

## 5.6: Central Limit Theorem (Worksheet)

Work in groups on these problems. You should try to answer the questions without referring to your textbook. If you get stuck, try asking another group for help.

### Student Learning Outcomes

- The student will compute normal probabilities using the Z Table.
- The student will demonstrate an understanding of the Central Limit Theorem.

### I. Calculating Standard Normal Probabilities

Recall that we denote a random variable with the standard normal distribution as  $Z$ , meaning that  $Z \sim N(0, 1)$ . Use the Z Table to calculate each of the following probabilities of  $Z$ .

1.  $P(0 < Z < 1.07)$
2.  $P(-1.07 < Z < 0)$
3.  $P(Z < 1.07)$
4.  $P(Z > 1.07)$
5.  $P(1.07 < Z < 2.89)$
6.  $P(-0.43 < Z < 1.07)$
7.  $P(-2.89 < Z < -0.43)$
8. Find the value of  $z$ , such that  $P(Z > z) = 0.0250$ .

### II. Calculating Non-Standard Normal Probabilities

Suppose that  $X \sim N(\mu = 5, \sigma = 2)$ . Use the Z Table to calculate each of the following probabilities of  $Z$ . You will need to convert each probability into an equivalent probability of  $Z$ .

1.  $P(5 < X < 6.3)$
2.  $P(1.7 < X < 6.3)$
3. Find the value of  $x$ , such that  $P(X < x) = 0.0020$ .

### III. Applying the Central Limit Theorem

Let the random variable  $Y$  = the monthly income of a randomly selected employed adult in Zimbabwe. We can model the distribution of  $Y$  as exponential with parameter  $\mu = \$477.5$  USD.

1. Determine the mean and standard deviation of  $Y$ .
2. Suppose a random sample of size  $n = 100$  of employed adults in Zimbabwe is obtained. Use the Central Limit Theorem to approximate the probability that the mean of the sample (that is, the sample mean  $\bar{Y}$ ) will be within \$25 USD of the population mean that you found in the previous question.

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