19.2

Sample means ($\bar{x}$) for the groups in order = 48.2, 35.4, 69.8

(SS) Sum of squared deviation = 612.8, 515.2, 732.8

Now calculating variance = $\frac{SS}{n-1}$

$Var1 = \frac{612.8}{5-1} = 153.2$

$Var2 = \frac{515.2}{5-1} = 128.8$

$Var3 = \frac{732.8}{5-1} = 183.2$

$MS_{error} = \frac{153.2+128.8+183.2}{3} = 155.07$

Calculating remaining error terms for Anova table

$df_{error} = 15-3 = 12$

$SS_{error} = (MS_{error}) \times (df_{error}) = 155.07 \times 12 = 1860.8$

Grand Mean = $\bar{x}_{grand} = \frac{48.2+35.4+69.8}{3} = 51.13$

Sum of squares (SS) means = 604.58

Variance of means = $\frac{604.58}{3-1} = 302.29$

$MS_{between} = (302.29) \times (3-1) = 3022.9$ ~~1511.45~~

$df_{groups} = 3-1 = 2$

$SS_{groups} = (1511.45) \times (3-1) = 3022.9$

Test statistic and critical value

$F = \frac{1511.45}{155.07} = 9.75$

$F_{critical}(2, 12) = 3.89$

$F > F_{critical}$. So Reject H_0

Anova table

Source	SS	df	MS	F
group	3022.9	2	1511.45	9.75
error	1860.8	12	155.07	
Total	4883.7			

Effect size: $n^2 = \frac{3022.9}{4883.7} = 0.62$

APA writeup → $F(2, 12) = 9.75, p < 0.05, n^2 = 0.62$