

Name: _____

Date: _____

Remember the formula for a z-score: $z = \frac{x - \bar{x}}{\sigma}$

What is a z-score?

the number of standard deviations away from the mean
- this does not need to be a whole number

Table of z-scores:

will tell you what percentage of the curve lives below that x -value

1. If $z = 1.5$ What is the area below z ?
 $= 1.50$ 0.9332

above z ?
 $1 - 0.9332$
 $= 0.0668$

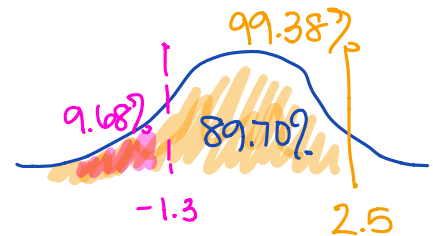
2. If $z = -1.26$ What is the area below z ?
0.1038

above z ?
 $1 - 0.1038$
 $= 0.8962$

3. What is the area between $z = -1.3$ and $z = 2.5$?

$$\begin{array}{r} 0.9938 \\ - 0.0968 \\ \hline 0.8970 \end{array}$$

0.0968 0.9938



4. If the area to the left of z is 0.9474, what is the z -score?

$z = 1.62$

5. If the area to the right of z is 0.9731, what is the z -score?

$1 - 0.9731 = 0.0269$

$z = -1.93$

6. If 20% of widgets are defective and 1000 widgets are produced, how many widgets were defective?

20% of 1000
 $20\% \times 1000$
 $\frac{20}{100} \times 1000 = 200$

So 200 widgets are defective.

INVERT

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

Example Fred finds out that best before dates on milk are based on the number of days before spoilage. He finds out that milk is good for an average of 12 weeks with a standard deviation of 1.5 weeks. He wants to find out what percentage of milk is spoiled after 10 weeks.

a. What z-score corresponds to 10 weeks?

$$z = \frac{10 - 12}{1.5} = \frac{-2}{1.5} = -1.\bar{3} = -1.33$$

b. What proportion of the area under a standard normal curve is below this z-score?

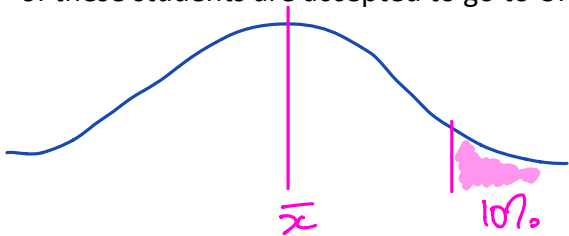


$$-1.33 \Rightarrow 0.0918$$

9.18% of the milk is spoiled before 10 weeks.

more interestingly, 90.82% spoils after 10 weeks

Example The GPA at Charles Xavier Academy has a mean of 2.8 with a standard deviation of 0.4. The top 10% of these students are accepted to go to University. What is the minimum GPA that these students have?



$$100 - 10 = 90$$

$$0.9000$$

$$0.8997 \Rightarrow z = 1.28$$

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

$$0.4 \times 1.28 = \frac{x - 2.8}{0.4} \times 0.4$$

$$0.512 = x - 2.8 + 2.8$$

$$x = 3.31$$

The gpa needed to attend university is 3.3

Example At the annual spaghetti harvest, the spaghetti has an average length of 80cm with a standard deviation of 12cm. Spaghetti that is shorter than 60cm is rejected as being too short. What percentage of the spaghetti is rejected?

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

$$= \frac{60 - 80}{12}$$

$$= \frac{-20}{12}$$

$$= -1.67 \Rightarrow 0.0475$$

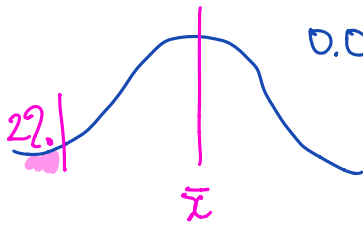
4.75% of spaghetti is rejected.

If they considered 10 000 pieces, how many were rejected?

$$\frac{4.75}{100} \times 10\,000 = 475 \text{ pieces rejected}$$

Example Apple is planning on marketing the iShoe. Their preliminary studies show that they last for an average of 8.5 months with a standard deviation of 1.1 months. They want to offer a money back guarantee for iShoes that wear out early, but only actually want to give the money back to less than 2% of all iShoe owners.

- a. How long should they warrantee their shoes for?



$$0.0200 - \boxed{0.0202} \quad 1.1 \times -2.05 = \frac{x - 8.5}{1.1} \times 1.1$$

$$\Rightarrow -2.05$$

$$+8.5 - 2.255 = x - 8.5 + 8.5$$

$$x = 6.25 \text{ months}$$

warranty length.

- b. When the iShoe is released, Apple sells 50000 pairs. How many do they expect to be turned in after 5 months?

x

$$z = \frac{5 - 8.5}{1.1}$$

$$= -3.18$$

$$\Rightarrow 0.0007$$

$$\Rightarrow 0.07\%$$

$$0.07\% \text{ of } 50000?$$

$$\frac{0.07}{100} \times 50000$$

$$= 35 \text{ pairs of shoes}$$

Example At Central, the average Foundations of Math 11 grade is 71% with a standard deviation of 12%. If 24 students have a B, how many students are taking Foundations of Math 11?