

FREQUENTLY ASKED Questions

Study Aid

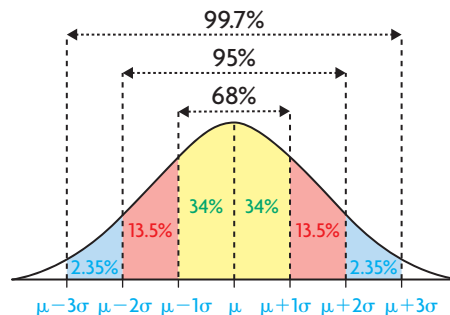
- See Lesson 5.4, Examples 1 and 2.
- Try Chapter Review Questions 7 and 8.

Study Aid

- See Lesson 5.5, Examples 1, 2, and 3.
- Try Chapter Review Questions 9 and 10.

Q: What is a normal distribution, and what are its properties?

A: When data is normally distributed, 50% of the data is above the mean and 50% is below the mean. This makes the distribution symmetrical. The measures of central tendency are equal or close to each other. The graph of a normal distribution (data values versus frequency) is a bell curve. For a normal distribution, approximately 68% of the data is within one standard deviation of the mean, 95% is within two standard deviations of the mean, and 99.7% is within three standard deviations of the mean.



Q: What is a z-score, and how do I calculate it?

A: A z-score indicates the distance of a data value from the mean of the set, measured in standard deviations. If the z-score is positive, the data value is greater than the mean. If the z-score is negative, the data value is less than the mean.

For example, a z-score of 2.00 means that the data value is 2.00 standard deviations above the mean.

To calculate a z-score, use the following formula:

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

To determine the z-score, given $x = 23.5$, $\mu = 18.6$, and $\sigma = 3.2$, substitute each value into the z-score formula.

$$z = \frac{23.5 - 18.6}{3.2}$$

$$z = 1.531\dots$$

The value is about 1.53 standard deviations above the mean.

Q: How do I compare two values from two normally distributed sets of data?

A: Determine the z -score of each piece of data. The value with the higher z -score is the greater relative value.

City	μ (\$)	σ (\$)
Edmonton	375 000	75 000
Calgary	415 000	80 000

For example, Max sells his house in Edmonton for \$392 000 and purchases a house in Calgary for \$417 000. The mean and standard deviations for houses in each city are shown in the table above.

Edmonton: $z = \frac{392\,000 - 375\,000}{75\,000}$ $z = 0.226\dots$	Calgary: $z = \frac{417\,000 - 415\,000}{80\,000}$ $z = 0.025$
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The house in Edmonton has the greater relative value because the z -score is higher.

Q: What is the difference between margin of error, confidence interval, and confidence level?

A: The purpose of a poll or survey is to gather information that can be used to make predictions about a population.

For example, in a recent telephone poll, 33% of Canadians, 18 years of age and older, thought that Olympic athletes who were caught using performance-enhancing drugs should be banned from competition for life (Nanos National Poll, Dec. 2009). The results were accurate to within 3.1 percent points, 19 times out of 20.

The margin of error is $\pm 3.1\%$, which indicates the sampling error in the poll. The margin of error can be combined with the result of the poll to generate a confidence interval. For this poll, we expect that if the entire population of Canadians, 18 years of age and older, were asked the same question, between 29.9% and 36.1% would indicate that they want drug-using athletes banned.

The confidence level of the poll is stated as 19 times out of 20, which is equivalent to 95%. If this poll were conducted over and over again, 95% of the time the result would fall within the confidence interval, 29.9% to 36.1%.

Study Aid

- See Lesson 5.5, Example 1.
- Try Chapter Review Question 10.

Study Aid

- See Lesson 5.6, Examples 1 and 4.
- Try Chapter Review Questions 11 and 12.

PRACTISING

Lesson 5.1

- Twila and Amber keep a log of the amount of time, in minutes, they spend on homework each school day for two weeks. Determine the mean and range for each girl's data, and compare the two sets of data.

Twila: 45 55 50 40 55 40 60 45 40 35
Amber: 80 10 65 15 75 30 40 85 20 35

Lesson 5.2

- Melody is comparing education levels of her generation with education levels of her parents' generation. She obtained the data in the table. Draw two frequency polygons on the same graph to compare the education levels. Comment on the results.

Level of Education	People 25 to 34 Years Old (%)	People 55 to 64 Years Old (%)
less than high school	11	23
high school diploma	23	24
trades certificate	10	13
college diploma	23	16
university certificate or diploma	5	6
university degree	29	18

Lesson 5.3

- Predict which girl's data in question 1 will have the lowest standard deviation. Justify your answer.
 - Determine the standard deviation for each girl's data. Was your prediction correct?
- The following data was taken from a 2000 federal government survey on the mean salary in each province for three categories.

Education	Salary (thousands of dollars)												
	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NU
no diploma	16	15	18	17	21	23	19	18	22	22	19	20	15
high school	17	18	21	20	24	28	23	22	26	26	26	32	27
post-secondary	31	29	33	32	35	44	34	33	41	38	38	48	43

- Determine the mean and standard deviation for each level of education.
- Which level of education yields the highest mean salary?
- Which level of education has the greatest variability in salary?

5. Marc usually puts a bag of either sunflower seeds or raisins in his lunch. The first table shows the number of sunflower seeds in the last 30 bags of sunflower seeds that Marc has had in his lunch. The second table shows the number of raisins in the last 30 bags of raisins that Marc has had in his lunch. Is Marc more likely to get the mean number of items in a bag of sunflower seeds or a bag of raisins? Justify your thinking.

Sunflower Seeds per Bag	28	29	30	31	32	33
Frequency	2	4	11	9	3	1

Raisins per Bag	27	28	29	30	31
Frequency	1	12	7	3	7

6. Scientists monitor the masses of polar bears. In 2010, the following data was obtained:

Adult Female	$\bar{x} = 247$ kg	$\sigma = 33$ kg
Adult Male	$\bar{x} = 461$ kg	$\sigma = 51$ kg

The masses of two polar bears were measured. The female had a mass of 277 kg, and the male had a mass of 499 kg. Use z -scores to determine which bear had the greater mass compared with other bears of the same sex.

Lesson 5.4

7. Judy always waits until her gas tank is nearly empty before refuelling. She keeps track of the distance she drives on each tank of gas. The distance varies depending on the weather and the amount she drives on the highway. The distance has a mean of 824 km and a standard deviation of 28 km.
- Sketch a normal curve to show the distribution of the driving distances for a tank of gas. Mark the kilometres driven for values that are 1, 2, and 3 standard deviations from the mean.
 - What percent of the time does Judy drive between 796 km and 852 km on a tank of gas?
 - What percent of the time does she drive between 740 km and 796 km on a tank of gas?
 - Between what two values will she drive 95% of the time?
8. The body temperatures of 130 adults are recorded in the frequency table to the right.
- Determine the mean and standard deviation of the data.
 - Are the temperatures normally distributed? Explain.



Polar bears go ashore when the sea ice melts. If the sea ice melts too early in the year, the polar bears must go ashore before they are ready. This forces them into a prolonged fast. Global warming may result in polar bears becoming too thin to reproduce.

Temperature (°C)	Frequency
35.8	2
36.0	3
36.2	5
36.4	11
36.6	14
36.8	29
37.0	27
37.2	20
37.4	13
37.6	3
37.8	2
38.0	0
38.2	0
38.4	1

Lesson 5.5

9. TJ is a Congo African Grey parrot. This species of parrot has a life expectancy of 50 years, with a standard deviation of 8 years. What is the likelihood that TJ will live over 60 years?



10. *Computers For All* offers an extended 3-year replacement warranty on its computers. The mean lifespan of its computers is 3.8 years, with a standard deviation of 0.45. *Everything Electronic* offers a 2-year replacement warranty on its computers. The mean lifespan of an *Everything Electronic* computer is 2.6 years, with a standard deviation of 0.31. Which computer is more likely to fail before its warranty period is over?

Lesson 5.6

11. A poll was conducted to determine where Canadians obtain health-related information. 61.9% said they research information on the Internet, 68.9% said they ask friends or family, and 17.9% said they call a health line. The results of this survey are considered accurate within ± 1.4 percent points, 99 times out of 100.
- Determine the confidence interval for each information source.
 - In a city with an adult population of 345 000, predict the range of the number of adults who will say they use each source.
12. Two different market research companies conducted a survey on the same issue. Company A used a 99% confidence level and company B used a 95% confidence level.
- If both companies used a sample size of 1000, what does this imply about the margin of error for each survey?
 - If both companies used the same margin of error of $\pm 2\%$, what does this imply about the sample size for each survey?