

Z - Scores

7 8 9 10 11 12



TI-30XPlus
MathPrint™



Worksheet



15 min

Calculator Skills:

- Normcdf

Formula:

$$z = \frac{\mu - x}{\sigma}$$

Question: 1.

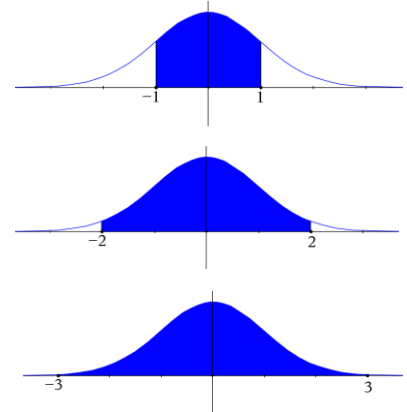
Each of the graphs shown opposite represent the standard normal distribution with a mean: $\mu = 0$ and standard deviation: $\sigma = 1$.

The graphs show the regions consisting of: 1, 2 and 3 standard deviations either side of the mean.:

- i) Use the calculator to determine the respective probabilities for each.

Given the graph is symmetrical, determine the respective probabilities for:

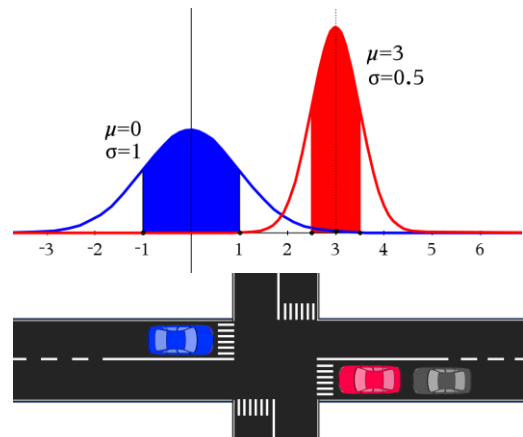
- $0 \leq x \leq 1$
- $-2 \leq x \leq 0$
- $-2 \leq x \leq 1$
- $-1 \leq x \leq 3$



Question: 2.

The average wait time at a busy intersection is normally distributed with a mean: $\mu = 3$ minutes and a standard deviation of $\sigma = 30$ seconds. (0.5 minutes). The information is shown as a graphical comparison with the standard normal distribution.

- Calculate the z score for a wait time of 3.5 minutes.
- Determine the likelihood of a car waiting between 2.5 and 3.5 minutes.
- What is the likelihood that a car will wait for less than 2 minutes?
- Use an appropriate answer from Question 1 to determine the likelihood that a car has to wait between 2 and 3.5 minutes.
- At a nearby intersection the average wait time is only 2.5 minutes but the standard deviation is 45 seconds. Alex notices that he ends up waiting 4 minutes just as frequently at either intersection. Explain Alex's observation.



Answers on Page 2

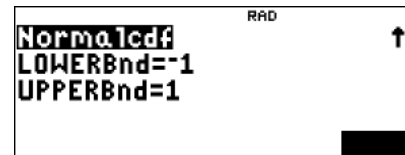
Question: 1.

i) Using Normalcdf

Lower-bound -1 and Upper-bound 1: 0.683

Lower-bound -2 and Upper-bound 2: 0.954

Lower-bound -3 and Upper-bound 3: 0.997



ii) Between 0 and 1, the result is $\frac{1}{2}$ of a Lower-bound of -1 and Upper bound of 1: 0.342

iii) Between -2 and 0, the result is $\frac{1}{2}$ of a Lower-bound of -2 and Upper bound of 2: 0.477

iv) Using the previous two results: $0.342 + 0.477 = 0.819$ [Check with calculator: 0.819]

v) Between -1 and 3 will be: $0.342 + 0.499 = 0.841$ [Check with calculator: 0.840]

Question: 2.

i) $z = \frac{3.5 - 3}{0.5} = 1$

ii) This is the same as standard normal from -1 to 1, which is 0.683, but can also be checked on the calculator.

iii) A wait time of less than 2 minutes is two standard deviations from the mean, a z-score of -2.
The likelihood of this wait time is therefore: 0.228

iv) A wait time between 2 and 3.5 minutes produces z-scores of -2 to 1, this is the same as Question 1(iv): 0.819

v) A wait time of 4 minutes from the first intersection is 2 standard deviations above the mean. For the second intersection 4 minutes is also 2 standard deviations from the mean.

Example: Intersection 1: $z = \frac{4 - 3}{0.5} = 2$ Intersection 2: $z = \frac{4 - 2.5}{0.75} = 2$

Notes:

- Z scores can be computed using the appropriate formula (no calculator required)
- Probabilities can be computed using the normalcdf command.
- Think of z-scores as the quantity of standard deviations above (positive) or below (negative) the mean.