# Vv557 Methods of Applied Mathematics II
# Green Functions for Partial Differential Equations


## Assignment 2

**Date Due: 1:00 PM, Thursday, the 14th of March 2018**

This assignment has a total of **(10 Marks)**.

**Exercise 2.1**
Show that

$$g \in \mathcal{D}'(\mathbb{R}^2), \qquad g(x) = -\frac{1}{2\pi}\log|x|$$

satisfies $-\Delta g = \delta(x)$ in the distributional sense.
**(3 Marks)**

**Exercise 2.2**
For $u\colon \mathbb{R}^2 \to \mathbb{R}$ given by[1]

$$u(x,t) = \begin{cases} 1/2 & t - |x| > 0, \\ 0 & \text{otherwise} \end{cases}$$

calculate $u_{tt} - u_{xx}$.
**(3 Marks)**

**Exercise 2.3**
Show that

$$\frac{d}{dx}\mathcal{P}\left(\frac{1}{x}\right) = -\mathcal{P}\left(\frac{1}{x^2}\right),$$

where

$$\mathcal{P}\left(\frac{1}{x^2}\right)(\varphi) := \lim_{\varepsilon \searrow 0} \int_{|x|>\varepsilon} \frac{1}{x^2}\big(\varphi(x) - \varphi(0)\big)\, dx.$$

**(4 Marks)**

[1] Zuily, C., *Problems in Distributions and Partial Differential Equations*, Exercise 28