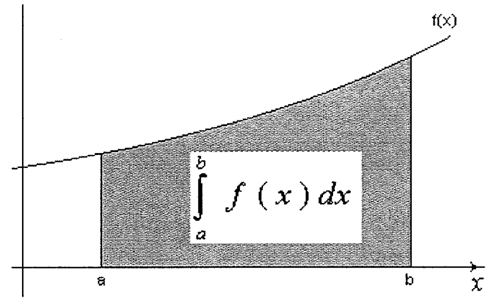
$$\int_a^b f(x)dx = F(b) - F(a)$$

where F is the antiderivative of f.



Recall:

*The general derivative is a **slope-finding function** or formula : (ex. f '(x) = 2x + 1)

*The specific derivative is the **actual slope** at a point (ex: f '(3) = 7)

Likewise…

The indefinite integral is an **Area-Finding Function** or formula (Ex: $\int 2x dx = x^2 + C$)

The definite integral is the **Actual Area** of the region for an interval (Ex: $\int_1^3 2x dx = 8$)

*If a function is **continuous** on a closed interval, then the function is able to be integrated on that interval

Class Examples:

1. Evaluate $\int_1^4 (3x^2 + 4x - 1)dx$

**NOTE: For definite integrals, we don't need to worry about the constant of integration " +C ". It will always wash out.

2. Evaluate $\int_{-2}^1 2x dx$

Integral Properties:

1) $\int_a^a f(x)dx = 0$

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

3) $\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$ (given that c is between a and b)

Example 3: If $\int_0^3 f(x)dx = 4$ and $\int_3^6 f(x)dx = -1$, find the below:

a) $\int_0^6 f(x)dx$

b) $\int_6^3 f(x)dx$

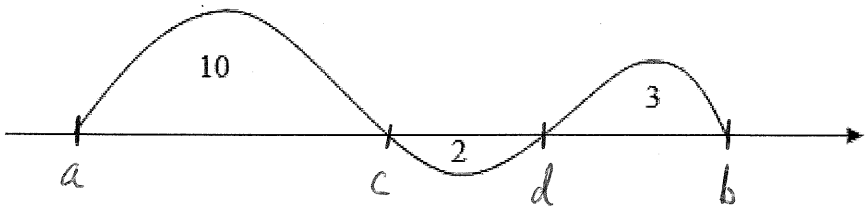
c) $\int_3^3 f(x)dx$

d) $\int_3^6 (-5f(x)+3)dx$

Ex. 4: If $\int_3^8 f'(x)dx = 10$ and $f(8) = 6$, find $f(3)$.

*Reminder that the FFTC can be used as an equation solving tool to find the value of an antiderivative at a specific point. Recall that $\int_a^b f'(x)dx = f(b) - f(a)$

Ex. 5: The area for each region is given. Find $\int_a^b f(x)dx$



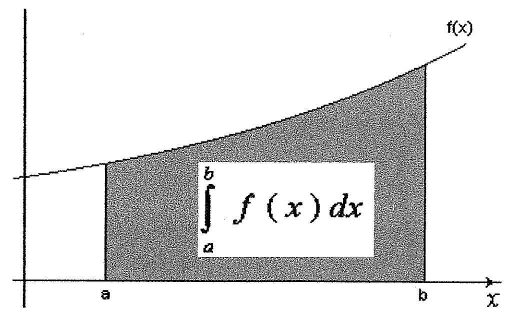
Key

Calculus Chapters 4.3/4.4a **1st Fundamental Theorem of Calculus**

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

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

where F is the antiderivative of f.



Recall:

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

Class Examples:

1. Evaluate $\int_1^4 (3x^2 + 4x - 1)dx$

$\left. \frac{3x^3}{3} + \frac{4x^2}{2} - x \right]_1^4$

$\left. x^3 + 2x^2 - x \right]_1^4$

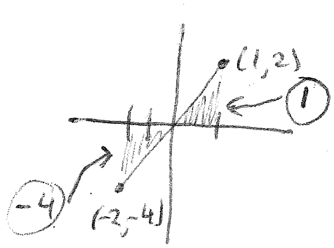
$4^3 + 2(4)^2 - 4 - (1^3 + 2 - 1)$

$92 - 2 = \boxed{90}$

For definite integrals:

**NOTE: we don't need to worry about the constant of integration " +C ". It will always wash out.

2. Evaluate $\int_{-2}^1 2xdx = \frac{2x^2}{2} = \left. x^2 \right]_{-2}^{1} = 1^2 - (-2)^2 = \boxed{-3}$



portions of graph below x-axis will result in negative value.

Integral Properties:

1) $\int_a^a f(x)dx = 0$

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

3) $\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$ (given that c is between a and b)

Example 3: If $\int_0^3 f(x)dx = 4$ and $\int_3^6 f(x)dx = -1$, find the below:

a) $\int_0^6 f(x)dx = \int_0^3 f(x)dx + \int_3^6 f(x)dx = 4 + (-1) = \boxed{3}$

b) $\int_6^3 f(x)dx = -\int_3^6 f(x)dx = -(-1) = \boxed{1}$

c) $\int_3^3 f(x)dx = \boxed{0}$

d) $\int_3^6 (-5f(x)+3)dx = -5\int_3^6 f(x)dx + \int_3^6 3\,dx$

$3x\Big]_3^6 = 18 - 9 = \underline{\underline{9}}$

$= -5(-1) + 9 = \boxed{14}$

Ex. 4: If $\int_3^8 f'(x)dx = 10$ and $f(8) = 6$, find $f(3)$.

*Reminder that the FFTC can be used as an equation solving tool to find the value of an antiderivative at a specific point. Recall that $\int_a^b f'(x)dx = f(b) - f(a)$

$\int_3^8 f'(x)dx = f(8) - f(3)$

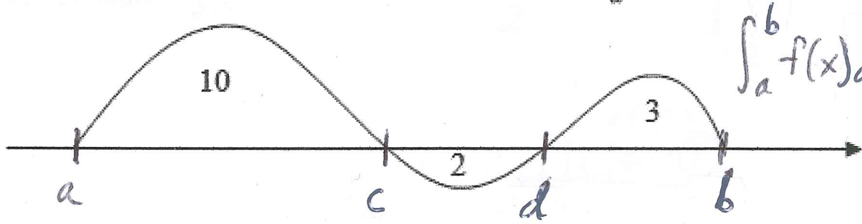
$10 = 6 - f(3)$

$10 - 6 = -f(3)$

$4 = -f(3)$

$\boxed{f(3) = -4}$

Ex. 5: The area for each region is given. Find $\int_a^b f(x)dx$



$\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^d f(x)dx + \int_d^b f(x)dx$

$= 10 + (-2) + 3$

$= \boxed{11}$