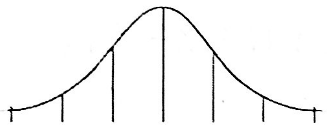
Statistical Reasoning
Normal Distribution – Z-Scores

Name: Key Date: Class:

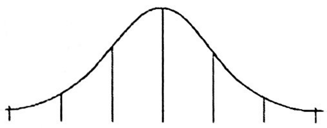
Normal Distributions Practice

1. Use the Z-Table to find the proportion of observations from a standard Normal distribution that satisfies each of the following statements. In each case, sketch a standard Normal curve and shade the area under the curve that is the answer to the question.

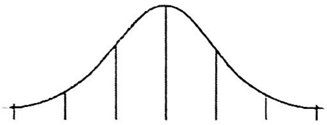
(a) z is less than -1.26



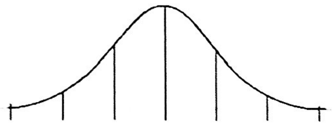
(b) z is greater than 1.84



(b) z is less than 2.09



(d) z is between -2.14 and 1.76



2. The height of young American women has an approximately normal distribution with mean □ = 65.5 inches and standard deviation □ = 2.5 inches. Find the relative frequencies of each of the following (draw and shade the appropriate regions of a normal curve):

(a) a woman is less than 67 inches tall

$z = \frac{67-65.5}{2.5} = 0.6$ $P(x<67) = .7257$ **72.57%**

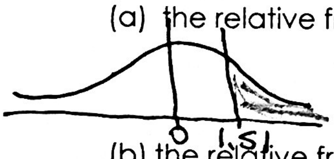
(b) a woman is above 67 inches tall

$P(x>67) = 1-.7257 = .2743$ **27.43%**

(c) a woman is between 64 and 67 inches tall

3. The Graduate Record Exam (GRE) is widely used to help predict the performance of applicants to graduate school. The range of possible scores on the each portion of the test is 200 to 800. A university finds that the scores of its applicants on the quantitative portion of the GRE are approximately normal with mean □ = 544 and standard deviation □ = 103. Find:

(a) the relative frequency of a score greater than 700

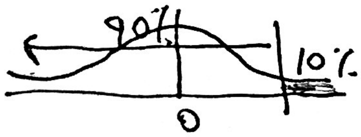


$z = \frac{700-544}{103} = 1.51$ $P(x>700) = .9345$ **93.45%**

(b) the relative frequency of a score between 500 and 800

$z = \frac{500-544}{103} = -0.43$ $z = \frac{800-544}{103} = 2.49$ 0.6589 **65.89%**

(c) how high you must score to be in the top 10% of the population



above 675.99 ~ 676

4. The amount of annual rainfall in a certain region is known to be a normally distributed random variable with a mean of 50 inches and a standard deviation of 4 inches. If the rainfall exceeds 57 inches during the year, it leads to floods. Find the probability that during a randomly selected year there will be floods.

$P(X>57) = 1 - 0.9599 = 0.0401$ $\boxed{4.01\%}$

5. The weight of food packed in certain containers is a normally distributed random variable with a mean weight of 500 pounds and a standard deviation of 5 pounds. If a container is picked at random, find the probability that it contains:

(a) more than 510 pounds.

$P(X>510)$
$= 1 - .9772$
$= \boxed{2.28\%}$

(b) less than 498 pounds

$P(X<498)$
$= 0.3446$
$\boxed{34.46\%}$

(c) between 491 and 498

$P(491<X<498)$
$= 0.3086$
$\boxed{30.86\%}$

6. The length of life of and instrument produced by a machine has a normal distribution with mean life of 12 months and a standard deviation of 2 months. Find the probability that an instrument will last:

(a) less than 7 months

$P(X<7)$
$= 0.0062$ $\boxed{.62\%}$

(b) between 7 and 12 months.

$P(7<X<12)$
$= .4938$ $\boxed{49.38\%}$

7. The nicotine content in a brand of king-size cigarettes has a normal distribution with a mean content of 1.8 mg and a standard deviation of 0.2 mg. Find the probability that the nicotine content of a randomly selected cigarette of this brand will be:

(a) less than 1.45 mg

$P(X<1.45)$
$= 0.0401$ $\boxed{4.01\%}$

(b) between 1.45 and 1.65 mg

$P(1.45<X<1.65)$
$= 0.1844$
$\boxed{18.44\%}$

(c) between 1.95 and 2.15 mg

$P(1.95<X<2.15)$
$= 0.1844$ $\boxed{18.44\%}$

(d) more than 2.15 mg.

$P(X>2.15)$ $\boxed{4.01\%}$
$= 1 - .9599 = 0.0401$

8. The demand for meat at a grocery store during any week is approximately normally distributed with a mean demand of 5000 pounds and a standard deviation of 300 pounds. If the store has 5300 pounds of meat, what is the probability that it is overstocked?

$P(X>5300)$
$= 1 - .8413 = 0.1587$

$\boxed{15.87\%}$