Indefinite integrals of x raised to a power – Khan Academy

$$\frac{d}{dx}\left[\frac{x^{n+1}}{n+1}+C\right]$$

$n \neq -1$

And we're going to assume here, because we want this expression to be defined, we're going to assume that n does not equal negative 1. If it equaled negative 1, we'd be dividing by 0, and we haven't defined what that means. So let's take the derivative here.

$$\frac{d}{dx}\left[\frac{x^{n+1}}{n+1}+C\right] = \frac{\cancelto{1}{(n+1)}\,x^{n}}{n+1} + 0 = x^{n} \qquad *$$

So the derivative of this thing-- and this is a very general terms-- is equal to x to the n. So given that, what is the antiderivative-- let me switch colors here. What is the antiderivative of x to the n?

$$\boxed{\underbrace{\int x^{n}\,dx}_{\text{in def. integral}} = \frac{x^{n+1}}{n+1} + C} \qquad n \neq -1$$

n does not equal negative 1. Once again, this thing would be undefined if n were equal to negative 1. So let's do a couple of examples just to apply this-- you could call it the reverse power rule if you want, or the anti-power rule.

$$\int x^{5}\,dx$$

What is the antiderivative of x to the fifth? Well, all we have to say is, well, look, the 5 is equal to the n.

$$\boxed{\underbrace{\int x^{n}\,dx}_{\text{in def. integral}} = \frac{x^{n+1}}{n+1} + C} \qquad n \neq -1$$

We just have to increment the exponent by 1.

$$\int x^{5}\,dx = \frac{x^{5+1}}{5+1} + C$$