

**QUESTIONS:**

- 1. This value of the normal distribution is a measure of the central tendency & often exists at the peak & centerline of the distribution.**
  - Mean
  - Range
  - Cumulative Probability
  - Probability Density
  
- 2. You manufacture a component whose critical feature follows the normal distribution with a mean value of 5.0, and a standard deviation of 0.25. What is the Z-score associated with the outcome of 4.75?**
  - 1.0
  - 0.33
  - -1.0
  - -0.5
  
- 3. The severity of a failure mode should be ranked and scored based on this:**
  - The effect on the end user
  - The probably of occurrence
  - The ability to detect that failure mode
  - The combination of detection and probability
  
- 4. You manufacture a component whose critical feature follows the normal distribution with a mean value of 20, and a standard deviation of 2. What is the Z-score associated with the outcome of 23?**
  - 0.5
  - 1.0
  - 1.5
  - 2.0
  
- 5. You manufacture a component whose critical feature follows the normal distribution with a mean value of 10, and a variance of 4. What is the Z-score associated with the outcome of 12?**
  - 0.5
  - 1.0
  - 1.5
  - 2.0

6. You manufacture a component whose width feature follows the normal distribution with a mean value of 100, and a variance of 9. What is the Z-score associated with the outcome of 91?
- -1.0
  - -2.0
  - -3.0
  - -4.0
7. What is the probability of having a z-score greater than zero?
- 0%
  - 25%
  - 50%
  - 75%
8. Let's say you're dealing with a random variable X that follows a normal distribution. What is the probability that Z will be less than 1.22?
- 11.13%
  - 38.87%
  - 88.87%
  - 62.13%
9. Let's say you're dealing with a random variable X that follows a normal distribution. What is the probability that Z will be between  $z = -0.68$  and  $z = 1.03$ ?
- 60.0%
  - 25.2%
  - 34.8%
  - 40.0%
10. You're working to assess the reliability of a new design, and you're focused on potential deficiencies associated with your product features and the interfaces between sub-systems, what type of FMEA are you doing?
- Process FMEA
  - Design FMEA
  - Reliability FMEA
  - Safety FMEA

**SOLUTIONS:**

1. This value of the normal distribution is a measure of the central tendency & often exists at the peak & centerline of the distribution.

- **Mean**
- Range
- Cumulative Probability
- Probability Density

2. You manufacture a component whose critical feature follows the normal distribution with a mean value of 5.0, and a standard deviation of 0.25. What is the Z-score associated with the outcome of 4.75?

- 1.0
- 0.33
- **-1.0**
- -0.5

$$Z = \frac{X - \mu}{\sigma} = \frac{4.75 - 5}{0.25} = -1.0$$

3. The severity of a failure mode should be ranked and scored based on this:

- **The effect on the end user**
- The probably of occurrence
- The ability to detect that failure mode
- The combination of detection and probability

4. You manufacture a component whose critical feature follows the normal distribution with a mean value of 20, and a standard deviation of 2. What is the Z-score associated with the outcome of 23?

- 0.5
- 1.0
- **1.5**
- 2.0

$$Z = \frac{X - \mu}{\sigma} = \frac{23 - 20}{2} = 1.5$$

5. You manufacture a component whose critical feature follows the normal distribution with a mean value of 10, and a variance of 4. What is the Z-score associated with the outcome of 12?

- 0.5
- **1.0**
- 1.5
- 2.0

$$Z = \frac{X - \mu}{\sigma} = \frac{12 - 10}{2} = 1.0$$

We're given the variance ( $\sigma^2 = 4$ ). To find the standard deviation ( $\sigma$ ) we simply take the square root ( $\sigma = 2$ ).

6. You manufacture a component whose width feature follows the normal distribution with a mean value of 100, and a variance of 9. What is the Z-score associated with the outcome of 91?

- -1.0
- -2.0
- **-3.0**
- -4.0

$$Z = \frac{X - \mu}{\sigma} = \frac{91 - 100}{3} = -3.0$$

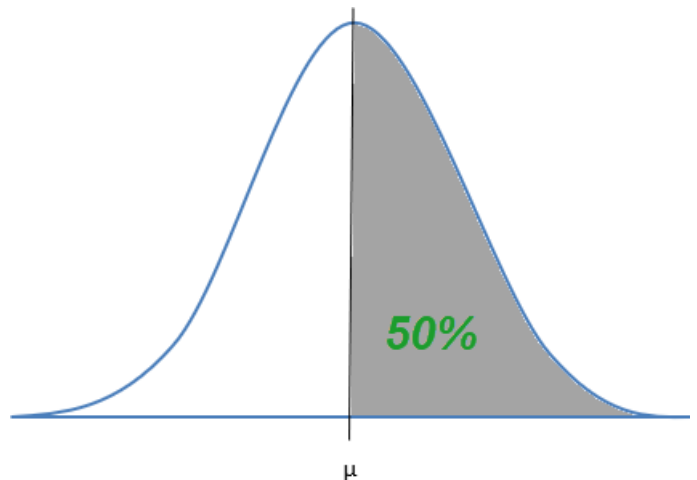
We're given the variance ( $\sigma^2 = 9$ ). To find the standard deviation ( $\sigma$ ) we simply take the square root ( $\sigma = 3$ ).

7. What is the probability of having a z-score greater than zero?

- 0%
- 25%
- **50%**
- 75%

The normal distribution is symmetric around the mean.

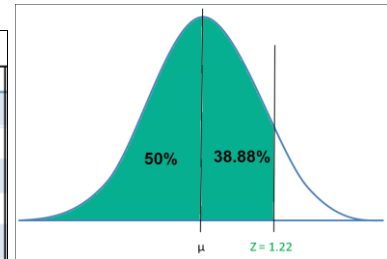
This means that 50% of the distribution is greater than the mean, and 50% is less than the mean.



8. Let's say you're dealing with a random variable X that follows a normal distribution. What is the probability that Z will be less than 1.22?

- 11.13%
- 38.87%
- **88.87%**
- 62.13%

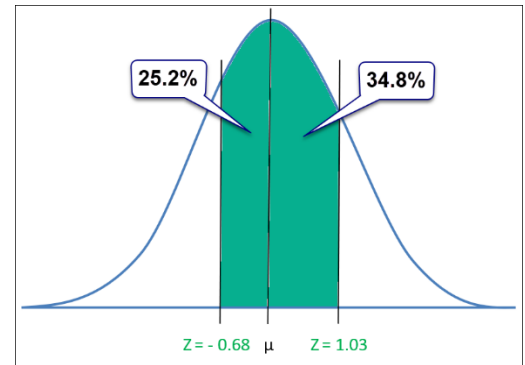
X	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07
0.0	0.00000	0.00399	0.00798	0.01197	0.01595	0.01994	0.02392	0.02790
0.9	0.31594	0.31859	0.32121	0.32381	0.32639	0.32894	0.33147	0.33398
1.0	0.34134	0.34375	0.34614	0.34849	0.35083	0.35314	0.35543	0.35769
1.1	0.36433	0.36650	0.36864	0.37076	0.37286	0.37493	0.37698	0.37900
1.2	0.38493	0.38693	<b>0.38877</b>	0.39065	0.39251	0.39435	0.39617	0.39796



We must find the area to the left of  $z = 1.22$ . which is 38.8%, plus 50% and is **88.87%**

9. Let's say you're dealing with a random variable X that follows a normal distribution. What is the probability that Z will be between  $z = -0.68$  and  $z = 1.03$ ?

- **60.0%**
- 25.2%
- 34.8%
- 40.0%



To solve this problem, we have to find the probability between  $Z = -0.68$  and  $Z = 1.03$ , which are highlighted below.

This area is shown as the shaded area above. So the cumulative area is  $25.2\% + 34.8\% = 60\%$

X	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.00000	0.00399	0.00798	0.01197	0.01595	0.01994	0.02392	0.02790	0.03188	0.03586
0.1	0.03983	0.04380	0.04776	0.05172	0.05567	0.05962	0.06356	0.06749	0.07142	0.07535
0.2	0.07926	0.08317	0.08706	0.09095	0.09483	0.09871	0.10257	0.10642	0.11026	0.11409
0.3	0.11791	0.12172	0.12552	0.12930	0.13307	0.13683	0.14058	0.14431	0.14803	0.15173
0.4	0.15542	0.15910	0.16276	0.16640	0.17003	0.17364	0.17724	0.18082	0.18439	0.18793
0.5	0.19146	0.19497	0.19847	0.20194	0.20540	0.20884	0.21226	0.21566	0.21904	0.22240
0.6	0.22575	0.22907	0.23237	0.23565	0.23891	0.24215	0.24537	0.24857	<b>0.25175</b>	0.25490
0.7	0.25804	0.26115	0.26424	0.26730	0.27035	0.27337	0.27637	0.27935	0.28230	0.28524
0.8	0.28814	0.29103	0.29389	0.29673	0.29955	0.30234	0.30511	0.30785	0.31057	0.31327
0.9	0.31594	0.31859	0.32121	0.32381	0.32639	0.32894	0.33147	0.33398	0.33646	0.33891
1.0	0.34134	0.34375	0.34614	<b>0.34849</b>	0.35083	0.35314	0.35543	0.35769	0.35993	0.36214

**10. You're working to assess the reliability of a new design, and you're focused on potential deficiencies associated with your product features and the interfaces between sub-systems, what type of FMEA are you doing?**

- Process FMEA
- **Design FMEA**
- Reliability FMEA
- Safety FMEA