

**Exercise sheet 4 for Math 263: ODEs for Engineers** Matt Roberts  
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1. (a) Are  $(3, 2, 0)$ ,  $(1, 0, 3)$  and  $(3, 4, -9)$  linearly independent?  
(b) How about  $(0, 1, 3)$ ,  $(2, 1, 0)$  and  $(1, 0, -1)$ ?
2. (a) Are  $e^x$  and  $\cos x$  linearly independent? (Use method 1.)  
(b) How about  $\cos x$ ,  $\cos 2x$  and  $\sin 3x$ ? (Use method 2.)  
(c) And  $\sin^2 x$ ,  $\cos^2 x$  and  $\cos 2x$ ?
3. Does there exist a linear homogeneous second order ODE with the general solution  $y = Ae^x + Bx^2$ ?
4. Let  $L = D^2$ . What is  $\ker(L)$ ?
5. Let  $L(y) = y''' - xy'' + y'e^x \cos x - y$ . Suppose that  $y_1$ ,  $y_2$  and  $y_3$  are solutions to  $L(y) = 0$ . Suppose also that  $W(0) = 1$ . What is  $W(\sqrt{2 \ln 7})$ ?

If you spot any errors, please inform me: [matthew.roberts@mcgill.ca](mailto:matthew.roberts@mcgill.ca)