



Calculus AB: section 5.4

Fundamental Theorem of Calculus, part 2

Example 1

Find a formula for the area function $A(x) = \int_3^x t^2 dt$

$$\int t^2 dt = \frac{1}{3} t^3 \Big|_3^x = \frac{1}{3} x^3 - \frac{1}{3} \cdot 3^3$$

$$A(x) = \frac{1}{3} x^3 - 9$$

Example 2 – Expressing an Antiderivative as an Integral

There is no elementary formula for an antiderivative of $f(x) = \sin(x^2)$. Express the antiderivative $F(x)$ satisfying

$F(-\sqrt{\pi}) = 0$ as an integral.

$$F(x) = \int_{-\sqrt{\pi}}^x \sin(t^2) dt$$

335: 11-14, 19-22

Example 3 – Differentiating an Integral

Find the derivative of $A(x) = \int_2^x \sqrt{1+t^3} dt$
and calculate $A'(2)$, $A'(3)$ and $A(2)$.

Example 4 – Combining the FTC and the Chain Rule

Find the derivative of $G(x) = \int_{-2}^{x^2} \sin t \, dt$

$$\frac{d}{dx} \int_a^x f(t) dt = f(x)$$

$$\frac{d}{dx} \int_a^b f(t) dt = 0$$

$$\int \sin(x^2) dx = -\cos x^2$$

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