Integral-1

Integral – the "area" between the function and the *x*-axis.
"Area" above the *x*-axis is positive.
"Area" below the *x*-axis is negative.

Integration is the inverse of differentiation.

So, $$f'\left(\int f(x)\ dx\right) = f(x)$$

And $$\int f'(x)\ dx = f(x)$$ (kind of)

$f(x) = x^2$ $g(x) = x^2 + 4$ $h(x) = x^2 - 4$

$f'(x) = 2x$ $g'(x) = 2x$ $h'(x) = 2x$

Note that **many** functions have the **same** derivative. This means that conversely, the integral of **one** function can be **many** functions!

$$\int f(x)\ dx = F(x) + c \qquad \text{(indefinite integral)}$$

$$\int_a^b f(x)\ dx = F(b) - F(c) \qquad \text{(definite integral)}$$

DESMOS Example:

$$\int_{-5}^{5} x^2\ dx = \frac{250}{3} \approx 83.3 \qquad \int_{-5}^{5} 4\ dx = 40$$

$$\int_{-5}^{5} (x^2 + 4)\ dx = \frac{370}{3} \approx 123.3$$

Note: this implies that $\int (f(x) + g(x))\ dx = \int f(x)\ dx + \int g(x)\ dx$

Integral-1

Determine the indefinite integral for each integral expression.

1. $\int 12x \; dx$

2. $\int x^2 \; dx$

3. $\int (x^2 + 3x + 2) \; dx$

4. $\int (x^2 + 1) \; dx$

5. $\int 8x^{-4} \; dx$

6. $\int (x + 1) \; dx$

7. $\int (9 - 5x) \; dx$

8. $\int (x^5 + 3x + 2) \; dx$

9. $\int 18x^{-4} \; dx$

10. $\int x^{-\frac{9}{5}} \; dx$

Answer Key

1. $6x^2 + c$

2. $\frac{1}{3}x^3 + c$

3. $\frac{1}{3}x^3 + \frac{3}{2}x^2 + 2x + c$

4. $\frac{1}{3}x^3 + x + c$

5. $-\frac{8}{3}x^{-3} + c$

6. $\frac{1}{2}x^2 + x + c$

7. $-\frac{5}{2}x^2 + 9x + c$

8. $\frac{1}{6}x^6 + \frac{3}{2}x^2 + 2x + c$

9. $-6x^{-3} + c$

10. $-\frac{5}{4}x^{-\frac{4}{5}} + c$