<u>Antiderivatives</u>

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1. A function $F(x)$ is an **antiderivative** of a function $f(x)$ if $F'(x) = f(x)$ for all x in the domain of f. The process of finding an antiderivative is **antidifferentiation**.
2. The family of all antiderivatives of a function $f(x)$ is the **indefinite integral** of f with respect to x and it denoted by $\int (f(x))\, dx$.
3. If F is any function such that $F'(x) = f(x)$, then $\int (f(x))\, dx = F(x) + C$ is called the general solution and C is called the **constant of integration** (an arbitrary constant).

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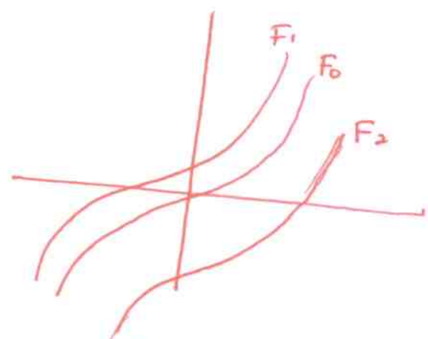
1. State three functions F_1, F_2, F_3 whose derivatives are $f(x) = 3x^2$. Now sketch all three of your functions on the same coordinate plane. Compare these with $f(x) = 3x^2$.

$F_0 = x^3$

$F_1 = x^3 + 1$

$F_2 = x^3 - 5$

$F_3 = x^3 + 100$



Same curve.
General solution:
$F(x) = x^3 + C$

2. Find a general solution of the differential equation $\dfrac{dy}{dx} = 3x^{-4}$ and check by differentiation.

$\int dy = \int 3x^{-4}\, dx$

$y = 3\dfrac{x^{-3}}{-3} + C$

$y = -x^{-3} + C$

$y = -\dfrac{1}{x^3} + C$

$\dfrac{d}{dx}\left[-\dfrac{1}{x^3} + C\right] = \dfrac{d}{dx}\left[-x^{-3} + C\right]$

$= -(-3)x^{-4} = 3x^{-4}$ ✓