MATH 10043 CHAPTER 6 EXAMPLES & DEFINITIONS

Section 6.2

Definition: The probability distribution associated with the standard score z is called the **standard normal distribution (or standard normal curve, or z-curve)**.

Properties of the Standard Normal Distribution:

1. The total area under the normal curve is equal to 1.
2. The distribution is mounded and symmetric; it extends indefinitely in both directions, approaching but never touching the horizontal axis.
3. The distribution has a mean of 0 and a standard deviation of 1.
4. The mean divides the area in half, 0.50 on each side.
5. Nearly all the area is between z = -3.00 and z = 3.00.

•Finding a probability for a normal distribution using the calculator:

2nd DISTR [this is the VARS key]
normalcdf [option 2]
enter values for left boundary, right boundary, μ, σ
ENTER

Ex. A) Draw a sketch, write in probability notation and find the area under the standard normal curve between:

(a) z = 0.85 and z = 1.41. **(b)** z = -2.51 and z = -0.05. **(c)** z = 3.16 and z = -0.99.

WHAT TO DO WHEN YOUR LOW OR HIGH VALUE IS -/+ INFINITY:

[Once you have stored these values, you should not need to do so again.]

Use –1 EE 99 for low value if low is $-\infty$.
You can store this in a letter: Ex. **–1 EE 99 STO ALPHA L ENTER**

Use 1 EE 99 for high value if high is $+\infty$
You can store value in a letter: Ex. **1 EE 99 STO ALPHA H ENTER**

Ex. B) Suppose a thermometer is manufactured so that at water's freezing temperature, the thermometers have a mean reading of 0ºC, with a standard deviation of 1ºC. Thermometer readings are normally distributed. If a thermometer is placed in freezing water, draw a sketch, write in probability notation and find the following probabilities:

(a) the probability that the thermometer reads less than 1.5ºC.
(b) the probability that the thermometer reads over - 1ºC
(c) the probability that the thermometer reads under -2ºC.

•Finding a z-value when you know a probability for a standard normal distribution using the calculator:

2^{nd} DISTR	[this is the VARS key]
invNorm	[option 3]

enter value for **Area to the left of z,** μ, σ ENTER

Ex. C) Using thermometers as in the example above, find the temperature separating the lowest 15% of the readings from the rest of the readings.

Ex. D) What z-scores bound the middle 90% of a normal distribution?

Alpha notation: z_α represents that z-value which has an area of α to its right.

Ex. E) (a) Find $z_{0.10}$. (b) Find $z_{0.80}$. (c) Find $z_{0.025}$.

PRACTICE PROBLEM OVER SECTION 6.2

1. Find the following values of z: (a) $z_{0.12}$ (b) $z_{0.28}$ (c) $z_{0.85}$ (d) $z_{0.05}$

Section 6.3

Ex. F) The mean January temperature at Icefang, Alaska is -1.5° F with a standard deviation of 6.9° F. Temperatures are known to be normally distributed. Find the probability that a January temperature selected at random is greater than -2° F.

Ex. G) The random variable x = stress resistance for a certain type of plastic sheet, measured in pounds per square inch (psi). If x is normally distributed with μ = 30 psi and σ = 0.6 psi, write in probability notation and find the probability that a plastic sheet chosen at random has a resistance: (a) of less than 28.2 psi,
(b) within 1 psi of the mean. On part (b), write a statement to interpret the answer.

•Finding an x-value when you know a probability for a normal distribution using the calculator:

2nd DISTR [this is the VARS key]
invNorm [option 3]
enter value for **Area to the left of x**, μ, σ
ENTER

Ex. H) The Stanford-Benet IQ test is normally distributed with a mean of 100 and a standard deviation of 16. Mensa is an organization that only allows people to join if their IQs are in the top 2% of the population. What is the lowest IQ one can have and still be eligible to join Mensa?

When using an entire population: $$\mathbf{z} = \frac{\mathbf{x} - \mu}{\sigma}$$

Ex. I) Waiting times at a large clinic are approximately normally distributed with a standard deviation of 14.8 minutes. If only 6% of the patients at this clinic wait less than 45 minutes to see a doctor, what is the mean waiting time?

PRACTICE PROBLEMS OVER SECTION 6.3

1. Companies who design furniture for elementary school classrooms produce a variety of sizes for children of different ages. Suppose the heights of kindergarten children are normally distributed with a mean of 38.2 inches and a standard deviation of 1.8 inches. **(a)** What percentage of kindergarten children should the company expect to be under 3 feet tall? Write a statement to interpret the answer. **(b)** In what height interval should the company expect to find the middle 80% of kindergarteners? **(c)** At least how tall are the biggest 5% of kindergarteners?

2. The Graduate Record Exam verbal ability section has a mean of 497 and standard deviation 115. Assume that GRE scores are normally distributed. A graduate school program in English will only admit students with GRE verbal scores in the top 30%. What is the lowest GRE score they will accept?

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PRACTICE PROBLEMS OVER SECTION 6.3, continued

3. The weights of ripe watermelons grown at Mr. Kerif's farm are normally distributed with a standard deviation of 2.8 pounds. Find the mean weight of the watermelons if only 3% weigh less than 15 pounds

4. The U.S. National Center for Health Statistics reports that males over 6 feet tall between 18 and 24 years of age have a mean weight of 175 pounds. Weights are normally distributed with a standard deviation of 14 pounds. Find the probability that the weight of such a randomly selected male is within 10 pounds of the population mean. Write a statement to interpret your answer.

5. The ages of farm operators in the United States of America are normally distributed with a mean of 50 years and a standard deviation of 9 years. Find the probability that the age of a U.S. farmer sampled at random differs from the population mean by more than 5 years.