Name: ______________________________ Date: ____________

AP Calculus AB: Finding Antiderivatives

Ms. Loughran

Do Now:

1. Given $f'(x) = 2x$, find $f(x)$.

$f(x) = x^2$

$f(x) = x^2 + 1$

$f(x) = x^2 - \pi$

in general: $f(x) = x^2 + c$ * c is a constant

The opposite of a derivative is called an antiderivative or integral. If $f(x)$ is the antiderivative of $g(x)$, then

upper limit

integrand

$$\int g(x)\,dx = f(x) + c$$

symbol for integration (looks like a stretched out S)

lower limit

variable of integration

* when there is no upper or lower limit, we call it a general integral or an indefinite integral

The process of creating such an expression is called antidifferentiation or integration. Why do we have to use a constant of integration?

There are lots of functions that have the same derivative.

Rules of Integration:

Power rule of integration: $\int x^n\,dx = \frac{x^{n+1}}{n+1} + c$

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

$$\int c f(x)\,dx = c\int f(x)\,dx$$

$$\int k\,dx = kx + c$$ * k is a constant

ex: $\int 3\,dx = 3x + c$

$\int \pi\,dx = \pi x + c$

Practice

1. $\int (3x + x^2)dx$

$$\int 3x\,dx + \int x^2 dx$$

$$3\int x\,dx + \int x^2 dx$$

$$3\frac{x^2}{2} + \frac{x^3}{3} + C = \frac{3}{2}x^2 + \frac{1}{3}x^3 + C$$

2. $\int (3x^2 + 4x)dx$

$$\int 3x^2 dx + \int 4x\,dx$$

$$3\int x^2 dx + 4\int x\,dx$$

$$\cancel{3}\cdot\frac{x^3}{\cancel{3}} + \overset{2}{\cancel{4}}\cdot\frac{x^2}{\cancel{2}} + C = x^3 + 2x^2 + C$$

3. $\int (7x^3 + 6x^5)dx$

$$\int 7x^3 dx + \int 6x^5 dx$$

$$7\cdot\frac{x^4}{4} + \cancel{6}\cdot\frac{x^6}{\cancel{6}} + C$$

$$\frac{7}{4}x^4 + x^6 + C$$

4. $\int 8dx = 8x + C$

5. $\int\left(2x^4+\frac{x^3}{3}+\sqrt{x}\right)dx$

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

$2\cdot\frac{x^5}{5}+\frac{1}{3}\cdot\frac{x^4}{4}+\frac{2}{3}x^{3/2}+C$

$\frac{2}{5}x^5+\frac{1}{12}x^4+\frac{2}{3}\sqrt{x^3}+C$

$\frac{2}{5}x^5+\frac{1}{12}x^4+\frac{2}{3}x\sqrt{x}+C$

Find the most general antiderivative, $F(x)$, of the function.

+C

6. $f(x)=x-3$

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

7. $f(x)=\frac{1}{2}+\frac{3}{4}x^2-\frac{4}{5}x^3$

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

8. $f(x)=(x+1)(2x-1)$

$f(x) = 2x^2+x-1$

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

9. $f(x)=5x^{\frac{1}{4}}-7x^{\frac{3}{4}}$

$\int(5x^{\frac{1}{4}}-7x^{\frac{3}{4}})\,dx = 4x^{\frac{5}{4}}-4x^{\frac{7}{4}}+C$

$4\sqrt[4]{x^5} - 4\sqrt[4]{x^7}+C$

$4x\sqrt[4]{x} - 4x\sqrt[4]{x^3}+C$

10. $f(x)=6\sqrt{x}-\sqrt[6]{x}$

$\int(6x^{\frac{1}{2}}-x^{\frac{1}{6}})\,dx = 4x^{3/2}-\frac{6}{7}x^{7/6}+C$

11. $f(x)=\frac{10}{x^9}$

$\int 10x^{-9}\,dx = -\frac{5}{4}x^{-8}+C = \frac{-5}{4x^8}+C$