Sampling Distribution of Difference of Proportions

$$\mu_{\hat{p}_1-\hat{p}_2} = E\left[\hat{p}_1\right] - E\left[\hat{p}_2\right]$$

$$= \mu_{\hat{p}_1} - \mu_{\hat{p}_2}$$

$$= p_1 - p_2$$

$$\sigma^2_{\hat{p}_1-\hat{p}_2} = Var\left(\hat{p}_1 - \hat{p}_2\right)$$

$$= Var\left(\hat{p}_1\right) + Var\left(\hat{p}_2\right) \qquad \because \hat{p}_1 \text{ and } \hat{p}_2 \text{ are independent}$$

$$= \sigma^2_{\hat{p}_1} + \sigma^2_{\hat{p}_2}$$

$$= \frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}$$