



Solving Differential Equations

Challenging problems can be solved with differential equations.

6A Understanding Differential Equations

1. Explain what it means to solve a differential equation
2. Find solutions to basic differential equations (including +C)
3. Use initial values to find solutions

[6.1] 11 - 23 odd, 31 - 38, 53

Explain what it means to solve a differential equation

Sample Question	What does it mean to solve the following differential equation? What does the solution represent? (Use calculus concepts in your explanation) $\frac{dy}{dx} = f(x)$
Sample Response	<p style="text-align: center;">Show / Hide Answer</p> What does it mean to solve the following differential equation? What does the solution represent? (Use calculus concepts in your explanation) $\frac{dy}{dx} = f(x)$ <p>THE SOLUTION TO A DIFF. EQ. IS THE ANTI DERIVATIVE, $F(x)$ SUCH THAT $F'(x) = f(x)$; SO $\int f(x) = F(x)$.</p>

Find solutions to basic differential equations (including +C)

Sample Question	Solve the following differential equation $\frac{dy}{dx} = x^3 + 2$
Sample Response	<p style="text-align: center;">Show / Hide Answer</p> <p>Solve the following differential equation</p> $\frac{dy}{dx} = x^3 + 2$ $dy = (x^3 + 2) dx$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> $y = \frac{x^4}{4} + 2x + C$ </div>

Use initial values to find solutions

Sample Question	<p>Consider the differential equation $\frac{dy}{dx} = x^2(y - 1)$.</p> <p>Find the particular solution $y = f(x)$ to the given differential equation with the initial condition $f(0) = 3$.</p>
Sample Response	<p style="text-align: center;">Show / Hide Answer</p> <p>Consider the differential equation $\frac{dy}{dx} = x^2(y - 1)$.</p> <p>Find the particular solution $y = f(x)$ to the given differential equation with the initial condition $f(0) = 3$.</p> $\frac{1}{y - 1} dy = x^2 dx$ $\ln y - 1 = \frac{1}{3}x^3 + C$ $ y - 1 = e^C e^{\frac{1}{3}x^3}$ $y - 1 = Ke^{\frac{1}{3}x^3}, K = \pm e^C$ $2 = Ke^0 = K$ $y = 1 + 2e^{\frac{1}{3}x^3}$