

## Solutions Quiz 1a

1.  $y' = e^{-y}$  has solution  $y = \ln(x)$ .  $y' = y(y+3)$  has the trivial solution  $y = 0$ .  $y' = \cos^2 y + \sin^2 y$  has solutions  $y = x$ .
2. Use the integrating factor method to find

$$y = \frac{\sin(x) + C}{x^3}$$

3. First order, linear.
4. All methods are appropriate
5. Using e.g. separation:

$$\begin{aligned} y'/y = \sin(x)/\cos(x) &\Rightarrow \ln(y) = \int \sin(x)/\cos(x) dx + C \\ &\Rightarrow \ln(y) = \ln(-\cos(x)) + C \Rightarrow y = \frac{C}{\cos(x)} \end{aligned}$$

Using the method for exact equations:

$$\begin{aligned} M &= -y \sin x \Rightarrow \partial_y M = -\sin(x) \\ N &= \cos x \Rightarrow \partial_x N = -\sin(x) \\ \phi &= \int M dx + C_1(y) \Rightarrow \phi = y \cos x + C_1 \\ \phi &= \int N dy + C_2(x) \Rightarrow \phi = y \cos x + C_2 \\ &\Rightarrow C_1 = C_2 = 0. \phi = \text{Const. is solution} \Leftrightarrow y \cos x = C. \end{aligned}$$