

5240 Workshop 05

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Assuming we have no other information about the older brother (in other words, he can be treated as a randomly selected 8th grader), what is the probability that the older brother will run the 5km in less than 24 minutes?

Ans : Given information :

- For Older Brother (Grade 8):
 - $\mu = 25$
 - $\sigma = 2$
 - $X = 24$

To find the probability that Older brother run's the 5 km race in less than 24 mins, we can calculate Z score for $x = 24$ and then find the probability $P(z < \text{calculated } z \text{ value})$

```
z_older_brother <- scale(24, center = 25, scale = 2)
round(100*(pnorm(z_older_brother)),2)
```

```
      [,1]
[1,] 30.85
attr(,"scaled:center")
[1] 25
attr(,"scaled:scale")
[1] 2
```

Probability that the older brother will run the 5km in less than 24 minutes is 30.85% or 0.3085

Suppose that the older brother runs his race in 23 minutes and 30 seconds and the younger brother runs his race in 27 minutes. Using Z-scores, determine which brother ran his race faster, relative to their respective grades.

Ans : To determine this we can calculate z score for both the brothers , as z scores allow us to compare different normal distributions on same scale. the lower z score will correspond to the brother who ran his race faster.

Given information from the table :

- For Older Brother (Grade 8):
 - $\mu = 25$
 - $\sigma = 2$
 - $X = 23.5$
- For Younger Brother (Grade 6):
 - $\mu = 28$
 - $\sigma = 3$
 - $X = 27$

```
z_older <- scale(23.5, center = 25, scale = 2)
z_younger <- scale(27, center = 28, scale = 3)
```

```
z_older
```

```
      [,1]
[1,] -0.75
attr(,"scaled:center")
[1] 25
attr(,"scaled:scale")
[1] 2
```

```
z_younger
```

```
      [,1]
[1,] -0.3333333
attr(,"scaled:center")
[1] 28
attr(,"scaled:scale")
[1] 3
```

Z-score for older brother (-0.75) < Z-score for younger brother (-0.33), Hence **Older brother** ran his race faster.