VIDYA BHAWAN BALIKA VIDYA PITH

शक्तिउत्थानआश्रमलखीसरायबिहार

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Find an anti-derivative (or integral) of the following functions by the method of inspection.

1. sin 2x

2. cos 3x

3. e^{2x}

4. $(ax + b)^2$

5. sin 2x – 4 e^{3x}

Solution:

1. sin 2x

The anti-derivative of sin 2x is a function of x whose derivative is sin 2x

We know that,

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

We get,

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

On further calculation, we get

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

Hence, the anti derivative of sin 2x is – 1 / 2 cos 2x

2. cos 3x

The anti-derivative of cos 3x is a function of x whose derivative is cos 3x

We know that,

$$\frac{d}{dx}(\sin 3x) = 3\cos 3x$$

We get,

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

On further calculation, we get

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

Hence, the anti derivative of cos 3x is 1 / 3 sin 3x

3. e^{2x}

The anti-derivative of e^{2x} is the function of x whose derivative is e^{2x}

We know that,

$$\frac{d}{dx}\left(e^{2x}\right) = 2e^{2x}$$

We get,

$$e^{2x} = \frac{1}{2}\frac{d}{dx}\left(e^{2x}\right)$$

On further calculation, we get

$$e^{2x} = \frac{d}{dx}\left(\frac{1}{2}e^{2x}\right)$$

Hence, the anti derivative of e^{2x} is 1 / 2 e^{2x}

4. $(ax + b)^2$

The anti-derivative of $(ax + b)^2$ is the function of x whose derivative is $(ax + b)^2$

We know that,

$$\frac{d}{dx}(ax+b)^3 = 3a(ax+b)^2$$

On further multiplication, we get

$$(ax+b)^2 = \frac{1}{3a}\frac{d}{dx}(ax+b)^3$$

Hence,

$$(ax+b)^2 = \frac{d}{dx}\left(\frac{1}{3a}(ax+b)^3\right)$$

Thus, the anti derivative of $(ax + b)^2$ is 1 / 3a $(ax + b)^3$

5. sin 2x – 4 e^{3x}

The anti-derivative of (sin 2x – 4 e^{3x}) is the function of x whose derivative of (sin 2x – 4e^{3x})

We know that,

$$\frac{d}{dx}\left(-\frac{1}{2}\cos 2x-\frac{4}{3}e^{3x}\right)=\sin 2x-4e^{3x}$$

Hence, the anti derivative of (sin 2x – 4e^{3x}) is (-1 / 2 cos 2x – 4 / 3 e^{3x})