3C1 Signals and Systems Homework No. 6

Q.1 Let $x[n] = a^n u[n-1]$ where a is a constant and $u[n]$ is the unit-step sequence. Show that $X(z)$, the z-transform of $x[n]$, is given by

$$X(z) = \frac{a\,z^{-1}}{1 - a\,z^{-1}}, \qquad |z| > |a|$$

Q.2 Determine the inverse z-transform of

$$X(z) = \frac{3 - z^{-1}}{(1 - 0.25z^{-1})(1 - 0.5z^{-1})}, \qquad |z| > 0.5$$

Q.3 Determine the z-transform and the associated region of convergence of each of the following sequences:

(i) $x_1[n] = 3\,(2)^n u[n] - 2\,(0.5)^n u[n]$

where $u[n]$ is the unit step sequence;

and

(ii) $x_2[n] = \delta[n-1] - \delta[n+1]$

where $\delta[n]$ is the unit-sample sequence.