5.2 Notes and Examples

Name: Block: Seat:

Natural Log Integration, including tan, cot, csc, and sec

Warm Up: $\int \frac{1}{x^2}\, dx =$

Can I use the power rule for 1(a) below? Why not?

1. Let u be a differentiable function of x.
   (a) $\int \frac{1}{x}\, dx =$

   (b) $\int \frac{1}{u}\, du =$

   (c) Because $du = u'\, dx$ the formula above can be written as $\int \frac{u'}{u}\, dx =$

2. Examples of Indefinite Integrals
   (a) $\int \frac{2}{x}\, dx$

   (b) $\int \frac{2x}{x^2+1}\, dx$

   (c) $\int \frac{1}{4x-1}\, dx$

3. Examples of Definite Integrals

   (a) $\displaystyle\int_1^{e^2} \frac{1}{2x}\, dx$

   (b) $\displaystyle\int_1^{4} \frac{1}{2x}\, dx$

   (c) $\displaystyle\int \frac{1}{x \ln x}\, dx$

4. "Why is this here in 5.2?" examples

   (a) *u-sub and find out*

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

   (b) $\displaystyle\int \frac{\sec^2 x}{\tan x}\, dx$

(c) *Try Long division and find out*
$$\int \frac{x^2+x+1}{x^2+1}\,dx$$

(d) *Try u-sub, split into 2 fractions, and then find out*
$$\int \frac{2x}{(x+1)^2}\,dx$$

(e) *Factor and find out*
$$\int \frac{x^2+2x+1}{x^2-1}\,dx$$

5. True or false: $\displaystyle\int \frac{1}{\text{cabin}}\,dx =$ houseboat

Trig Integrals

Recall...

1. $\int \sin x \; dx =$

2. $\int \cos x \; dx =$

And now the rest...

3. $\int \tan x \; dx =$

4. $\int \cot x \; dx =$

5. $\int \sec x \; dx =$
   Hint: Multiply top and bottom by $\tan x + \sec x$*, then do u-sub with* $u = \tan x + \sec x$

6. $\int \csc x \; dx =$
   Hint: Multiply top and bottom by $\cot x + \csc x$*, then do u-sub with* $u = \cot x + \csc x$

6. Find the average value of $f(x) = \tan x$ on the closed interval $[0, \frac{\pi}{4}]$

7. Find $\int_0^{\pi/4} \sqrt{1 + \tan^2 x}\, dx$