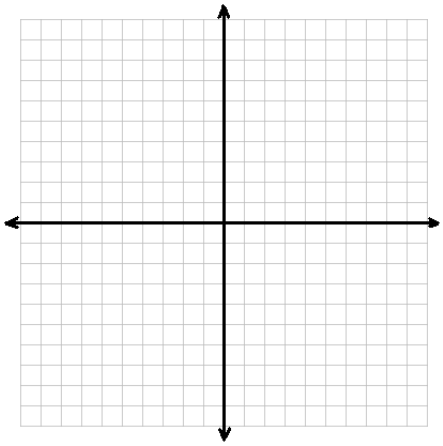
The Fundamental Theorem of Calculus

Warm-up

Graph the function and find the area under it: $y = \frac{x}{2} + 2$ over [0, 3]



Evaluating the Definite Integral

The Fundamental Theorem of Calculus

$$\int_a^b f(x)dx = F(b) - F(a)$$

Example 1: Evaluate

a) $\int_1^2 x dx$

b) $\int_0^3 \left(\frac{x}{2} + 2\right) dx$

c) $\int_0^{\pi} \cos x dx$

d) $\int_1^9 \sqrt{x} dx$

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Practice Problems: Evaluate

1. $\int_4^9 x^2\sqrt{x}\,dx$

2. $\int_0^{\pi/2} \frac{\sin x}{5}\,dx$

3. $\int_0^{\pi/3} \sec^2 x\,dx$

4. $\int_0^{\ln 3} 5e^x\,dx$

5. $\int_{-e}^{-1} \frac{1}{x}\,dx$

6. $\int_1^1 x^2\,dx$

7. $\int_0^4 x\,dx$

8. $\int_4^0 x\,dx$

Integrals of Piecewise Functions

Example 2: Evaluate:

$$\int_0^3 f(x)\,dx \qquad \text{if} \quad f(x) = \begin{cases} x^2, x < 2 \\ 3x - 2, x \geq 2 \end{cases}$$