

Show any calculator functions that you use.

1. A company uses an automated packaging device to produce 50-gram bags of Karmel Korn. The machine needs frequent checking to see if it is actually putting 50 g in each bag. The following are masses, in grams, of thirty bags of Karmel Korn.

Mass	Frequency
46	1
47	2
48	3
49	6
50	7
51	4
52	4
53	2
54	1

$n=30$

- a) What are the mean and standard deviation for this data, rounded to the nearest tenth?

$$\bar{x} = \mu = 50$$

$$\sigma = 1.88$$

- b) What problems will be encountered if the standard deviation gets too high?

If σ too big, some bags will have too much corn, some bags not enough.

2. The following table represents the raw test scores for a group of students.

60	55	80	70	75
75	45	90	60	85

- a) What are the mean and standard deviation for the raw test scores, rounded to the nearest tenth?

$$\bar{x} = \mu = 69.5$$

$$\sigma = 13.5$$

- b) If all the marks are increased by 5, what is the new mean and standard deviation? Explain your results.

$$\bar{x} = \mu = 74.5$$

$$\sigma = 13.5$$

The dispersion is unchanged but all marks going up raised the average 5%.

- c) If the top mark is reduced by 10 marks and the lowest score is increased by 10 marks, what is the new mean and standard deviation? Explain your results.

$$\bar{x} = \mu = 69.5$$

$$\sigma = 10.6$$

45 → 55

90 → 80

The total sum of marks is the same so the average stays. The dispersion is less so the deviation is lower.

3. Use the following information to determine which class Sally is ranked higher in.

	Mark	Mean	Standard Deviation
Math	74	67	5
Chemistry	78	70	7

$$\begin{aligned} \text{MATH } z &= \frac{74-67}{5} \\ z &= \frac{7}{5} \\ z &= 1.40 \end{aligned}$$

$$\begin{aligned} \text{CHEM } z &= \frac{78-70}{7} \\ z &= \frac{8}{7} \\ z &= 1.14 \end{aligned}$$

RANKED HIGHER
IN "MATH".

4. Given $z = \frac{x-\mu}{\sigma}$.

- a) What z-score would represent a piece of pipe that has a diameter of 2.5 cm if the pipe manufactured has mean diameter of 2.3 cm with a standard deviation of 0.25 cm.

$$\begin{aligned} z &= \frac{2.5-2.3}{0.25} \\ z &= \frac{0.2}{0.25} = 0.80 \end{aligned}$$

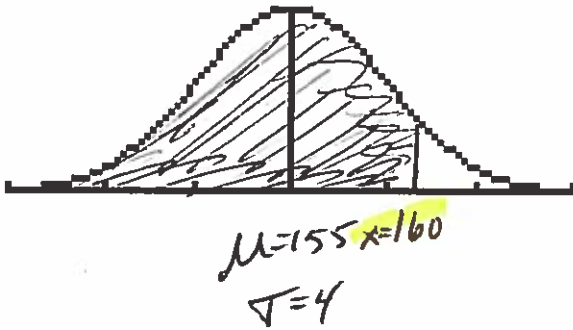
- b) Determine the actual mark for a student who has z-score ranking of -1.25 in a class that has an average of 72% and a standard deviation of 8.0%.

$$\begin{aligned} -1.25 &= \frac{x-72}{8.0} \\ -10 &= x-72 \\ x &= -10+72 = \boxed{62\%} \end{aligned}$$

- c) The standard deviation for a shipment of bolts is 0.75 grams. What is the average mass for this shipment of bolts if a bolt that has a mass of 12.6 grams represents a z-score of 1.60?

$$\begin{aligned} 1.60 &= \frac{12.6-\mu}{0.75} \\ 1.2 &= 12.6-\mu \\ \mu &= 12.6-1.2 \\ \mu &= 11.4 \end{aligned}$$

5. The number of jelly beans in a bag is normally distributed. There is an average of 155 jelly beans with a standard deviation of 4 beans
- a) Shade the normal curve to represent the probability of having at most 160 jelly beans in a bag. Find the z-score for having 160 jelly beans in a bag. Find the probability of have at most 160 jelly beans in a bag.



$$Z = \frac{160 - 155}{4} = \frac{5}{4} = 1.25$$

normalcdf(-5, 1.25)

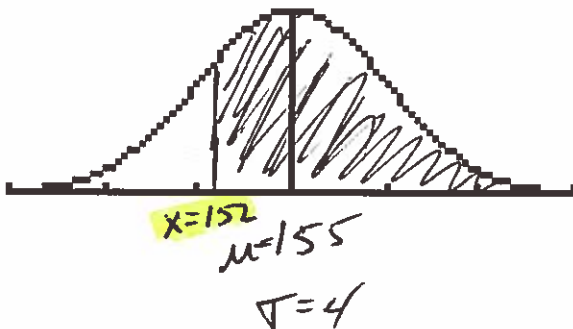
lower = -5

upper = 1.25

Area = 0.8944

OR
89%

- b) Shade the normal curve to represent having at least 152 jelly beans. Find the z-score for having 152 jelly beans in a bag. Find the probability of have at least 152 beans in a bag.



$$Z = \frac{152 - 155}{4} = \frac{-3}{4} = -0.75$$

normalcdf(-0.75, 5)

lower = -0.75

upper = 5

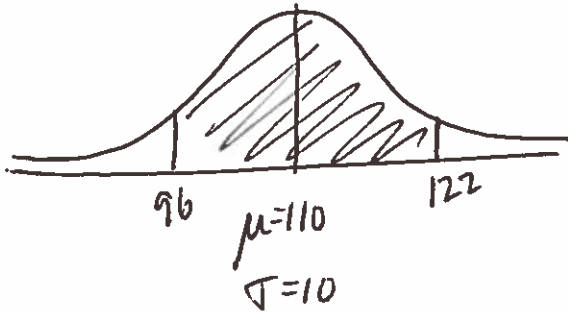
Area = 0.7734

OR
77%

6. For each of the following: draw a normal curve, find the z-score(s) and shade the curve.

In the general population, the IQ scores of individuals are normally distributed with a mean of 110 and a standard deviation of 10. If a large group of people is tested,

- a) What proportion will be expected to have IQs between 96 and 122?



$$z = \frac{96 - 110}{10}$$

$$z = \frac{122 - 110}{10}$$

$$z = -1.40$$

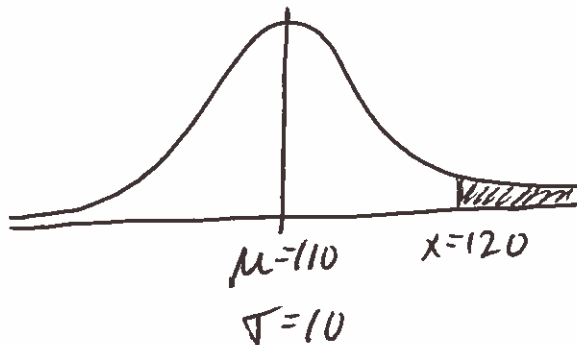
$$z = 1.20$$

$$\text{normalcdf}(-1.40, 1.20)$$

$$\text{Area} = 0.8042$$

$$\text{OR } 80\%$$

- b) What is the probability that an individual has an IQ of at least 120?



$$z = \frac{120 - 110}{10} = 1.00$$

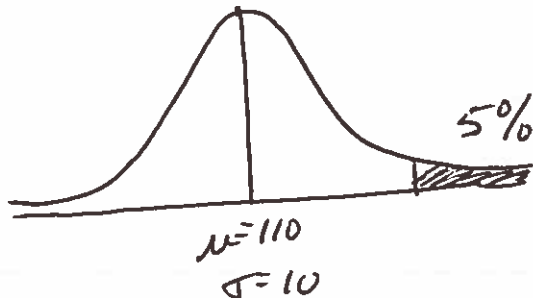
$$\text{Normalcdf}(1.00, 5.00)$$

$$\text{Area} = 0.1587$$

$$\text{OR } 16\%$$

- c) What IQ is necessary to be within the top 5% of the sample group?

"95% below"



$$\text{INVNORM}(0.95)$$

$$z = 1.64$$

$$1.64 = \frac{x - 110}{10}$$

$$16.4 = x - 110$$

$$110 + 16.4 = x$$

$$x = 126$$

Use the following information to answer the next question.

Henry played 24 golf games on the same course during the past two seasons. In the first season, his mean score was 78 with a standard deviation of 2.1. In the second season, his mean score was 74 with a standard deviation of 3.8.

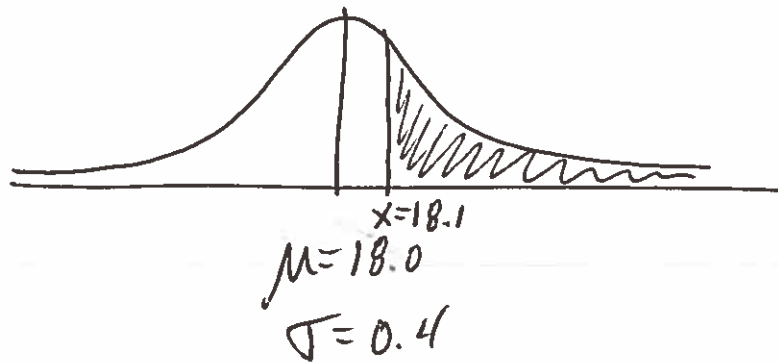
7. What does the **standard deviation** of Henry's scores for the two seasons indicate?
- A. His average score was better in the first season.
 - B. His average score was better in the second season.
 - C. His scores were **more consistent in the first season.**
 - D. His scores were more consistent in the second season.
8. The life of a light bulb is normally distributed with a **mean of 283 hours** and a **standard deviation of 25 hours**. A battery that lasts 275 hours has a z-score of

- A. 0.63
- B. 0.37
- C. 0.32
- D. -0.32

$$Z = \frac{275 - 283}{25} = \frac{-8}{25}$$

9. A billiard manufacturer claims that the cues they produce have a **mean mass of 18.0 oz** with a **standard deviation of 0.4 oz**. If one cue is randomly selected, the probability that its weight is exactly 18.1 oz or more is

- A. 0.75
- B. 0.60
- C. 0.40
- D. 0.25



$$Z = \frac{18.1 - 18.0}{0.4} = 0.25$$

$$\text{normalcdf} = (0.25, 5)$$

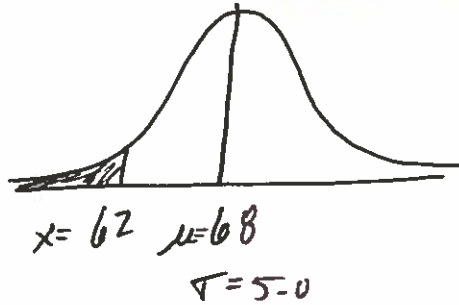
$$\text{AREA} = 0.4013$$

Use the following information to answer the next two questions.

An English 30 Diploma exam had an average of 68 and a standard deviation of 5.0. In Lacombe, 90 students wrote the exam.

10. The number of students who scored 62 or lower is

- A. 10
- B. 19
- C. 22
- D. 48



$$z = \frac{62 - 68}{5} = -1.2$$

normalcdf(-5, -1.2)

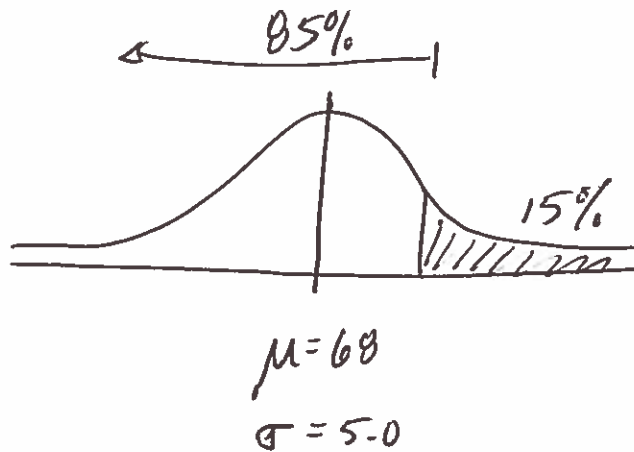
lower = -5
upper = -1.2

$$\text{AREA} = 0.115$$

$$\underline{\quad \times 90 \quad} = 10.$$

11. What minimum score would a student require to be ranked in the top 15% of this exam?

- A. 82
- B. 73
- C. 75
- D. 78



InvNorm(0.85)

$$z = 1.04$$

$$1.04 = \frac{x - 68}{5}$$

$$5.2 = x - 68$$

$$x = 73$$