Calculus

7.2 Verifying Solutions

Notes

Write your questions and thoughts here!

Derivatives can be used to verify that a function is a solution to a given differential equation.

We already covered some of this in lesson 6.8, where we found particular solutions. Let's remind ourselves what we did.

1. If $\frac{dy}{dx} = e^{2x} - 2x^2$, find the particular solution of y if $y(0) = 4$.

2. This problem is exactly the same. A curve has a slope of $e^{2x} - 2x^2$ at each point (x, y) on the curve. What is an equation for this curve if it passes through the point $(0, 4)$?

3. If $\frac{d^2y}{dx^2} = \frac{1}{x^2} + (1 - 2x)^2$, find the particular solution of y if $y'(1) = \frac{7}{6}$ and $y(1) = 0$.

RECALL

$\frac{d}{dx}\sin x =$ $\qquad$ $\frac{d}{dx}\cos x =$

$\int \sin x\, dx =$ $\qquad$ $\int \cos x\, dx =$

4. For what value of k, if any, will $y = ke^{-4x} - 2\sin(5x)$ be a solution to the differential equation $y'' + 25y = -82e^{-4x}$?

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Practice

For each differential equation, find the particular solution that passes through the given point.

1. $\frac{dy}{dx} = 4x + 2$; $(-1, 3)$

2. $\frac{dy}{dx} = \frac{3}{2-x} + 6x^2$; $(1, 1)$

3. $\frac{dy}{dx} = 8\cos(4x)$; $\left(\frac{\pi}{8}, -2\right)$

4. $\frac{dy}{dx} = 9e^{3x} - 1$; $(0, 7)$

5. $\frac{d^2y}{dx^2} = \frac{1}{(2-x)^2} + 1$ and $y'(3) = 6$ and $y(1) = 4$

6. $\frac{d^2y}{dx^2} = e^{2x} - x$ and $y'(0) = \frac{3}{2}$ and $y(0) = \frac{3}{4}$

Find the value of k of each equation that would be a solution to the given differential equation.

7. $y = 3ke^{2x} + \cos(4x)$

   Diff Eq: $\frac{y''}{2} + 8y = 15e^{2x}$

8. $y = k\sin(-x) + 2\cos(3x)$

   Diff Eq: $2y'' + 18y = 32\sin(-x)$

9. $y = e^{-3x} + ke^{4x}$

   Diff Eq: $3y' + y'' = -14e^{4x}$

10. $y = e^{3x} + ke^{-2x}$

    Diff Eq: $y'' - 2y' - 3y = 4e^{-2x}$

11. Of the following, which are solutions to the differential equation $y'' - 5y' + 4y = 0$

I. $y = 5\cos(2x)$

II. $y = 2e^{x}$

III. $y = Ce^{4x}$, where C is a constant.

(A) I only

(B) II only

(C) III only

(D) I and II only

(E) II and III only

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12. Consider the differential equation $\frac{dy}{dx} = (y-4)^3 \sin\left(\frac{\pi x}{2}\right)$. There is a horizontal line with equation $y = c$ that satisfies this differential equation. Find the value of c.