

Statistical Reasoning
Normal Distribution - Z-Scores

Name: Key

Date: _____

Class: _____

Z-Score More Practice Worksheet

* 1. A normal distribution of scores has a standard deviation of 10. Find the z-scores corresponding to each of the following values:

a) A score that is 20 points above the mean.

$$z = \frac{20}{10} = \boxed{2}$$

b) A score that is 10 points below the mean.

$$z = \frac{-10}{10} = \boxed{-1}$$

c) A score that is 15 points above the mean.

$$z = \frac{15}{10} = \boxed{1.5}$$

d) A score that is 30 points below the mean.

$$z = \frac{-30}{10} = \boxed{-3}$$

2. The Welcher Adult Intelligence Test Scale is composed of a number of subtests. On one subtest, the raw scores have a mean of 35 and a standard deviation of 6. Assuming these raw scores form a normal distribution:

a) What number represents the 65th percentile (what number separates the lower 65% of the distribution)?

$$\boxed{37.31}$$

c) What is the probability of getting a raw score between 28 and 38?

$$0.5698 \quad \boxed{56.98\%}$$

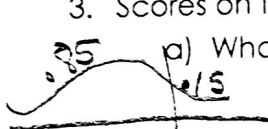
b) What number represents the 90th percentile?

$$\boxed{42.69}$$

d) What is the probability of getting a raw score between 41 and 44?

$$0.0918 \quad \boxed{9.18\%}$$

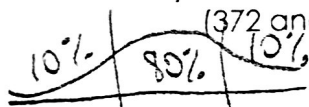
3. Scores on the SAT form a normal distribution with $\mu = 500$ and $\sigma = 100$.



a) What is the minimum score necessary to be in the top 15% of the SAT distribution?

$$\boxed{603.64}$$

b) Find the range of values that defines the middle 80% of the distribution of SAT scores (372 and 628).



$$\boxed{372 \text{ to } 628}$$

4. For a normal distribution, find the z-score that separates the distribution as follows:

($\mu = 0$ $\sigma = 1$) or use chart



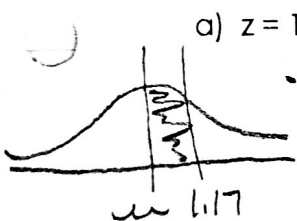
a) Separate the highest 30% from the rest of the distribution.

$$\boxed{0.5244 = z}$$

b) Separate the lowest 40% from the rest of the distribution.

$$\boxed{-0.2533 = z}$$

5. For the numbers below, find the area between the mean and the z-score:

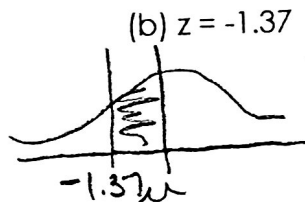


a) $z = 1.17$

$$.8790 - .50$$

$$0.3790$$

$$\boxed{37.90\%}$$



(b) $z = -1.37$

$$.50 - 0.0853$$

$$= 0.4147$$

$$\boxed{41.47\%}$$

6. A patient recently diagnosed with Alzheimer's disease takes a cognitive abilities test and scores a 45. The mean on this test is 52 and the standard deviation is 5. What is the patient's percentile rank?

$$0.0808$$

$$\boxed{8.08\%}$$

7. A fifth grader takes a standardized achievement test (mean = 125, standard deviation = 15) and scores a 148. What is the child's percentile rank?

$$0.9374$$

$$\boxed{93.74\%}$$

8. Pat and Chris both took a spatial abilities test (mean = 80, std. dev. = 8). Pat scores a 76 and Chris scored a 94. What percent of individuals would score between Pat and Chris?

$$0.4514$$

$$\boxed{45.14\%}$$

9. A normal distribution of scores has a standard deviation of 10. Find the z-scores corresponding to each of the following values:

- a) A score of 60, where the mean score of the sample data values is 40.

$$z = \frac{60 - 40}{10} = \boxed{2}$$

- b) A score that is 30 points below the mean.

$$z = \frac{-30}{10} = \boxed{-3}$$

- c) A score of 80, where the mean score of the sample data values is 30.

$$z = \frac{80 - 30}{10} = \boxed{5}$$

- d) A score of 20, where the mean score of the sample data values is 50.

$$z = \frac{20 - 50}{10} = \boxed{-3}$$

10. IQ scores have a mean of 100 and a standard deviation of 16. Albert Einstein reportedly had an IQ of 160.

- a) What is the difference between Einstein's IQ and the mean?

$$\boxed{60 \text{ points}}$$

- b) How many standard deviations is that?

$$\frac{160 - 100}{16} = \boxed{3.75}$$

- c) Convert Einstein's IQ score to a z score.

$$\boxed{3.75}$$

- d) If we consider "usual IQ scores to be those that convert z scores between -2 and 2; is Einstein's IQ usual or unusual?

$$\boxed{\text{unusual}}$$

11. Women's heights have a mean of 63.6 in. and a standard deviation of 2.5 inches. Find the z score corresponding to a woman with a height of 70 inches and determine whether the height is unusual.

$$z = \frac{70 - 63.6}{2.5} = \boxed{2.56}$$

Unusual (but not outlier)

12. Three students take equivalent stress tests. Which is the highest relative score (meaning which has the largest z score value)?

- a) A score of 144 on a test with a mean of 128 and a standard deviation of 34.

$$z = \frac{144 - 128}{34} = \boxed{0.47}$$

← Higher relative score

- b) A score of 90 on a test with a mean of 86 and a standard deviation of 18.

$$z = \frac{90 - 86}{18} = \boxed{0.22}$$