Continuous Assessment Item 6

3. Continuous Assessment A newly developed construction material was tested for its fire resistance. Results from testing two samples show that serious fire damage after exposed to only 2 hrs of fire, whereas the other lasted for 3 hrs. Suppose the duration of fire, T, for damage of a material follows a Normal Distribution N(μ, 0.5). Before the tests, the mean duration until damage, μ for this material was expected to be 3 hrs with a variance about the mean of 20% based on a study.
(a) Determine the updated mean duration until damage for this material.

$$\tilde{x} = \frac{3+2}{2}$$
$$= 2.5$$

$$\sigma^2 = 3 * 0.2$$
$$= 0.6$$

$$n_1 = 2, n = 1.$$

$$\tilde{\mu} = \frac{\mu\left(\frac{s}{\sqrt{n_1}}\right)^2 + \bar{x}\left(\frac{\sigma}{\sqrt{n}}\right)^2}{\left(\frac{s}{\sqrt{n_1}}\right)^2 + \left(\frac{\sigma}{\sqrt{n}}\right)^2} = \frac{3(0.25)^2 + 2.5(0.6)^2}{(0.25)^2 + (0.6)^2}$$
$$= 2.574$$

(b) With the above observed information, what is the probability that a wall constructed using this material will be damaged in less than 1 hr of fire

$$\tilde{\sigma} = \sqrt{\frac{\left(\frac{s}{\sqrt{n_1}}\right)^2 (\sigma)^2}{\left(\frac{s}{\sqrt{n_1}}\right)^2 + (\sigma)^2}} = \sqrt{\frac{(0.25)^2 * (0.6)^2}{(0.25)^2 + (0.6)^2}}$$
$$= 0.2308$$

Convert the observation of 1 to a z-score,

$$Z = \frac{1 - 2.574}{0.2308}$$

$=$ -68.20

Using standard normal table:

$P(X < 1) = 0.0000$

Thus, it is never going to happen ☺.