Probability a normal random variable is within 1, 2, or 3 standard deviations of its mean:

$$P(\mu_{x} - \sigma_{x} < \chi < \mu_{x} + \sigma_{x}) = P(\mu_{x} - \sigma_{x} - \mu_{x} < \chi - \mu_{x} < \mu_{x} + \sigma_{x} - \mu_{x})$$

$$= P(-1 < 7 < 1)$$

$$= P(7 < 1) - P(7 < -1)$$

$$= P(7 < 1) - (1 - P(7 < 1))$$

$$= 0.8413 - (1 - 0.8413)$$

$$= 0.6826$$

i.e. a Normal rendem variable is within I standard deviation of its mean u. 71 probability 68%.

Similarly, 
$$P(\mu_X - 2\sigma_X \angle X \angle \mu_X + 2\sigma_X) = P(Z \angle Z) - (1 - P(Z \angle Z))$$
  
= 0.9772 - (1 - 0.9772)  
= 0.9544  
i.e. X is within two standard deviations of its mean with prob 957.

Similarly  $P(\mu_X - 3\sigma_X < X < \mu_X + 3\sigma_X) = P(723) - (1-p(723))$ = 0.9987 - (1-0.9987) = 0.9974 lie. X is within 3 Std. dev. of its mean with prob 99.74%

