Case 1:

Perform the theoretical power analysis assuming the following: $\mathit{\Delta} = 180\ seconds\ (3\ minutes)$, $\alpha = 0.05$, $\sigma^2 = 352.19$, and $n_i = 3,\ i = 1,2,3.$

Answer: Here,

$$F_{0.05,3,8} = 4.07$$

$$\delta^2 = \frac{n \times \Delta^2}{2 \times \sigma^2} = \frac{3 \times 180^2}{2 \times 352.19} = 137.99$$

So, the power is $P\left(F_{0.05,3,8,137.99} > 4.07\right) = 1.$

Interpretation: If we use $n_i = 3$ treatment and all other assumptions are true, then if two treatments means are 120 seconds apart and others equal, the F test will have a p-value<0.05 almost all the time.

R code:

```
qf(0.05,3,8,lower.tail = FALSE)
1-pf(4.07,3,8,137.99)
```

Case 2:

Perform the theoretical power analysis assuming the following: $\mathit{\Delta} = 120\ seconds\ (2\ minutes)$, $\alpha = 0.05$, $\sigma^2 = 352.19$, and $n_i = 3,\ i = 1,2,3..$

Answer: Here,

$$F_{0.05,3,4} = 4.07$$

$$\delta^2 = \frac{n \times \Delta^2}{2 \times \sigma^2} = \frac{3 \times 120^2}{2 \times 352.19} = 61.33$$

So, the power is $P\left(F_{0.05,3,8,61.33} > 4.07\right) = 1.$

Interpretation: If we use $n_i = 3$ treatment and all other assumptions are true, then if two treatments means are 120 seconds apart and others equal, the F test will have a p-value<0.05 almost all the time.

R code:

```
qf(0.05,3,8,lower.tail = FALSE)
1-pf(4.07,3,8,61.33)
```