The weights of female adult penguins found on a remote island are normally distributed with a mean of 3.15 kg. It is found that 81% of these penguins weigh more than 3 kg. The weights of the penguins have a standard deviation of σ.

a) Find the standardized value for 3kg.

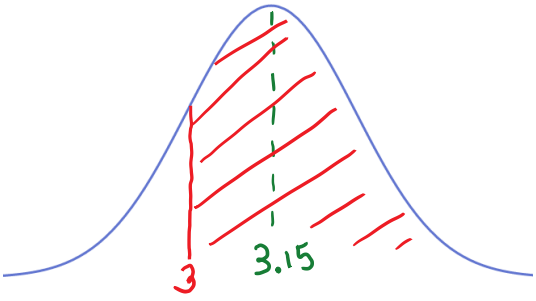
b) Hence, find the value of σ.

It is estimated that there are 4000 female adult penguins on the island. Penguins are considered underweight if they weigh less than 2.9 kg.

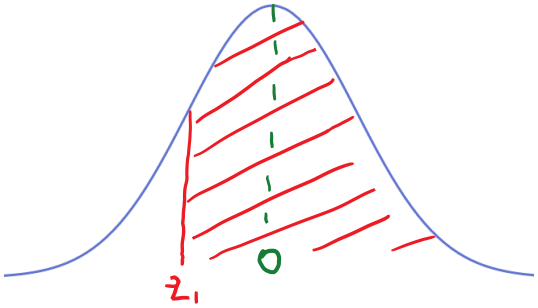
c) Find the estimated number of underweight female penguins on the island.

<table>
<tr>
<td>a) $X \sim N(3.15, \sigma^2)$

$P(X > 3) = 0.81$

 
</td>
<td>$Z \sim N(0, 1^2)$

$P(Z > z_1) = 0.81$

$InvNorm(0.81) \approx -0.878$ {right tail}

$\boldsymbol{z_1 \approx -0.878}$

In working below, a higher degree of accuracy is used</td>
</tr>
<tr>
<td>b) $Z = \frac{X-\mu}{\sigma}$

$-0.877896 = \frac{3 - 3.15}{\sigma}$

$-0.877896\sigma = -0.15$

$\boldsymbol{\sigma \approx 0.171}$</td>
<td></td>
</tr>
<tr>
<td>c) $X \sim N(3.15, 0.1709^2)$

$P(X < 2.9) \approx 0.0717$</td>
<td>Number of underweight adult female

$4000 \times 0.0717 \approx \mathbf{287}$</td>
</tr>
</table>