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## 12.2: The Power Rule

Differentials. If  $\frac{dy}{dx} = f'(x)$ , then the differential  $dy = f'(x)dx$ .

Ex1: Find the differential  $dy$  if

a)  $y = x^3 + 3x^2 + 2$

b)  $y = x^3 e^x$

Power rule for derivatives

$$\frac{d}{dx} [u(x)]^n = n [u(x)]^{n-1} u'(x).$$

$$\Rightarrow \int n [u(x)]^{n-1} u'(x) dx = [u(x)]^n + C.$$

So: power rule for integrals

$$\int [u(x)]^n dx = \frac{[u(x)]^{n+1}}{n+1} + C,$$

$n \neq -1.$

Ex2:  $\int (3x^2 + 1)^4 9x^2 dx$

Ex3:  $\int (3x^2 - 4)^6 x dx$

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

Ex 4:  $\int 7x^3 \sqrt{x^4+6} dx$

Ex 5:  $\int (x^2+1)^2 dx$  (doesn't work w/ power rule).

Ex 6:  $\int \frac{5x dx}{(x^2-1)^3}$

Ex 7:  $\int \frac{x^3-1}{(x^4-4x)^3} dx$

Ex 8:  $\int \frac{x^2+1}{\sqrt{x^3+3x+10}} dx$

Ex 9: A new firm predicts that the number of franchises for its product will grow @ rate  $\frac{dN}{dt} = 9\sqrt{t+1}$ , where  $t$  is in yrs ( $0 \leq t \leq 10$ ). If there is presently 1 franchise ( $t=0$  &  $N=1$ ), how many franchises in 8 years?

Hint: find  $\int$