

Answer on Question #79198 – Math – Differential Equations

Question

$$dy/dx+2y=2x^2+3$$

$$y_p(x)=x^2-x+2$$

$$y_p(x)=x^2+x+2$$

$$y_p(x)=-x^2-x+2$$

$$y_p(x)=-x^2-x-2$$

Solution

Note that if $y_p(x)$ is a particular solution of the differential equation $dy/dx+2y=2x^2+3$, then substituting $y_p(x)$ for y and using the derivative of $y_p(x)$ we obtain the identity.

1) Consider $y_p(x)=x^2-x+2$.

$$dy_p(x)/dx = d(x^2-x+2)/dx = 2x-1, \quad 2y_p(x) = 2(x^2-x+2) = 2x^2-2x+4.$$

The left-hand side of our equation in this case:

$$dy_p(x)/dx + 2y_p(x) = 2x-1 + 2x^2-2x+4 = 2x^2+3.$$

We get $2x^2+3=2x^2+3$, hence $y_p(x)=x^2-x+2$ is a particular solution of the differential equation $dy/dx+2y=2x^2+3$.

2) Consider $y_p(x)=x^2+x+2$.

$$dy_p(x)/dx = d(x^2+x+2)/dx = 2x+1, \quad 2y_p(x) = 2(x^2+x+2) = 2x^2+2x+4.$$

The left-hand side of our equation in this case:

$$dy_p(x)/dx + 2y_p(x) = 2x+1 + 2x^2+2x+4 = 2x^2+4x+5.$$

We get $2x^2+4x+5 \neq 2x^2+3$, hence $y_p(x)=x^2+x+2$ is not a particular solution of the differential equation $dy/dx+2y=2x^2+3$.

3) Consider $y_p(x)=-x^2-x+2$.

$$dy_p(x)/dx = d(-x^2-x+2)/dx = -2x-1, \quad 2y_p(x) = 2(-x^2-x+2) = -2x^2-2x+4.$$

The left-hand side of our equation in this case:

$$dy_p(x)/dx + 2y_p(x) = -2x-1 - 2x^2-2x+4 = -2x^2-4x+3.$$

We get $-2x^2-4x+3 \neq 2x^2+3$, hence $y_p(x)=-x^2-x+2$ is not a particular solution of the differential equation $dy/dx+2y=2x^2+3$.

4) Consider $y_p(x)=-x^2-x-2$.

$$dy_p(x)/dx = d(-x^2-x-2)/dx = -2x-1, \quad 2y_p(x) = 2(-x^2-x-2) = -2x^2-4x-4.$$

Left-hand side of our equation in this case:

$$dy_p(x)/dx + 2y_p(x) = -2x-1 - 2x^2-4x-4 = -2x^2-4x-5.$$

We get $-2x^2-4x-5 \neq 2x^2+3$, hence $y_p(x)=-x^2-x-2$ is not a particular solution of the differential equation $dy/dx+2y=2x^2+3$.

Answer: the first option is correct, $y_p(x)=x^2-x+2$.