# NCERT Solutions Class 12 Maths Chapter 9: Differential Equations Exercise 9.2

**Document Information:**
**Class:** 12 | **Subject:** Mathematics | **Chapter:** 9 | **Exercise:** 9.2
**Total Questions:** 12 | **Academic Year:** 2025-26
**Source:** www.ncertbooks.net | **Generated:** February 21, 2026



**Quick Summary:** In NCERT Solutions Class 12 Maths Chapter 9 Exercise 9.2, students learn to distinguish between general and particular solutions of differential equations through verification problems. This exercise covers fundamental methods for checking whether given functions satisfy specific differential equations, building essential problem-solving skills for CBSE board exams and competitive tests.

**Key Takeaways:**

- General solutions contain arbitrary constants (like y = x^2 + 2x + C), while particular solutions have specific values
- Verification process involves substituting the given function and its derivatives into the differential equation
- Common function types include exponential y = e^x, polynomial, trigonometric y = \cos x + C, and algebraic functions like y = √1 + x^2
- Mastering verification techniques is crucial for solving complex differential equation problems in CBSE Class 12 exams

## Complete Solutions

### Question 1

QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: y = e^x + 1

Differential equation: y'' - y' = 0

SOLUTION

We are asked to verify if the function is a solution to the differential equation .

**Step 1: Find the first derivative,**

Given , we differentiate with respect to :

Since the derivative of is and the derivative of a constant (1) is 0:

**Step 2: Find the second derivative,**

Now, we differentiate with respect to to find the second derivative:

The derivative of is , so:

**Step 3: Substitute and into the differential equation**

The given differential equation is . We substitute the expressions we found for and :

**Step 4: Simplify and verify**

Simplifying the left-hand side:

Since the equation holds true, the given function is indeed a solution to the differential equation.

**Final Answer:** The function is a solution to the differential equation .

## Question 2

QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: y = x^2 + 2x + C

Differential equation: y' - 2x - 2 = 0

SOLUTION

We are asked to verify if the given function is a solution to the differential equation .

**Step 1: Find the derivative of the given function**

We need to find , which is the first derivative of with respect to .

Given:

Differentiating both sides with respect to :

Using the power rule and the fact that the derivative of a constant is zero:

Therefore,

**Step 2: Substitute into the differential equation**

The given differential equation is .

Substitute into the equation:

**Step 3: Simplify the equation**

Simplifying the left-hand side:

**Step 4: Conclusion**

Since the substitution of into the differential equation results in a true statement (), the given function is indeed a solution to the differential equation .

## Question 3

QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: y = \cos x + C

Differential equation: y' + \sin x = 0

SOLUTION

We are asked to verify if the function is a solution to the differential equation .

**Step 1: Find the derivative of the given function**

The given function is , where is a constant.

Differentiating with respect to , we get:

Since the derivative of is and the derivative of a constant is 0, we have:

**Step 2: Substitute the derivative into the differential equation**

The given differential equation is .

Substitute into the differential equation:

**Step 3: Simplify and verify**

Simplifying the left-hand side of the equation, we get:

Since the equation holds true, the given function is indeed a solution to the differential equation .

**Final Answer:** Verified that is a solution to .

## Question 4

### QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: y = √1 + x^2

Differential equation: y' = (xy)/(1 + x^2)

### SOLUTION

We need to verify if the given function is a solution to the differential equation .

**Step 1: Find the derivative of the given function with respect to**

Given , we can rewrite it as .

Using the chain rule, we differentiate with respect to :

Simplifying, we get:

**Step 2: Substitute into the right-hand side of the differential equation**

The right-hand side of the differential equation is .

Substituting into this expression, we get:

We can rewrite this as:

**Step 3: Compare the derivative with the right-hand side of the differential equation**

We found that and the right-hand side of the differential equation, after substituting , is also .

Since both sides are equal, the given function is indeed a solution to the differential equation.

**Final Answer:** The given function is a solution to the differential equation .

## Question 5

QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: y = Ax

Differential equation: xy' = y (x \ne 0)

SOLUTION

We are given a function and a differential equation , where . We need to verify that the given function is a solution to the given differential equation.

**Step 1: Find the derivative of the given function**

Given:

Differentiate both sides with respect to :

Since is a constant, we have:

**Step 2: Substitute and into the differential equation**

The given differential equation is .

Substitute and into the equation:

**Step 3: Verify the equality**

Since the left-hand side (LHS) is equal to the right-hand side (RHS), the given function satisfies the differential equation.

Therefore, is a solution of the differential equation .

**Final Answer:** The given function is a solution of the corresponding differential equation .

**Conclusion:** By finding the derivative of the given function and substituting it into the differential equation, we showed that the equation holds true. This verifies that the given function is indeed a solution to the differential equation.

## Question 6

### QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: y = x\sin x

Differential equation: xy' = y + x√x^2 - y^2 (x \ne 0\ \textand\ x > y\ \textor\ x < -y)

### SOLUTION

We are asked to verify if the function is a solution to the differential equation , given the conditions and or .

**Step 1: Find the derivative of with respect to**

Given , we need to find . We will use the product rule: .

Let and . Then and .

Therefore, .

**Step 2: Substitute and into the left-hand side (LHS) of the differential equation**

LHS = .

**Step 3: Substitute into the right-hand side (RHS) of the differential equation**

RHS = .

We can factor out from inside the square root:

RHS = .

Since , we have:

RHS = .

**Step 4: Consider the condition or**

Given , the condition or implies or . This means and .

Also, since we are given , we can assume has the same sign as , so we can replace with .

RHS = .

**Step 5: Compare LHS and RHS**

LHS =

RHS =

Since LHS = RHS, the given function is a solution to the differential equation under the given conditions.

## Question 7

### QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: $xy = \log y + C$

Differential equation: $y' = (y^2)/(1 - xy)$ $(xy \ne 1)$

### SOLUTION

We are given a function and a differential equation with the condition . We need to verify that the given function is a solution of the given differential equation.

**Step 1: Differentiate the given function with respect to x**

Given:

Differentiating both sides with respect to , we use the product rule on the left side and the chain rule on the right side:

**Step 2: Solve for**

We want to isolate , which is .

**Step 3: Compare with the given differential equation**

The differential equation given is:

Our derived expression for matches the given differential equation.

**Final Answer:**

Since the derivative of the given function satisfies the given differential equation, the given function is a solution of the differential equation .

## Question 8

QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: y - \cos y = x

Differential equation: (y\sin y + \cos y + x)\,y' = y

SOLUTION

We are given a function and a differential equation . We need to verify that the given function is a solution of the given differential equation.

**Step 1: Differentiate the given function with respect to x**

Given:

Differentiating both sides with respect to , we get:

Factoring out , we have:

Therefore,

**Step 2: Substitute into the differential equation**

The given differential equation is .

Substitute into the left-hand side (LHS) of the differential equation:

**Step 3: Simplify the expression using the given function**

From the given function, we have . Substitute this into the LHS:

**Step 4: Compare with the right-hand side (RHS)**

The RHS of the differential equation is .

Since , the given function is a solution of the given differential equation.

**Final Answer:** The given function is a solution of the differential equation .

## Question 9

### QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: x + y = \tan^-1y

Differential equation: y^2y' + y^2 + 1 = 0

### SOLUTION

We are given a function and a differential equation . We need to verify that the given function is a solution to the given differential equation.

**Step 1: Differentiate the given function with respect to x**

Given:

Differentiating both sides with respect to , we get:

Here, is represented as .

So,

**Step 2: Isolate y'**

Multiplying both sides by , we have:

**Step 3: Simplify the equation**

Subtract from both sides:

Rearranging the terms, we get:

**Step 4: Compare with the given differential equation**

The differential equation we obtained is , which is the same as the given differential equation.

**Final Answer:**

Since the derivative of the given function satisfies the given differential equation, the given function is a solution of the differential equation .

## Question 10

### QUESTION

Verify that the given function is a solution of the corresponding differential equation:

Given: y = √a^2 - x^2,\ x \in (-a, a)

Differential equation: x + y(dy)/(dx) = 0 (y \ne 0)

### SOLUTION

We are given a function and a differential equation . We need to verify that the given function is a solution to the differential equation.

**Step 1: Find the derivative**

Given , we can rewrite it as .

Using the chain rule, we have:

**Step 2: Substitute and into the differential equation**

The differential equation is .

Substituting the expressions for and , we get:

**Step 3: Simplify the equation**

We can simplify the expression by canceling out the terms:

**Step 4: Conclusion**

Since the substitution of and into the differential equation results in a true statement (), the given function is indeed a solution to the differential equation .

## Question 11

### QUESTION

The number of arbitrary constants in the general solution of a differential equation of fourth order are:

### SOLUTION

We are asked to find the number of arbitrary constants in the general solution of a fourth-order differential equation.

**Key Concept:** The order of a differential equation determines the number of arbitrary constants in its general solution. The general solution of an th order differential equation contains arbitrary constants.

**Step 1: Identify the order of the differential equation**

The problem states that the differential equation is of the fourth order. This means the highest derivative present in the equation is the fourth derivative.

**Step 2: Recall the relationship between order and arbitrary constants**

For a differential equation of order , the general solution will have arbitrary constants. These constants arise from the integrations needed to solve the differential equation.

**Step 3: Apply the concept to the given problem**

Since the given differential equation is of the fourth order (order = 4), the general solution will have 4 arbitrary constants.

**Step 4: State the answer**

Therefore, the number of arbitrary constants in the general solution of a differential equation of the fourth order is 4.

**Correct Answer:** 4

**Why the other options are incorrect:**

Option 0 is incorrect because a differential equation of fourth order will have arbitrary constants.

Option 2 is incorrect because the number of arbitrary constants must match the order of the differential equation.

Option 3 is incorrect because the number of arbitrary constants must match the order of the differential equation, which is 4 in this case.

### ANSWER

3

## Question 12

QUESTION

The number of arbitrary constants in the particular solution of a differential equation of third order are:

SOLUTION

We are asked to find the number of arbitrary constants in the **particular solution** of a third-order differential equation.

**Key Concepts:**

- **General Solution:** A general solution of a differential equation contains arbitrary constants equal to the order of the differential equation.
- **Particular Solution:** A particular solution is obtained from the general solution by assigning specific values to the arbitrary constants. This is usually done using initial or boundary conditions.

**Step 1: Understanding the General Solution**

A third-order differential equation will have a general solution with three arbitrary constants. Let's denote them as , , and . The general solution will look something like:

**Step 2: Understanding the Particular Solution**

To find a particular solution, we need to determine the specific values of , , and . This is done by using given conditions (e.g., initial values or boundary values).

Once we substitute the values for , , and , they are no longer arbitrary constants; they are now fixed values.

**Step 3: Conclusion**

Since the particular solution is obtained by assigning specific values to the arbitrary constants in the general solution, there are **no** arbitrary constants left in the particular solution.

**Correct Answer: 0**

**Why the other options are incorrect:**

- **3:** This is the number of arbitrary constants in the *general* solution, not the particular solution.
- **2, 1:** A particular solution has *no* arbitrary constants.

ANSWER

3

## 📚 Relevant Resources

**Explore more NCERT solutions (click links to visit):**

| Resource | Visit Link |
| --- | --- |
| NCERT Class 12 Sociology Textbook | Download Book → |
| NCERT Class 10 Maths (Foundation) | View Solutions → |

## 🗒 Key Formulas

### Important Formulas for Exercise 9.2

| Formula / Concept | Description |
| --- | --- |
| Differential Equation | An equation that involves an independent variable, a dependent variable, and the derivatives of the dependent variable with respect to the independent variable. |
| Solution of a Differential Equation | A function y = f(x) is a solution to a differential equation if it and its derivatives satisfy the equation. When the function and its derivatives are substituted into the equation, the Left-Hand Side (LHS) must equal the Right-Hand Side (RHS). |
| General Solution | The solution of a differential equation which contains as many arbitrary constants as the order of the differential equation. For example, the general solution of a second-order differential equation will have two arbitrary constants. |
| Particular Solution | A solution obtained by assigning specific values to the arbitrary constants in the general solution. This type of solution is free from arbitrary constants. |
| Arbitrary Constants | The constants that appear in the general solution of a differential equation. The number of arbitrary constants in a general solution is equal to the order of the differential equation. |
| Verification of a Solution | The process to check if a given function is a solution to a differential equation. The steps are:<br>1. Find the derivatives of the given function (e.g., y', y'').<br>2. Substitute the function and its derivatives into the differential equation.<br>3. If the equation holds true (LHS = RHS), the function is a solution. |



## 📚 More Exercises

**Visit all exercises from Chapter 9:**

Exercise 9.1 →

Exercise 9.2 ✓ →

Exercise 9.3 →

Exercise 9.4 →

Exercise 9.5 →

Miscellaneous Exercise on Chapter 9 →

🌐 **Complete Chapter:** Class 12 Maths Ch 9: Differential Equations →

---