

EXERCISE 22.10

Question. 1

Solution:

From the question it is given that,

$$(dy/dx) + 2y = e^{3x} \quad \dots \text{[equation (i)]}$$

The given linear differential equation is comparing with, $(dy/dx) + py = Q$

$$\text{So, } p = 2, Q = e^{3x}$$

$$\begin{aligned} \text{IF} &= e^{\int p dx} \\ &= e^{\int 2 dx} \\ &= e^{2x} \end{aligned}$$

Then, multiplying both side of equation (i) by IF,

$$e^{2x}(dy/dx) + e^{2x} 2y = e^{2x} \times e^{3x}$$

$$e^{2x}(dy/dx) + e^{2x} 2y = e^{5x} \quad \dots \text{[because } a^m \times a^n = a^{m+n}]$$

Now, integrating the above equation with respect to x,

$$ye^{2x} = \int e^{5x} dx + c$$

$$ye^{2x} = (e^{5x}/5) + c$$

$$y = (e^{5x}/5) + ce^{-2x}$$

Question. 2

Solution:

From the question it is given that,

$$4(dy/dx) + 8y = 5e^{-3x}$$

Dividing both side by 4 we get,

$$dy/dx + 2y = 5e^{-3x}/4 \quad \dots \text{[equation (i)]}$$

The given linear differential equation is comparing with, $(dy/dx) + py = Q$

$$\text{So, } p = 2, Q = 5e^{-3x}/4$$

$$\begin{aligned} \text{IF} &= e^{\int p dx} \\ &= e^{\int 2 dx} \\ &= e^{2x} \end{aligned}$$

Then, multiplying both side of equation (i) by IF,

$$e^{2x}(dy/dx) + e^{2x} 2y = e^{2x} \times 5e^{-3x}/4$$

$$e^{2x}(dy/dx) + e^{2x} 2y = 5e^{-x}/4$$

Now, integrating the above equation with respect to x,

$$ye^{2x} = \int 5e^{-x}/4 dx + c$$

$$ye^{2x} = (-5/4) e^{-x} + c$$

$$y = (-5/4) e^{-3x} + ce^{-2x}$$

Question. 3

Solution:

From the question it is given that,

$$(dy/dx) + 2y = 6e^x \quad \dots \text{ [equation (i)]}$$

The given linear differential equation is comparing with, $(dy/dx) + py = Q$

$$\text{So, } p = 2, Q = 6e^x$$

$$\text{IF} = e^{\int p dx}$$

$$= e^{\int 2 dx}$$

$$= e^{2x}$$

Then, multiplying both side of equation (i) by IF,

$$e^{2x}(dy/dx) + e^{2x} 2y = e^{2x} \times 6e^x$$

$$e^{2x}(dy/dx) + e^{2x} 2y = 6e^{3x} \quad \dots \text{ [because } a^m \times a^n = a^{m+n}]$$

Now, integrating the above equation with respect to x,

$$ye^{2x} = \int 6e^{3x} dx + c$$

$$ye^{2x} = (6/3) e^{3x} + c$$

$$y = 2e^{3x} + ce^{-2x}$$

Question. 4

Solution:

From the question it is given that,

$$(dy/dx) + y = e^{-2x} \quad \dots \text{ [equation (i)]}$$

The given linear differential equation is comparing with, $(dy/dx) + py = Q$

$$\text{So, } p = 1, Q = e^{-2x}$$

$$\text{IF} = e^{\int p dx}$$

$$= e^{\int 1 dx}$$

$$= e^x$$

Then, multiplying both side of equation (i) by IF,

$$e^x(dy/dx) + e^x y = e^x \times e^{-2x}$$

$$e^x(dy/dx) + e^x y = e^{-x} \quad \dots \text{ [because } a^m \times a^n = a^{m+n}]$$

Now, integrating the above equation with respect to x,

$$ye^x = \int e^{-x} dx + c$$

$$ye^x = e^{-x}/-1 + c$$

$$y = -e^{-2x} + ce^{-x}$$

Question. 5

Solution:

From the question it is given that,

$$x(dy/dx) = x + y$$

$$dy/dx = (x + y)/x$$

$$dy/dx = 1 + (y/x) \quad \dots \text{[equation (i)]}$$

The given linear differential equation is comparing with, $(dy/dx) + py = Q$

$$\text{So, } p = -1/x, Q = 1$$

$$\text{IF} = e^{\int p dx}$$

$$= e^{\int -1/x dx}$$

$$= e^{-\log x}$$

$$= e^{\log(1/x)}$$

$$= 1/x$$

Then, multiplying both side of equation (i) by IF,

$$Y(1/x) = \int 1(1/x) dx + c$$

$$ye^x = \log x + c$$

$$y = x \log x + cx$$



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