos x$

3. $\frac{d}{dx}(\cos x) = -\sin x$

4. $\frac{d}{dx}(\tan x) = \sec^2 x$

5. $\frac{d}{dx}(\cot x) = -\cot^2 x$

6. $\frac{d}{dx}(\sec x) = (\sec x)(\tan x)$

7. $\frac{d}{dx}(\csc x) = -(\csc x)(\cot x)$

8. $\frac{d}{dx}(uv) = uv' + vu'$

9. $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{vu' - uv'}{v'}$

10. $\frac{d}{dx}(f(g(x))) = f'(g(x)) \cdot g'(x)$

11. $\frac{d}{dx}(e^x) = e^x$

12. $\frac{d}{dx}(a^x) = (\ln a)a^x$

13. $\frac{d}{dx}(\ln x) = \frac{1}{x}$

14. $\frac{d}{dx}(\log_b x) = \left(\frac{1}{\ln b}\right)\left(\frac{1}{x}\right)$

15. $\frac{d}{dx}(\arcsin x) =$ $\frac{1}{\sqrt{1-x^2}}$

16. $\frac{d}{dx}(\arccos x) =$ $\frac{-1}{\sqrt{1-x^2}}$

17. $\frac{d}{dx}(\arctan x) =$ $\frac{1}{1+x^2}$

18. $\frac{d}{dx}(\text{arccot } x) =$ $\frac{-1}{1+x^2}$

(don't worry about it)

19. $\frac{d}{dx}(\text{arcsec } x) =$ $\frac{1}{|x|\sqrt{x^2-1}}$

20. $\frac{d}{dx}(\text{arccsc } x) =$ $\frac{-1}{|x|\sqrt{x^2-1}}$

Calc BC: 8.0 Basic Integration Name:__________________

Hint: What is the pirate's favorite letter?

1. $\int x^n \, dx$

$\frac{x^{n+1}}{n+1} + C$

2. $\int \sin x \, dx$

$-\cos x + C$

3. $\int \cos x \, dx$

$\sin x + C$

4. $\int \sec^2 x \, dx$

$\tan x + C$

5. $\int \csc^2 x \, dx$

$-\cot x + C$

6. $\int \frac{1}{x} \, dx = \ln|x| + C$

7. $\int \frac{1}{\sqrt{1-x^2}} \, dx = \arcsin x + C$

8. $\int \frac{1}{\sqrt{a^2-x^2}} \, dx = \arcsin \frac{x}{a} + C$

9. $\int \frac{1}{1+x^2} \, dx = \arctan x + C$

10. $\int \frac{1}{a^2+x^2} \, dx = \frac{1}{a} \arctan \frac{x}{a} + C$

11. $\int \tan x \, dx$

See page 516 to check your work.

$= -\ln(\cos x) + C$

$\int \frac{\sin x}{\cos x} dx$

$\boxed{\begin{array}{l} u = \cos x \\ -du = \sin x \, dx \end{array}}$

$-\int \frac{1}{u} du = -\ln(\cos x) + C$

12. $\int -\csc^2 x \, dx$

$= \cot x + C$

13. $\int \tan x \sec x \, dx$

$= \sec x + C$

14. $\int -\cot x \csc x \, dx$

$= \csc x + C$

Calc BC: 8.1 Basic Integration Rules Name: Block: Seat:

In the sections following this one, we will expand on the basic integration techniques in order to learn how to solve higher level integrals. A listing of all the basic integration rules can be found on the inside front cover of this book. The key to solving an integration problem is identifying which integration technique to use. We will review the basic techniques in this section before moving to higher level integrals.

Example: A Comparison of Three Similar Integrals

a) $\int \frac{4}{x^2+9}dx$

$4\int \frac{1}{x^2+3^2}dx$

$4\left[\frac{1}{3}\arctan\frac{x}{3}\right]+C$

b) $\int \frac{4x}{x^2+9}dx$

$$\boxed{\begin{aligned} u &= x^2+9 \\ du &= 2x\,dx \\ 2\,du &= 4x\,dx \end{aligned}}$$

$4\int \frac{1}{u}\,du$

$4\ln(x^2+9)+C$

c) $\int \frac{4x^2}{x^2+9}dx$

$$\boxed{\begin{array}{r} 4 \\ x^2+9\,\overline{)\,4x^2+0} \\ -(4x^2+36) \\ \hline -36 \end{array}}$$

$\int 4 - \frac{-36}{x^2+3^2}dx$

$4x - 36\int \frac{1}{x^2+3^2}dx$

1. Expand a function:

$$(1+e)^2 = 1+2e^x+e^{2x}$$

2. Separate the numerator:

$$\frac{x+1}{x^2+1} = \frac{x}{x^2+1}+\frac{1}{x^2+1}$$

3. Complete the square:

$$\frac{1}{\sqrt{2x-x^2}} = \frac{1}{\sqrt{1+(-1)(x^2-2x+1)}} = \frac{1}{\sqrt{1-(x-1)^2}}$$

4. Long division:

$$\frac{x^2}{x^2+1} = 1-\frac{1}{x^2+1}$$

5. Add and subtract terms in numerator:

$$\frac{2x}{(x+1)^2} = \frac{2x+2-2}{(x+1)^2} = \frac{2(x+1)}{(x+1)^2}-\frac{2}{(x+1)^2}$$

6. Use trigonometric identities:

$$\cot^2 x = \csc^2 x - 1$$

7. Multiply and divide by Pythagorean conjugate:

$$\frac{1}{1+\sin x}$$

$$\left(\frac{1}{1+\sin x}\right)\left(\frac{1-\sin x}{1-\sin x}\right)$$

$$\frac{1-\sin x}{\cos^2 x}$$

$$\sec^2 x - \frac{\sin x}{\cos^2 x}$$

2015

1. $\int \frac{x^2}{\sqrt{16-x^6}}dx$

$u = x^3$
$du = 3x^2 dx$
$\frac{1}{3} du = x^2 dx$

$\int \frac{x^2}{\sqrt{4^2-(x^3)^2}} dx$

$\frac{1}{3}\int \frac{1}{\sqrt{4^2-(u)^2}} du$

$\frac{1}{3} \arcsin \frac{x^3}{4} + C$

3. $\int (\cot x)(\ln(\sin x))dx$

Who is u? $u_1 = \cot x$ or | u

$du_1 = \ln(\sin x) dx$ |

$\int u_1 \, du_1$

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

$\frac{\cot^2 x}{2} + C$

check: $\frac{2 \cot x}{2} \cdot \ln(\sin x)$ ✓

(Identity Crisis)

OR

$\int u_2 \, d$

$\frac{u_2^2}{2} + C$

$\frac{(\ln(\sin}{2}$

check:

2. $\int \frac{1}{1+e^x}dx$

$u = 1 + e^x$
$du = e^x dx$

make it so!
$(+e^x - e^x)$

$\int \frac{1+e^x-e^x}{1+e^x} dx$

$\int \frac{1+e^x}{1+e^x} - \frac{e^x}{1+e^x} dx$

4. $\int \tan^2(2x)dx$

$\frac{s^2}{c^2} + \frac{c^2}{c^2} = \frac{1}{c^2}$
$\tan^2 + 1 = \sec^2$

$\int \sec^2(2x) - 1 \, dx$

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

$\frac{1}{2}\int (\sec^2 u - 1) du$

$\frac{1}{2} \tan u - \frac{1}{2} u + C$