QUESTIONS:

1. **Fill in the blank: A _____ is a formula, table or graph that defines the probability associated with each possible outcome in an experiment.**
   - Probability Distribution
   - Continuous Distribution
   - Discrete Distribution
   - Cumulative Probability

2. **Fill in the blank: _____ is a measure of the location of the mode in relationship to the mean when data is normally distributed.**
   - Kurtosis
   - The Mean Value
   - The Median Value
   - Skewness

3. **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

4. **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

5. **Which of the following roles would be considered stakeholders for a project or process?**
   - Project Manager
   - Process Owner
   - Supplier
   - All of the above

6. **Let's say you're dealing with a random variable X that follows a normal distribution. What is the probability that Z will be greater than -0.75?**
   - 27.3%
   - 23.7%
   - 77.3%
   - 73.7%

7. **For a random variable that is normally distributed with a mean value of 1.50 and a standard deviation of 0.25, what is the probability of occurrence of the values between 1.25 to 2.00?**
   - 47%
   - 75%
   - 66%
   - 82%

8. **What is the primary interpretation of the Z-transformation?**
   - It measures process capability
   - It indicates the degree of nonlinearity in data
   - It represents the number of standard deviations a data point is from the mean
   - It quantifies the total variation in a process

9. **Which equation defines the z-transformation for a data point 'X'?**
   - $Z = (X - \mu) / \sigma$
   - $Z = (X + \mu) * \sigma$
   - $Z = (X * \mu) / \sigma$
   - $Z = (X - \mu) * \sigma$

10. **What is skewness in a distribution and its significance in Six Sigma?**
    - A measure of the spread of data
    - A measure of the symmetry of a distribution
    - A measure of the central tendency
    - A measure of the standard deviation

SOLUTIONS:

1. **Fill in the blank: A _____ is a formula, table or graph that defines the probability associated with each possible outcome in an experiment.**
   - **Probability Distribution**
   - Continuous Distribution
   - Discrete Distribution
   - Cumulative Probability

   A probability distribution is a fundamental concept in probability theory that specifies the probabilities associated with different outcomes in a random experiment.

   The other options, continuous distribution, discrete distribution, and cumulative probability, are related concepts but not the precise definition of a probability distribution.

2. **Fill in the blank: _____ is a measure of the location of the mode in relationship to the mean when data is normally distributed.**
   - Kurtosis
   - The Mean Value
   - The Median Value
   - **Skewness**

   Skewness is a measure of the location of the mode in relationship to the mean when data is normally distributed. Skewness quantifies the degree to which a distribution is asymmetrical.

   Positive skewness means the mode is to the right of the mean, and the tail is longer on the right side. Negative skewness means the mode is to the left of the mean, and the tail is longer on the left side.

3. **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

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

4. **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

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

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

5. **Which of the following roles would be considered stakeholders for a project or process?**
   - Project Manager
   - Process Owner
   - Supplier
   - **All of the above**

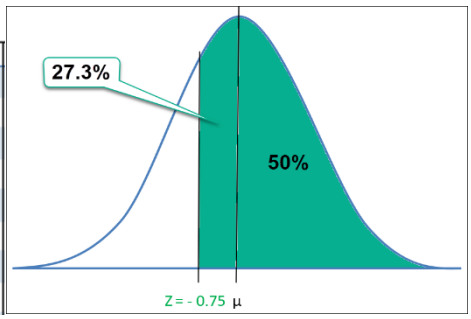
   Project Manager, Process Owner, and Supplier are all examples of roles that would be considered stakeholders for a project or process, as they can influence or be affected by its outcomes.

6. **Let's say you're dealing with a random variable X that follows a normal distribution. What is the probability that Z will be greater than -0.75?**
   - 27.3%
   - 23.7%
   - **77.3%**
   - 73.7%

   We must find the area to the right of z = -0.75 to find the probability that Z will be greater than 0.75. This is 27.3% plus 50% for a total area of **77.3%.**

Area under the Normal Curve from 0 to X

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
0.1	0.03983	0.04380	0.04776	0.05172	0.05567	0.05962	0.06356	0.06749
0.2	0.07926	0.08317	0.08706	0.09095	0.09483	0.09871	0.10257	0.10642
0.3	0.11791	0.12172	0.12552	0.12930	0.13307	0.13683	0.14058	0.14431
0.4	0.15542	0.15910	0.16276	0.16640	0.17003	0.17364	0.17724	0.18082
0.5	0.19146	0.19497	0.19847	0.20194	0.20540	0.20884	0.21226	0.21566
0.6	0.22575	0.22907	0.23237	0.23565	0.23891	0.24215	0.24537	0.24857
0.7	0.25804	0.26115	0.26424	0.26730	0.27035	0.27337	0.27637	0.27935



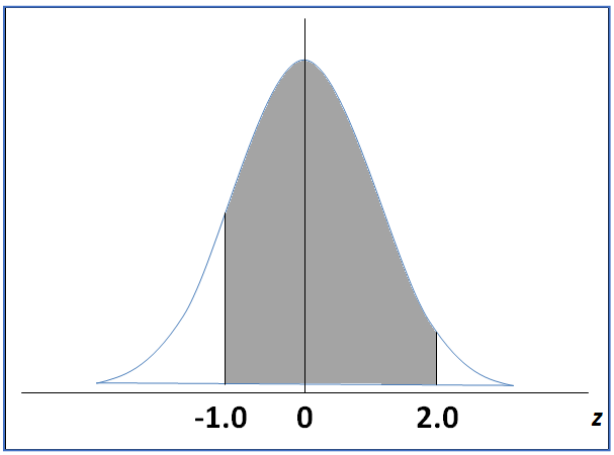
7. For a random variable that is normally distributed with a mean value of 1.50 and a standard deviation of 0.25, what is the probability of occurrence of the values between 1.25 to 2.00?

- 47%
- 75%
- 66%
- **82%**

To solve this problem, we first must calculate the Z-score for both 1.25 & 2.00.

$$Z = \frac{1.25 - 1.50}{0.25} = -1.0 \qquad AND \qquad Z = \frac{2.00 - 1.50}{0.25} = 2.0$$

Then we need to go to the table to look up the probability of Z = 1.0 & Z = 2.0 and add them up. The probability of Z = 1.00 is 34.134% (0.34134) and the Probability of Z = 2.00 is equal to 47.725% (0.47725).



Graphically this looks like this, with 34.134% of the distribution existing on the left half of the gray shaded area, and the other 47.725% existing on the right half of the gray shaded area out to Z = 2.0.

When we add these two shaded areas together, we find that the area under the curve equals **81.859%.**

Area under the Normal Curve from 0 to X

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
1.9	0.47128	0.47193	0.47257	0.47320	0.47381	0.47441	0.47500	0.47558
2.0	0.47725	0.47778	0.47831	0.47882	0.47932	0.47982	0.48030	0.48077

8. What is the primary interpretation of the Z-transformation?

- It measures process capability
- It indicates the degree of nonlinearity in data
- **It represents the number of standard deviations a data point is from the mean**
- It quantifies the total variation in a process

The primary interpretation of the z-transformation is that it represents the number of standard deviations a data point is from the mean. This information helps practitioners understand the relative position of a data point within a distribution and is a fundamental concept in statistical analysis.

9. Which equation defines the z-transformation for a data point 'X'?

- **$Z = (X - \mu) / \sigma$**
- $Z = (X + \mu) * \sigma$
- $Z = (X * \mu) / \sigma$
- $Z = (X - \mu) * \sigma$

The correct equation for the z-transformation is $Z = (X - \mu) / \sigma$, where 'X' represents the data point, 'μ' is the mean of the data, and 'σ' is the standard deviation. This equation standardizes the data by measuring how many standard deviations the data point is away from the mean.

10. What is skewness in a distribution and its significance in Six Sigma?

- A measure of the spread of data
- **A measure of the symmetry of a distribution**
- A measure of the central tendency
- A measure of the standard deviation

Skewness in a distribution is a measure of the asymmetry or lack of symmetry. It tells us whether the data is skewed to the left (negatively skewed) or to the right (positively skewed).

In Six Sigma, understanding skewness is essential because it impacts the process analysis, helping to identify issues and potential improvement areas.