Johannes Zimmer



# MA10193: Mathematics 2

**H1**. Find the three solutions to $z^3 = 8$, write each of them in standard form and plot them in the Argand diagram. [6]

**H2**. Find all solutions of $z^5 = -1$ and plot them in the Argand diagram. [6]

**H3**. Classify each of the following equations according to: (non)-linear; their order; (un-)forced; constant (or non-constant) coefficients. [4]

a) $\frac{\mathrm{d}^2 y}{\mathrm{d}x^2} + x\,\frac{\mathrm{d}y}{\mathrm{d}x} = \cos(\pi x + \frac{\pi}{2}) + \frac{1}{2}$,

b) $2\,\frac{\mathrm{d}^3 y}{\mathrm{d}x^3} + 3\left(\frac{\mathrm{d}^2 y}{\mathrm{d}x^2}\right)^3 + \frac{1}{3}\,y = 0$,

c) $\frac{\mathrm{d}^2 x(t)}{\mathrm{d}t^2} + 2\,\frac{\mathrm{d}x(t)}{\mathrm{d}t} = [\cos(t + \pi/4)]^2$,

d) $2\,\frac{\mathrm{d}^2 x(t)}{\mathrm{d}t^2} + \mathrm{e}^{-t}\,x(t) = \mathrm{e}^{-2t}$.

**H4**. Find the general solutions of the following homogeneous differential equations

a) $y'' - 5y' + 6y = 0$,

b) $y'' + 5y' - 14y = 0$,

c) $3y'' + 4y' + 2y = 0$,

d) $y'' + 9y = 0$,

where $y = y(x)$ and the prime denotes differentiation with respect to $x$. [20]

**H5**. Show that the quadratic equation

$$a\,m^2 + b\,m + c = 0, \qquad a, b, c \in \mathbb{R},$$

has two distinct real roots, complex conjugate roots, or a double real root. [4]

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**Please hand in solutions by 11:15am on Friday 22 March, in the pigeon hole marked MA0193 in 4W on level 1.**

Please note in your solutions if you have difficulties with a topic or homework problem and would like a particular discussion in the tutorial.