Name: ____________________________________ Date: ___________

AP Calculus AB: Finding Antiderivatives Ms. Loughran

Do Now:

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

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

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

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

Rules of Integration:

Practice

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

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

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

4. $\int 8dx$

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

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

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

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

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

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

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

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

More Practice Exercises

1. In each part, confirm that the formula is correct, and state a corresponding integration formula.

(a) $\frac{d}{dx}[\sqrt{1+x^2}] = \frac{x}{\sqrt{1+x^2}}$

(b) $\frac{d}{dx}[xe^x] = (x+1)e^x$

2. In each part, confirm that the stated formula is correct by differentiating.

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

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

In Exercises 3–6, find the derivative and state a corresponding integration formula.

3. $\frac{d}{dx}[\sqrt{x^3+5}]$

4. $\frac{d}{dx}\left[\frac{x}{x^2+3}\right]$

5. $\frac{d}{dx}[\sin(2\sqrt{x})]$

6. $\frac{d}{dx}[\sin x - x\cos x]$

In Exercises 7 and 8, evaluate the integral by rewriting the integrand appropriately, if required, and then applying Formula 2 in Table 7.2.1.

7. (a) $\int x^8 \, dx$ (b) $\int x^{5/7} \, dx$ (c) $\int x^3\sqrt{x} \, dx$

8. (a) $\int \sqrt[3]{x^2} \, dx$ (b) $\int \frac{1}{x^6} \, dx$ (c) $\int x^{-7/8} \, dx$

In Exercises 9–12, evaluate the integral by applying Theorem 7.2.3 and Formula 2 in Table 7.2.1 appropriately.

9. (a) $\int \frac{1}{2x^3} \, dx$ (b) $\int (u^3 - 2u + 7) \, du$

10. $\int (x^{2/3} - 4x^{-1/5} + 4) \, dx$

11. $\int (x^{-3} + \sqrt{x} - 3x^{1/4} + x^2) \, dx$

12. $\int \left(\frac{7}{y^{3/4}} - \sqrt[3]{y} + 4\sqrt{y}\right) dy$

In Exercises 13–30, evaluate the integral, and check your answer by differentiating.

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

14. $\int (2+y^2)^2 \, dy$

15. $\int x^{1/3}(2-x)^2 \, dx$

16. $\int (1+x^2)(2-x) \, dx$

17. $\int \frac{x^5 + 2x^2 - 1}{x^4} \, dx$

18. $\int \frac{1-2t^3}{t^3} \, dt$