

HOMEWORK #1 Answers (Chapter 1 Review Exercises)

1) $y = c_1 e^x + c_2 x e^x$ (Problem 5.)

Ans: $y' = c_1 e^x + c_2 e^x + c_2 x e^x$, $y'' = c_1 e^x + 2c_2 e^x + c_2 x e^x$, $y'' + y = 2y' \therefore y'' - 2y' + y = 0$

In Problems 2)~4), match each of the given differential equations with one or more of the solutions:

(a) $y = 0$ (b) $y = 2$ (c) $y = 2x$ (d) $y = 2x^2$

2) $xy' = 2y$ (Problem 7.)

Ans: (a) and (d)

3) $y' = 2y - 4$ (Problem 9.)

Ans: (b)

4) $y'' + 9y = 18$ (Problem 11.)

Ans: (b)

5) What is the slope of the tangent line to the graph of the solution $y' = 6\sqrt{y} + 5x^3$ that through $(-1, 4)$? (Problem 20.)

Ans: $y'|_{(-1,4)} = 7$

6) Verify that the indicated function is a particular solution of the given differential equation. Given an interval of definition I for the solution.

$x^2 y'' + xy' + y = 0$; $y = \sin(\ln x)$

Ans: $y = \sin(\ln x)$, $y' = \frac{1}{x} \cos(\ln x)$, $y'' = -\frac{1}{x^2} \cos(\ln x) - \frac{1}{x^2} \sin(\ln x)$

$$x^2 y'' + xy' + y = x^2 \left[-\frac{1}{x^2} \cos(\ln x) - \frac{1}{x^2} \sin(\ln x) \right] + x \left[\frac{1}{x} \cos(\ln x) \right] + \sin(\ln x) = 0$$

$(0, \infty)$

