Please staple this cover sheet in front of your answers. (Behind Department of Physics coversheet.)

NAME: **ID#:**

ELEC441: Assignment 1
Due 4pm Friday 11th March 2021

https://amoqt.otago.ac.nz/people/asbradley/elec441

1. For each of the following sketch and give a formula for the function, its derivative and antiderivative.

   (a) $f(t) = \frac{|t|}{t}$

   (b) $f(t) = u(t)\sin(t)$

   In the sketches denote the delta function by a vertical arrow of length one.

2. Evaluate using the formal definition of the delta function and the properties of generalised functions.

   (a)
   $$\int_{-\infty}^{\infty} \exp(x)\delta(\alpha x)dx$$

   (b)
   $$\int_{-\infty}^{\infty} \sin(x)\delta'(x-x_0)dx$$

3. For the damped, driven, simple harmonic oscillator, find the solution when the mass is given a sharp "kick" at $t=0$, of strength λ:
   $$\frac{d^2}{dt^2}x + 2\gamma\frac{d}{dt}x + \omega^2 x = \lambda\delta(t).$$

   The initial condition is that $x(t) = 0$ for $t < 0$. You can assume that the oscillator is weakly damped, that is $0 < \gamma < \omega$.

   Hint: First find the general solution of the homogeneous equation (without forcing). Then plug it in to the forced equation and find a particular solution. You will find it easier if you absorb the boundary conditions into the form of the general solution (is there a generalized function that can help with this?).

SCORE: