Calculus : Integrals Name KEY

Discovery Worksheet - Finding the Antiderivative Date ________ Period ______

Let $\frac{d\left(x^2+x+3\right)}{dx}=2x+1$. Then the antiderivative of $2x+1$ is:

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

The problem is that we have no clue as to what the constant was before we started. So we use an arbitrary c to represent the constant.

Example: $\int(2x+1)dx = x^2+x+c$

You should reason backwards to find the antiderivative. See if you can discover a rule.

1. $\int 3x^2 dx$

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

2. $\int 5x^4 dx$

$= \frac{5x^5}{5} + C = x^5 + C$

3. $\int 2x dx$

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

4. $\int(x+1)dx$

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

5. $\int\left(6x^2+6x\right)dx$

$\frac{6x^3}{3} + \frac{6x^2}{2} + C$

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

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

$= \frac{x^5}{5} + \frac{3x^3}{3} + C$

$= \frac{x^5}{5} + x^3 + C$

7. $\int x^3 dx$

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

8. $\int(4x-5)dx$

$= \frac{4x^2}{2} - 5x + C$

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

9. $\int 100x^{99} dx$

$\frac{100x^{100}}{100} + C$

$= x^{100} + C$

10. $\int 50x^{99} dx$

$= \frac{50x^{100}}{100} + C$

$= \frac{x^{100}}{2} + C$

11. $\int\left(6x^5+5x^4+3x^2+2x+3\right)dx$

$= \frac{6x^6}{6} + \frac{5x^5}{5} + \frac{3x^3}{3} + \frac{2x^2}{2} + 3x + C$

$= x^6 + x^5 + x^3 + x^2 + 3x + C$

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Did you discover that the rule is the opposite of taking the derivative?

$$\int x^2 dx = \frac{x^{n+1}}{n+1} + c \qquad \text{Example: } \int x^4 dx = \frac{x^5}{5} + c$$

In other words…Raise the exponent by one and divide by the new exponent.

12. $\int x^7 dx$

$= \frac{x^8}{8} + C$

13. $\int 5x^3 dx$

$= \frac{5x^4}{4} + C$

14. $\int(-2x^{-3})dx$

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

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

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

$\frac{x^3}{3} - \frac{x^2}{2} + x + C$

16. $\int(7x^3 + 2x^2 - 5)dx$

$\frac{7x^4}{4} + \frac{2x^3}{3} - 5x + C$

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

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

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

18. $\int x^{\frac{3}{5}} dx$

$= \frac{x^{8/5}}{8/5} + C$

$= \frac{5}{8}x^{8/5} + C$

19. $\int\left(x^{-5} + x^{\frac{1}{4}}\right)dx$

$= \frac{x^{-4}}{-4} + \frac{x^{5/4}}{5/4} + C$

$= -\frac{1}{4x^4} + \frac{4}{5}x^{5/4} + C$

*** Use your knowledge of trigonometric derivatives to find each antiderivative. Watch your signs…+, -.

21. $\int \sec^2 x dx$

$= \tan x + C$

22. $\int \cos x dx$

$= \sin x + C$

23. $\int \sec x \tan x dx$

$= \sec x + C$

24. $\int \csc^2 x dx$

$= -\cot x$

25. $\int \sin x dx$

$= -\cos x + C$

26. $\int \csc x \cot x dx$

$= -\csc x + C$