

Example sheet 0: Recap of key techniques

Derive the general solution to the following ordinary differential equations for $y = y(x)$, $x > 0$:

1.

$$\frac{dy}{dx} = \frac{y-1}{x+3}; \quad (1)$$

2.

$$\frac{dy}{dx} = \frac{x^2 - 1}{y^2}; \quad (2)$$

3.

$$\frac{dy}{dx} = \frac{1}{xy^3}; \quad (3)$$

4.

$$\frac{dy}{dx} + y^2 = 2y; \quad (4)$$

5.

$$\frac{dy}{dx} + 2y = 3e^x; \quad (5)$$

6.

$$\frac{dy}{dx} - y = e^{3x}; \quad (6)$$

7.

$$x \frac{dy}{dx} + 3y + 2x^2 = x^3 + 4x; \quad (7)$$

8.

$$y'' - 5y' + 6y = 0; \quad (8)$$

9.

$$y'' - 5y' = 0; \quad (9)$$

10.

$$y'' - 2y' + 5y = 0; \quad (10)$$

[can you write your solution using real coefficients only?]

11.

$$y'' - 5y' + 6y = x^2 \quad (11)$$

12.

$$y'' - 5y' + 6y = e^{2x} \quad (12)$$

13.

$$y'' - 5y' = \cos(x). \quad (13)$$