Z1

## Confidence interval for the difference of two means. Independent samples, variance known

**University example**

| | Engineering | Management | Difference |
|---|---|---|---|
| **Size** | 100 | 70 | ? |
| **Sample mean** | 58 | 65 | -7.00 |
| **Population std** | 10 | 5 | 1.16 |

### Variance of the difference

$$\sigma^2_{diff} = \frac{\sigma_e^2}{n_e} + \frac{\sigma_m^2}{n_m}$$

$$\sigma^2_{diff} = \frac{10^2}{100} + \frac{5^2}{70} = 1.36$$

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| | x | y | x-y |
|---|---|---|---|
| | Engineering | Management | Difference |
| Size | 100 | 70 | ? |
| Sample mean | 58 | 65 | -7.00 |
| Population std | 10 | 5 | 1.16 |
| | | | |
| 95% z-stat | 1.96 | | |

$$(\bar{x} - \bar{y}) \pm z_{\alpha/2} \sqrt{\frac{\sigma_x^2}{n_x} + \frac{\sigma_y^2}{n_y}}$$

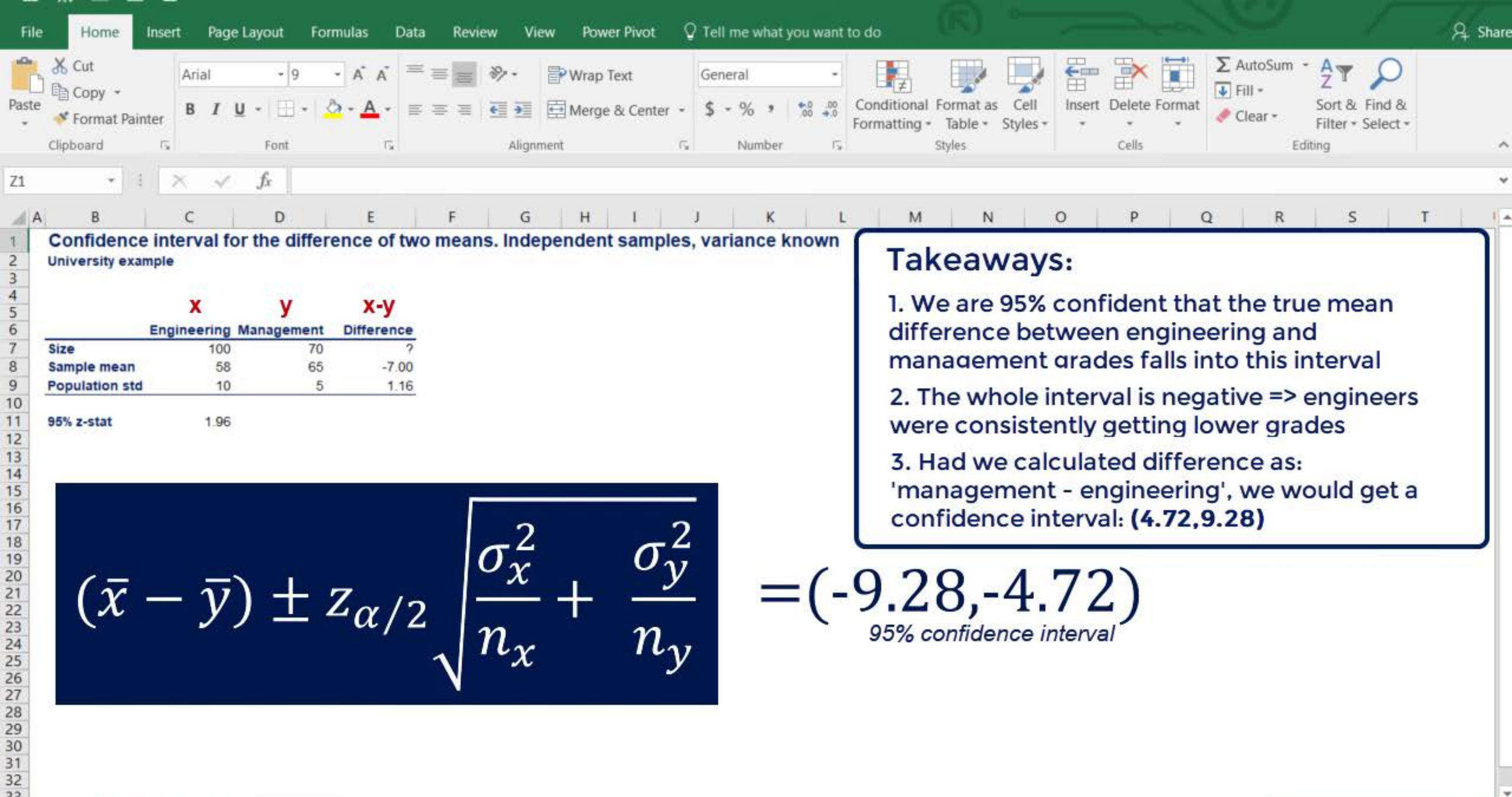
difference point estimator

test statistic

standard error

$$= (-9.28, -4.72)$$

*95% confidence interval*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Takeaways:
1. We are 95% confident that the true mean difference between engineering and management grades falls into this interval
2. The whole interval is negative => engineers were consistently getting lower grades
3. Had we calculated difference as: 'management - engineering', we would get a confidence interval: (4.72,9.28)
=(-9.28,-4.72)
95% confidence interval