Q5

(1) The solutions are stable. Since $\lambda = -5 < 0$, all nonzero solutions decay exponetially, so every solution is not only stable, but asymptotically stable.

(2) $h \le -\frac{2}{\lambda} = \frac{2}{5}$. Since $h = 0.5 > 0.4$, it's unstable by Euler's method.

(3) $y_1 = y_0 + hy_0' = y_0 + h\lambda y_0 = (1 - 5 \times 0.5) \times 1 = -1.5$

(4) $\left|\frac{1}{1-h\lambda}\right| = \left|\frac{1}{1+2.5}\right| < 1$, it's stable by backward Euler method.

(5) $y_1 = y_0 + h\lambda y_1$

$y_1 = \frac{1}{1-h\lambda} y_0 = \frac{1}{1 - 0.5 \times (-5)} \times 1 = \frac{2}{7}$