

## Discovery Exercise for Guess and Check

A linear second-order differential equation starts with the following expression:

$$a_2(x)\frac{d^2y}{dx^2} + a_1(x)\frac{dy}{dx} + a_0(x)y \tag{1}$$

Suppose the three different functions  $c_1(x)$ ,  $c_2(x)$ , and  $p(x)$  have the following properties: if you plug  $y = c_1(x)$  into Equation 1 you get 0. If you plug in  $y = c_2(x)$  in, you again get 0. And if you plug in  $y = p(x)$ , you get out the function  $A(x)$ .

1. What do you get if you plug  $y = 3c_1(x)$  into Equation 1?
2. What do you get if you plug  $y = 5c_2(x)$  into Equation 1?
3. What do you get if you plug  $y = 10p(x)$  into Equation 1?
4. What do you get if you plug  $y = 13c_1(x) - 12c_2(x) + p(x)$  into Equation 1?

*See Check Yourself #63 at [felderbooks.com/checkyourself](http://felderbooks.com/checkyourself)*

5. Would your answers change if Equation 1 began with  $a_3(x)y'''(x)$ ? (Assume that the functions  $c_1(x)$ ,  $c_2(x)$ , and  $p(x)$  still gave the same answers as before.)
6. Would your answers change if Equation 1 contained  $a_0(x)y^2$  instead of  $a_0(x)y$ ? (same comment)