

Comparing Z-Scores

THE NORMAL DISTRIBUTION



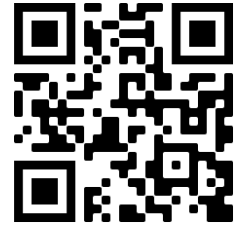
Student Worksheet

7 8 9 10 11 12



Instructions

The first question is provided as a sample. Scan the QR code with your phone to watch the tutorial on YouTube. The tutorial demonstrates how to answer the question, a brief explanation of 'why' and how to use your calculator to help solve the problem.



Sample Question

Two brands of light bulbs are being compared.

The life span of the globes for each brand is normally distributed.

A light bulb is deemed to be defective if it has a life span of less than 500 hours.

A consumer makes the following claim: "Brand A light bulbs are more likely to be defective than Brand B."

Brand	A	B
Mean Life Span:	600 hours	700 hours
Standard Deviation:	50 hours	100 hours

Question: Determine whether or not the consumer's claim is correct and justify your answer using information provided.

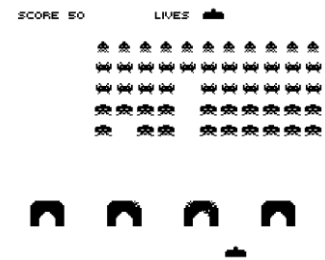
Question: 1.

Basketball scores are normally distributed. Team A has an average score of 80 and a standard deviation of 10. Team B has an average score of 90 and a standard deviation of 5.

- Which team is most likely to obtain a score that exceeds 100?
- Which team is most likely to obtain a score that exceeds 95?
- Which team is most likely to obtain a score that exceeds 105?

Question: 2.

Space Invaders was introduced in 1978. Players attempted to defeat waves of alien space craft. The console was a commercially produced rigid coffee table sized machine. High scores were recorded on each console and found to be normally distributed. A resurgence of the game's popularity amongst retro-gamers produced a new set of high scores. Modern technology is more responsive so these scores are not directly comparable. The mean and standard deviation for the original and retro gamers are in the table below.



- Buzz is an original gamer. He had a high score of 6210 points. JD is a Retro-Gamer with a high score of 7280 points. Which gamer might be deemed as the most skilled?

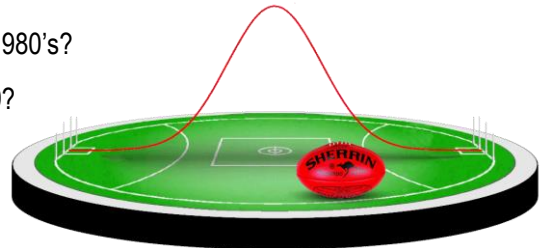
Player	Original - Gamers	Retro-Gamers
Mean High Score:	6000 points	7000 points
Standard Deviation:	200 points	250 points

- Renee is a Retro-Gamer with a high score of 6990. Her mum Skye was an original gamer with a high of 6180. Even though Skye's score is numerically higher, Renee would like to beat her mum's standardised score, a score relative to her mum's era. What score does Renee need to acquire in order to achieve this goal? For additional help for this question, check out the video: <http://bit.ly/z-scores>

Question: 3.

In any given year Australian Rules Football (AFL) game scores are approximately normally distributed. In the 1980's the average (mean) score was 110 points with a standard deviation of 30. After a series of rule and structure changes, the average score in 2019 was 81 points with a standard deviation of 22.

- a) A statistical body declares that a high scoring game occurs when a team scores 2 standard deviations above the mean.
 - i. What would be classified as a high score in the 1980's?
 - ii. What would be classified as a high score in 2019?
 - iii. Of the games played in the 1980's, what proportion of the scores would have been classified as high scoring in 2019?
 - iv. Of the games played in 2019, what proportion of them would have been classified as high scoring in the 1980's?
 - v. Identify an appropriate classification for a 'low scoring' game. Of the games played in 2019, what proportion of them would have been classified as low scoring in the 1980's?
- b) Each AFL game consists of 4 quarters, each of 20 minute duration. During 2020 the AFL changed the duration to 4 quarters, each of 16 minute duration. [Note: Duration = Actual Game Time] During 2020 the average score was 61 points with a standard deviation of 20.
 - i. What would be classified as a high score in 2020?
 - ii. Many people commented that the 2020 scores were much lower than expected. Based on game time, determine whether the 'average' score was 'to be expected'.

**Question: 4.**

Growth charts provide a range of typical heights for range of age groups. The height of adolescent males is normally distributed. The growth chart (opposite) shows the mean height bounded by the fifth and ninety fifth percentiles.

- a) Based on the chart, what is the approximate standard deviation of 20 year old males?
- b) A high school teacher measured the heights of boys in the class as: 166, 163, 169, 166, 174, 175, 167, 182, 179, 163, 168, 176, 160 and 173. Determine the likely age of the boys. Justify your answer.
- c) Nelson Asofa-Solomona is the tallest NRL player at 200cm. Mason Cox plays is the tallest AFL player at 211cm. Assuming males stop growing (height) at the age of 20, what percentiles do Nelson and Mason belong?

