**Part A**

To show is a pivotal statistic under the null hypothesis, we rewrite where and thus does not depend on any of the unknown parameters. Let be the t’th row of .

Rewrite as ,

After ’s cancel each other, Durbin-Watson test statistic becomes a function of the random vector *u,* which does not depend on and thus DB test statistic is pivot under the null hypothesis.

**Part D**