EXERCISE 22.3

Question. 1
Solution:
From the question it is given that,
$y = be^x + ce^{2x}$ … [equation (i)]
Now, differentiate the equation (i) with respect x,
$dy/dx = be^x + 2ce^{2x}$ … [equation (ii)]
Then, the above equation is again differentiating with respect to x we get,
$d^2y/dx^2 = be^x + 4ce^{2x}$ … [equation (iii)]
The given differential equation is $d^2y/dx^2 – 3 (dy/dx) + 2y = 0$
Substitute the equation (i), equation (ii) and equation (iii) in given differential equation ,
$d^2y/dx^2 – 3 (dy/dx) + 2y = 0$
$(be^x + 4ce^{2x}) – 3 (be^x + 2ce^{2x}) + 2(be^x + ce^{2x}) = 0$
$be^x + 4ce^{2x} - 3be^x - 6ce^{2x} + 2be^x + 2ce^{2x} = 0$
$3be^x – 3be^x + 6ce^{2x} – 6ce^{2x} = 0$
$0 = 0$
Hence it is proved that, $d^2y/dx^2 – 3 (dy/dx) + 2y = 0$

Question. 2
Solution:
From the question it is given that,
$y = 4 \sin 3x$ … [equation (i)]
Now, differentiate the equation (i) with respect x,
$dy/dx = 4(3) \cos 3x$
$dy/dx = 12 \cos 3x$ … [equation (ii)]
Then, the above equation is again differentiating with respect to x we get,
$d^2y/dx^2 = 12(3) \cos 3x$
$d^2y/dx^2 = - 36 \sin 3x$ … [equation (iii)]
The given differential equation is $d^2y/dx^2 + 9y = 0$
Substitute the equation (i) and equation (iii) in given differential equation ,
$d^2y/dx^2 + 9y = 0$
$- 36 \sin 3x + 9 (4 \sin 3x) = 0$
$- 36 \sin 3x + 36 \sin 3x = 0$
$0 = 0$
Hence it is verified that, $y = 4 \sin 3x$ is a solution of the differential equation is $d^2y/dx^2 + 9y = 0$.

Question. 3
Solution:
From the question it is given that,
$y = ae^{2x} + be^{-x}$ … [equation (i)]
Now, differentiate the equation (i) with respect x,
$dy/dx = 2\ ae^{2x} – be^{-x}$ … [equation (ii)]
Then, the above equation is again differentiating with respect to x we get,
$d^2y/dx^2 = 4\ ae^{2x} + be^{-x}$ … [equation (iii)]
The given differential equation is $d^2y/dx^2 – dy/dx – 2y = 0$
Substitute the equation (i), equation (ii) and equation (iii) in given differential equation,
$d^2y/dx^2 – dy/dx – 2y = 0$
$(4\ ae^{2x} + be^{-x}) – (2\ ae^{2x} – be^{-x}) – 2(ae^{2x} + be^{-x}) = 0$
$4\ ae^{2x} + be^{-x} – 2ae^{2x} + be^{-x} – 2ae^{2x} – 2be^{-x} = 0$
$4\ ae^{2x} – 4ae^{2x} + 2be^{-x} – 2be^{-x} = 0$
$0 = 0$
Hence it is verified that, $y = ae^{2x} + be^{-x}$ is a solution of the differential equation is $d^2y/dx^2 – dy/dx – 2y = 0$.

Question. 4
Solution:
From the question it is given that,
$y = A \cos x + B \sin x$ … [equation (i)]
Now, differentiate the equation (i) with respect x,
$dy/dx = - A \sin x + B \cos x$ … [equation (ii)]
Then, the above equation is again differentiating with respect to x we get,
$d^2y/dx^2 = - A \cos x - B \sin x$ … [equation (iii)]
The given differential equation is $d^2y/dx^2 + y = 0$
Substitute the equation (i) and equation (iii) in given differential equation,
$(- A \cos x - B \sin x) + (A \cos x + B \sin x\ ) = 0$
$- A \cos x – B \sin x + A \cos x + B \sin x = 0$
$0 = 0$
Hence it is verified that, $y = A \cos x + B \sin x$ is a solution of the differential equation is $d^2y/dx^2 + y = 0$.

Question. 5
Solution:
From the question it is given that,

y = A cos 2x - B sin 2x … [equation (i)]

Now, differentiate the equation (i) with respect x,

dy/dx = - 2A sin (2x) – 2B cos 2x

Taking common terms outside,

dy/dx = -2 (A sin 2x + B cos 2x) … [equation (ii)]

Then, the above equation is again differentiating with respect to x we get,

d^2y/dx^2 = - 2 [2A cos 2x – 2B sin 2x]

= -4 [A cos 2x – B sin 2x] … [equation (iii)]

The given differential equation is $d^2y/dx^2 + 4y = 0$

Substitute the equation (i) and equation (iii) in given differential equation,

$d^2y/dx^2 + 4y = 0$

-4 [A cos 2x – B sin 2x] + 4 (A cos 2x - B sin 2x) = 0

-4A cos 2x + 4B sin 2x + 4A cos 2x – 4B sin 2x = 0

0 = 0

Hence it is verified that, y = A cos 2x - B sin 2x is a solution of the differential equation is $d^2y/dx^2 + 4y = 0$.