WARM UP!!

For each of the derivatives listed below, find a possible value for f(x).

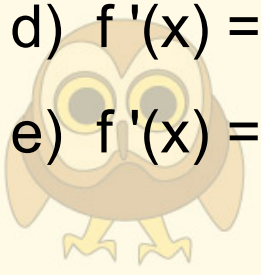
a) $f'(x) = 2x$ $f(x) = x^2 + C$

b) $f'(x) = x$ $f(x) = \frac{1}{2}x^2 + C$

c) $f'(x) = x^2$ $f(x) = \frac{1}{3}x^3 + C$

d) $f'(x) = 1/x^2$ $f(x) = -\frac{1}{x} + C$

e) $f'(x) = 1/x^3$ $f(x) = -\frac{1}{2x^2} + C$



4.1 Antiderivatives!

At the end of this lesson you will be able to:

- Understand what is meant by an antiderivative
- Write antiderivatives with proper notation
- Compute antiderivatives of simple polynomial, radical and rational functions

Antidifferentiation is the inverse operation for differentiation. (Like addition/subtraction, multiplication/division, ...)

So derivatives and antiderivatives are the results of these inverse operations (like sums/differences, products/quotients, ...)

NOTATION!!

$$\int 2x\,dx = x^2 + C$$

integral symbol

integrand

antiderivative

constant of integration

Integration Formulas (can you derive them?)

1) $\int a\,dx = ax + C$

2) $\int x^n\,dx = \frac{1}{n+1}x^{n+1} + C$

3) $\int [f(x)+g(x)]\,dx = \int f(x)\,dx + \int g(x)\,dx$

4) $\int af(x)\,dx = a\int f(x)\,dx$

5) $\int f'(x)\,dx = f(x) + C$

6) $\frac{d}{dx}\int f(x)\,dx = f(x)$

Let's do some together!!

1) $\int 7x\,dx = 7 \cdot \frac{1}{2}x^2 + C = \frac{7}{2}x^2 + C$

2) $\int 7x^3\,dx = \frac{7}{4}x^4 + C$

3) $\int [2x + 3x^2 - 5x^4]\,dx$

$= x^2 + x^3 - x^5 + C$

Give these a try!

1) $\int \left(x^3 - 4x + 2\right) dx = \frac{1}{4}x^4 - 2x^2 + 2x + C$

2) $\int \frac{4}{x^3} dx = \frac{-2}{x^2} + C$

3) $\int (3x-1)^2 \, dx = \int (9x^2 - 6x + 1) dx = 3x^3 - 3x^2 + x + C$

4) $\int \frac{3x^2 - x + 1}{\sqrt{x}} dx = \int \left(3x^{\frac{3}{2}} - x^{\frac{1}{2}} + x^{-\frac{1}{2}}\right) dx$
$= \frac{6}{5}x^{\frac{5}{2}} - \frac{2}{3}x^{\frac{3}{2}} + 2x^{\frac{1}{2}} + C$

5) $\int \left(\theta^2 + \sin\theta\right) d\theta = \frac{1}{3}\theta^3 - \cos\theta + C$

6) $\int (1 + \cot^2 x) dx = \int \csc^2 x \, dx = -\cot x + C$

7) $\int \frac{\sin x}{\cos^2 x} dx = \int \sec x \tan x \, dx = \sec x + C$

In your groups, complete each of the following antiderivative rules.

1) $\int \sin x \, dx =$ $-\cos x + C$

2) $\int \cos x \, dx =$ $\sin x + C$

3) $\int \sec^2 x \, dx =$ $\tan x + C$

4) $\int \sec x \tan x \, dx =$ $\sec x + C$

5) $\int \csc^2 x \, dx =$ $-\cot x + C$

6) $\int \csc x \cot x \, dx =$ $-\csc x + C$

What have we learned??

- What is an antiderivative?
- What is an indefinite integral?
- Can I antidifferentiate a basic polynomial or trigonometric function?