Key

Notes: Section 12.4 Day 2 **Standard Scores (Z-Scores)**

A **z-score** (or standard score) is the number of standard deviations a data value lies above or below the mean of a normal distribution. If the data value is above the mean, then the z-score is positive. If the data value is below the mean, the z-score is negative. The z-score for the mean is 0.

1) The scores of a final exam were normally distributed. The z-scores for some of the students are given: Robert 1.1 Janet -2 Joel 0.0 John -.8 Linda 1.8

a) Who scored on the mean? Joel
b) Who scored above the mean? Linda and Robert
c) Who scored furthest from the mean? Janet

To find the z-score (standard score) of a data value in a normal distribution:

$$z = \frac{\text{data value} - \text{mean}}{\text{standard deviation}}$$ deviation

2) A test is normally distributed with a mean of 80 and a standard deviation of 10. How many standard deviations above the mean is a score of 98?

80 | 90 | 100

$z = \frac{98-80}{10} = 1.8$

3) A pizza parlor franchise specifies that the mean amount of cheese on a large pizza should be 8 oz and a standard deviation of .5 oz. An inspector picks out a large pizza at random and finds that it is made with 6.9 oz of cheese. If the amount of cheese is more than 3 standard deviations from the mean, the parlor will be in danger of losing its franchise. How many standard deviations is 6.9 oz?

$\bar{x} = 8$ data value = 6.9 $\frac{6.9-8}{.5} = \frac{-1.1}{.5} = -2.2$

$s = .5$

4) The length of horse pregnancies from conception to birth is normally distributed with a mean of 336 days and a standard deviation of 3 days. Find the z-score for a horse pregnancy of

$\bar{x} = 336$ $s = 3$

a. 342 days.

$z = \frac{342-336}{3}$

$= \frac{6}{3}$

$z = 2$

b. 336 days.

$z = \frac{336-336}{3}$

$z = 0$

c. 333 days.

$z = \frac{333-336}{3}$

$= \frac{-3}{3}$

$z = -1$

5) The SAT (Scholastic Aptitude Test) has a mean of 500 and a standard deviation of 100.The ACT (American College Test) has a mean of 18 and a standard deviation of 6. Both tests measure the same kind of ability, with scores that are normally distributed. Suppose that you score 550 on the SAT and 24 on the ACT. On which test did you have the better score?

SAT $\bar{X} = 500$ $S = 100$ ACT $\bar{X} = 18$ $S = 6$

$z = \frac{550 - 500}{100}$ $z = \frac{24 - 18}{6}$

$z = .5$ $z = 1$

Better on ACT

6) The mean score on a placement test is 150 with a standard deviation of 20. If your z-score on the test was 1.8, then what was your actual test grade? (Assume the test is normally distributed.)

x

$\bar{X} = 150$ $S = 20$

$z = 1.8 = \frac{x - 150}{20}$

$x = 186$

7) Intelligence quotients (IQs) on the Stanford-Binet intelligence test are normally distributed with a mean of 100 and a standard deviation of 16.

a. What is the IQ corresponding to a z-score of -2.25?

x

$\bar{X} = 100$ $S = 16$ $z = -2.25 = \frac{x - 100}{16}$

$x = 64$

b. Mensa is a group of people with high IQs whose members have z-scores of 1.75 or greater on the Stanford-Binet intelligence test. What is the IQ corresponding to a z-score of 1.75?

$z = 1.75 = \frac{x - 100}{16}$

$x = 128$