F - tests

$$\text{F-stat} = (R\hat{\beta} - r)' \left[R(\hat{V}_n/n)R' \right]^{-1} (R\hat{\beta} - r) / Q$$

You **DO NOT** need to know this

where $H_0 : R\beta = r$ and Q is the # of hypotheses.

When this is just one hypothesis, say $H_0 : \beta_1 = 0$,
then

$$\text{F-stat} = (\text{t-stat})^2$$

When there are two hypotheses,
say $H_0 : \beta_1 = 0;\ \beta_2 = 0$

$$\text{F-stat} = \frac{1}{2} \left(\frac{\text{t-stat}_1^2 + \text{t-stat}_2^2 - 2\widehat{\text{corr}}(\text{t-stat}_1, \text{t-stat}_2)}{1 - \widehat{\text{corr}}(\text{t-stat}_1, \text{t-stat}_2)^2} \right)$$

Under Homoskedasticity assumption,

$$\text{F-stat} = \frac{(SSR_R - SSR_u)/Q}{(SSR_u)/(n-k-1)}$$

Distribution of these test stats

In general, $\text{F-stat} \xrightarrow{d} F_{Q,\infty}$

Under the assumption of homoskedasticity and normal, iid residuals,

$$\text{F-stat} \sim F_{Q,n-k-1}$$

We usually use $F_{Q,\infty}$, as we think n is "large".

F-TEST R outputs

Without Specified variance:

	Res. Df	RSS	Df	Sum Sq	F	Pr(>F)
1	$n-k-1+Q$	SSR_R				
2	$n-k-1$	SSR_u	Q	$SSR_R - SSR_u$	F-STAT	$P(\text{F-STAT} > F_{Q,n-k-1}(1-\alpha))$

Res. Df → Model Degrees of freedom

F-STAT → Assuming homoskedas. $\dfrac{(SSR_R - SSR_u)/Q}{(SSR_u)/(n-k-1)}$

Pr(>F) → p-value

With Specified Variance

	Res. Df	Df	F	Pr(>F)
1	$n-k-1+Q$			
2	$n-k-1$	Q	F-STAT	$P(\text{F-STAT} > F_{Q,n-k-1}(1-\alpha))$