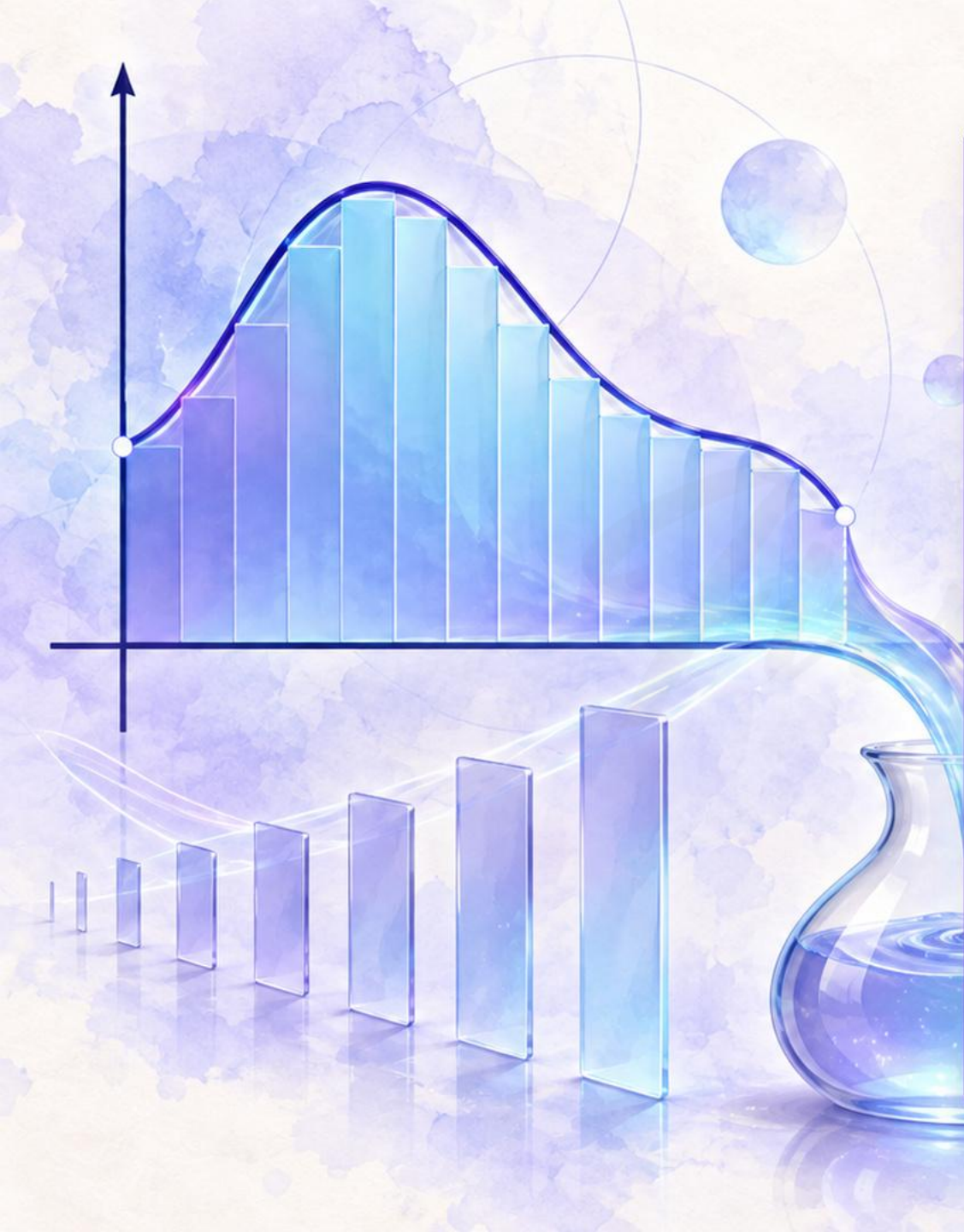




MATHEMATICS • CLASS 12

7

CHAPTER

Integrals

NCERT SOLUTIONS

INTEGRAL OF SINE TWO X – EXERCISE 7.1 Q1

Q. Find an antiderivative of $\sin 2x$ by inspection.

Answer:

The derivative of $\cos 2x$ is $-2\sin 2x$.

Therefore multiply $\cos 2x$ by $-\frac{1}{2}$ to obtain the required derivative.

Every antiderivative differs by a constant.

We have

$$\frac{d}{dx}(\cos 2x) = -2\sin 2x.$$

Hence,

$$\frac{d}{dx}\left(-\frac{1}{2}\cos 2x\right) = -\frac{1}{2} \times (-2\sin 2x) = \sin 2x.$$

Therefore, an antiderivative of $\sin 2x$ is $-\frac{1}{2}\cos 2x$.

$$\text{Hence, } \int \sin 2x \, dx = -\frac{1}{2}\cos 2x + C.$$

INTEGRAL OF COSINE THREE X – EXERCISE 7.1 Q2

Q. Find an antiderivative of $\cos 3x$.

Answer:

Since $\frac{d(\sin 3x)}{dx} = 3 \cos 3x$, divide by 3 to reverse the differentiation.

Thus, $\cos 3x = \frac{1}{3} \frac{d(\sin 3x)}{dx}$.

Therefore, an antiderivative of $\cos 3x$ is

$$\int \cos 3x \, dx = \frac{1}{3} \int \frac{d(\sin 3x)}{dx} \, dx = \frac{1}{3} \sin 3x + C,$$

where C is the constant of integration.

Check: $\frac{d}{dx} \left(\frac{1}{3} \sin 3x \right) = \frac{1}{3} \cdot 3 \cos 3x = \cos 3x$.

Hence, $\int \cos 3x \, dx = \frac{1}{3} \sin 3x + C$.

INTEGRAL OF E TO TWO X – EXERCISE 7.1 Q3

Q. Find an antiderivative of e^{2x} .

Answer:

The chain rule gives $\frac{d(e^{2x})}{dx} = 2e^{2x}$. A factor $\frac{1}{2}$ compensates for the inner derivative.

Let $F(x) = \frac{1}{2} e^{2x}$. Then, using the constant multiple rule and the chain rule,

$$\begin{aligned} F'(x) &= \frac{1}{2} \cdot \frac{d(e^{2x})}{dx} \\ &= \frac{1}{2} \cdot 2e^{2x} \\ &= e^{2x}. \end{aligned}$$

Thus, a function whose derivative is e^{2x} is $\frac{1}{2} e^{2x}$, and we add an arbitrary constant since all antiderivatives differ by a constant.

Hence, $\int e^{2x} dx = \frac{1}{2} e^{2x} + C.$

INTEGRAL OF A LINEAR SQUARE – EXERCISE 7.1 Q4

Q. Find an antiderivative of $(ax + b)^2$, where a and b are constants.

Answer:

First, expand the square of the linear expression.

$$(ax + b)^2 = a^2x^2 + 2abx + b^2.$$

Integrate each term separately, using the power rule.

$$\begin{aligned}\int (ax + b)^2 dx &= \int (a^2x^2 + 2abx + b^2) dx \\ &= \frac{a^2x^3}{3} + abx^2 + b^2x + C.\end{aligned}$$

This is an antiderivative for all constants a and b , including the case $a = 0$. If $a = 0$, the integrand becomes b^2 and the result reduces to $b^2x + C$, which is consistent.

If $a \neq 0$, an equivalent compact form can be obtained by the substitution method.

Let $u = ax + b$. Then $du = a dx$, so $dx = \frac{du}{a}$.

$$\begin{aligned}\text{Then } \int (ax + b)^2 dx &= \int u^2 \cdot \frac{du}{a} \\ &= \frac{1}{a} \int u^2 du \\ &= \frac{1}{a} \cdot \frac{u^3}{3} + C \\ &= \frac{(ax + b)^3}{3a} + C.\end{aligned}$$

Hence, $\int (ax + b)^2 dx = \frac{a^2x^3}{3} + abx^2 + b^2x + C$; for $a \neq 0$, also $\frac{(ax + b)^3}{3a} + C$.



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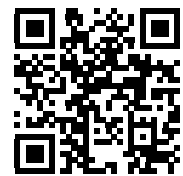


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