HL SL

It is known that 2% of Filips lightbulbs have a life of less than 1000 hours and 10% have a life less than 1100 hours. It can be assumed that lightbulb life is normally distributed with a mean of μ and a standard deviation of σ

a) Find the value of μ and the value of σ.

b) Find the probability that a randomly selected Filips lightbulb will have a life of at least 1200 hours.

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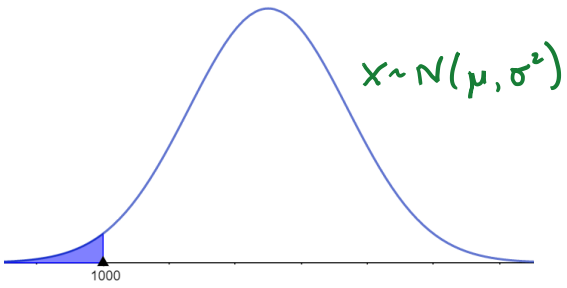
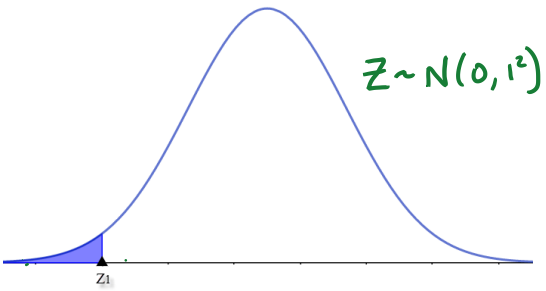
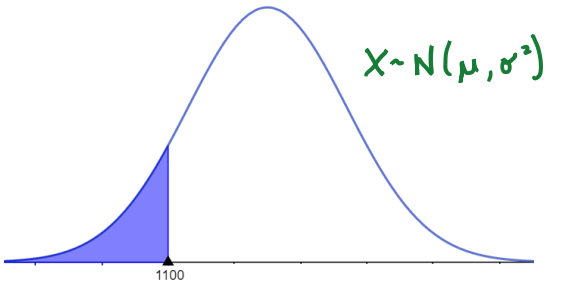
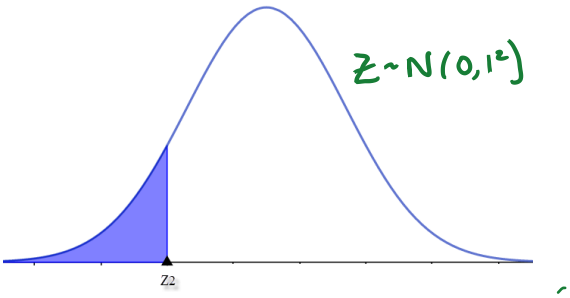
a) Let $X \sim N(\mu, \sigma^2)$

Draw a sketch of the two pieces of information and standardize using $Z = \frac{X-\mu}{\sigma}$

$P(X < 1000) = 0.02$ 	$P(Z < z_1) = 0.02$  $InvNorm(0.02) \approx -2.0537$ $-2.0537 = \frac{1000-\mu}{\sigma}$
$P(X < 1100) = 0.1$ 	$P(Z < z_2) = 0.01$  $InvNorm(0.1) \approx -1.2816$ $-1.2816 = \frac{1100-\mu}{\sigma}$

We have two simultaneous equations to solve

$$-2.0537 = \frac{1000 - \mu}{\sigma}$$
$$-1.2816 = \frac{1100 - \mu}{\sigma}$$

Rearrange

$$-2.0537\,\sigma + \mu = 1000$$
$$-1.2816\sigma + \mu = 1100$$

Use the simultaneous equation solver on the graphical calculator…

…to 3 significant figures (we should use a higher degree of accuracy for these values in the next question)

$\boldsymbol{\mu \approx 1270}$

$\boldsymbol{\sigma \approx 130}$

b) Let $X \sim N(\mathbf{1270}, \mathbf{130}^2)$

$P(X > 1200) \approx \mathbf{0.695}$

{using the values $\mu \approx 1270$ and $\sigma \approx 130$, we get a value for the probability of **0.705**}