

Example sheet 0: Recap of key techniques

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

1.
$$\frac{dy}{dx} = \frac{y-1}{x+3}; \tag{1}$$

2.
$$\frac{dy}{dx} = \frac{x^2-1}{y^2}; \tag{2}$$

3.
$$\frac{dy}{dx} = \frac{1}{xy^3}; \tag{3}$$

4.
$$\frac{dy}{dx} + y^2 = 2y; \tag{4}$$

5.
$$\frac{dy}{dx} + 2y = 3e^x; \tag{5}$$

6.
$$\frac{dy}{dx} - y = e^{3x}; \tag{6}$$

7.
$$x \frac{dy}{dx} + 3y + 2x^2 = x^3 + 4x; \tag{7}$$

8.
$$y'' - 5y' + 6y = 0; \tag{8}$$

9.
$$y'' - 5y' = 0; \tag{9}$$

10.
$$y'' - 2y' + 5y = 0; \tag{10}$$

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

11.

$$y'' - 5y' + 6y = x^2 \tag{11}$$

12.

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

13.

$$y'' - 5y' = \cos(x). \tag{13}$$