

<b>STUDENT NAME:</b> <b>STUDENT NUMBER:</b>
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**THE UNIVERSITY OF SOUTH AUSTRALIA**

MID SEMESTER EXAM

**EEET3041**

Signals and Systems

**OPEN BOOK**

Due Monday 14th of September

**EEET3041 Signals and Systems**  
**MID SEMESTER EXAM**

**20 marks in total. Each question worth 5 marks**

1. Plot the signal

$$x(t) = \frac{u(t)}{(t+1)^{2/3}} = \begin{cases} (t+1)^{-2/3} & t \geq 0 \\ 0 & t < 0, \end{cases}$$

where  $u(t)$  is the step function. Show whether the signal  $x(t)$  is bounded, periodic, absolutely integral, square integrable.

2. Show whether the system

$$Hx(t) = 1 + x(t-1)$$

is causal, linear, shift-invariant, regular, stable.

3. Find the Laplace transform and the region of convergence of the signal

$$x(t) = te^{t/3}u(t).$$

Sketch the region of convergence.

4. Consider the operational amplifier circuit in Figure 1. Assuming an ideal operational amplifier, show that the input voltage signal  $x$  and the output voltage signal  $y$  satisfy the differential equation

$$-R_2C_1Dx = y + R_1C_1Dy.$$

Find the transfer function of a linear shift-invariant system  $H$  that maps the input voltage signal  $x$  to output voltage signal  $y$ .

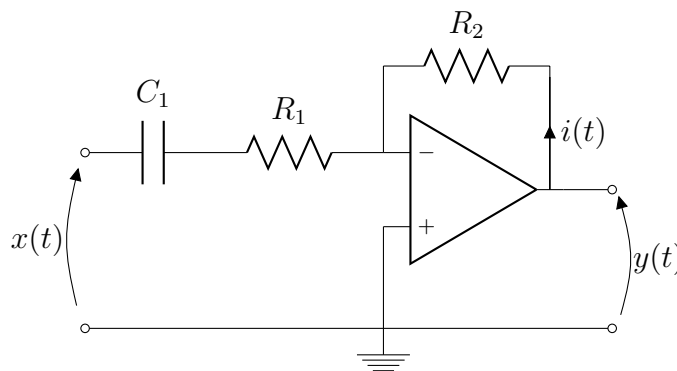


Figure 1: Operational amplifier circuit for question 4.