



Significant figures

When psychologists use descriptive and inferential statistics they generate values from their data.

This can be in relation to:

- Standard deviation
- Mean
- Correlation coefficient

In the exam you could be asked to state a result according to significant figures.

There are two things that you need to know in relation to significant figures.

- What the first significant figure is in a number.
- How to round the number next to the significant figure up or down.

Misconceptions

- When candidates have been asked to work out a value according to a significant figure, they have included zero digits to the left of the value, leading to an incorrect answer.

Step 1: First significant figure

In a number/value generated, the **first significant figure** is the **first non-zero digit** from the left of the value.

Example:

- | | | | |
|---------------------|---|------------------|-------------------------------------|
| • Left of the value | ➡ | 1 .234. | 1 is the first non-zero to the left |
| • Left of the value | ➡ | 0. 9 842. | 9 is the first non-zero to the left |
| • Left of the value | ➡ | 0.0 8 145 | 8 is the first non-zero to the left |

Activity 1

Find the first significant figure (first non-zero value) in the following numbers:

- | | |
|-------------|-------------|
| 1. 4.567 | 6. 8.9045 |
| 2. 0.00234 | 7. 0.000560 |
| 3. 0.7621 | 8. 0.080543 |
| 4. 0.000032 | 9. 0.21432 |
| 5. 0.0452 | 10. 0.00001 |



Step 2: Rounding the next number up or down.

In the exam you will be asked to state the value according to a specific significant figure. This could be 1, 2, 3 or even 4 significant figures.

Example: Write the following value to 1 significant figure: 0.8234

To write the number 0.8234 to 1 significant figure, identify the first significant figure from the left of the value. Remember do not include zero digits.

- 0.8234. 8 is the first non-zero to the left of the value

The next step is to look at the digit after 8, and this will determine if we round up or down.

- For numbers 5 and above we round up.
- For numbers 4 and below we round down.

In the number 0.8234, the next number is 2 so we would round down.

Therefore, the number 0.8234 to 1 significant figure is 0.8.

Examples

- **4.5432** to 1 significant figure:
 - The next number after 4 is 5
 - So, we round up to 5
- **0.00329** to 2 significant figures:
 - The next number after 32 is 9
 - So, we round up to 0.0033
- **0.0045312** to 3 significant figures:
 - The next number after 453 is 1
 - So, we round down to 0.00453
- **8.76452** to 4 significant figures:
 - The next number after 8.764 is 5
 - So, we round up to 8.765

Activity 2 – Write the number according to the following significant figures:

1. 56982 to 1 significant figure
2. 867543 to 2 significant figures
3. 0.087365 to 4 significant figures
4. 0.0030490 to 1 significant figure
5. 0.0032490 to 2 significant figures
6. 0.0050181 to 3 significant figures
7. 0.078241 to 3 significant figures
8. 566064 to 3 significant figures
9. 0.054215 to 4 significant figures



10.4982100 to 2 significant figures

Exam questions

1. Becca wants to find out if there are sex differences in male and female brain functioning. She decides to use a laboratory experiment. Becca's results are shown in the table.

	Mean time taken to accurately complete the coordination task (seconds)	Mean time taken to accurately complete the word-meaning task (seconds)
Males	57.24	63.51
Females	64.43	51.36

Calculate the difference between the mean time (seconds) taken by males to accurately complete the coordination task and word-meaning task. You must give your answer to two significant figures.
(2)

2. Skylar wanted to investigate the influence of a reward on the behaviour of rats. Skylar set up a maze and recorded how long, in seconds, it took rats to complete the maze. The time taken to complete the maze was recorded for each rat without a reward (Condition A) and for the same rats with a reward (Condition B).

Skylar's results are shown in Table 2.

Rat	Condition A Time taken (seconds) to complete the maze without a reward	Condition B Time taken (seconds) to complete the maze with a reward
A	20.14	10.02
B	19.89	15.21
C	15.14	9.86
D	25.21	19.86
E	20.08	15.01
Estimated total time for all rats (in seconds) to complete the maze		

Calculate the mean score of Condition B in the table to four significant figures.
(1)

3. Marco asked for volunteers from his company to complete training which involved learning about coercive power, legitimate power and reward power.

Marco calculates the standard deviation for the three types of power. For legitimate power, Marco's standard deviation result was 1.07496. Give Marco's standard deviation result for legitimate power to three significant figures. (1)

4. Jacob is carrying out psychological research into the role of rehearsal in memory. He finds that 60% of his participants are male and 40% are female. The mean recall for the males is 10.5654 words and the mean recall for the females is 12.1232 words.

- What is the mean recall for males to three significant figures? (1)
- What is the mean recall for females to four significant figures? (1)



Challenge question:

A group of researchers is conducting research into anxiety among adults. The researchers believe that negative life events may be a cause of anxiety. They have asked people with anxiety to record the number of positive and negative life events they have experienced over the last 12 months. Examples of events participants were asked to consider included marriage/divorce, promotion/losing a job, moving home/losing a house, bereavement and births. The participants provided a total score for both positive and negative life events. The results are presented in the table.

Calculate the standard deviation for negative life events. Show your working and give your answer to two significant figures. (4)

The participants provided a total score for both positive and negative life events. The results are presented in **Table 1**.

	Positive life events	Negative life events
Participant A	3	6
Participant B	1	5
Participant C	2	1
Participant D	0	9
Participant E	1	8
Participant F	2	6
Participant G	4	6
Participant H	3	11
Participant I	4	9
Participant J	2	12
Mean	2.2	7.3



Mark scheme

1. One mark for calculating the difference. $63.51 - 57.24 = 6.27$ (1)
One mark for answer to two significant figures. 6.3 (1)
2. AO2 (1 mark) Credit one mark for calculating the mean score to four significant figures.
For example: 13.99 (1)
Reject all other answers.
3. AO2 (1 mark) Credit one mark for correct answer to three significant figures.
For example: 1.07
Reject all other answers.
4. a. AO2 (1 mark) Credit one mark for correct answer to three significant figures.
For example: 10.6
Reject all other answers.

B. AO2 (1 mark) Credit one mark for correct answer to two significant figures.
For example: 12.12
Reject all other answers.

Challenge question

AO2 (4 marks)

- One mark for squaring the values of negative life events minus the mean for each score (1), $(x - \bar{x})^2$ -1.32, -2.32, -6.32, 1.72, 0.72, 1.32, 1.32, 3.72, 1.72, 4.72
- One mark for calculating the sum of these values = 92.1
- One mark for dividing this by 9 ($n-1$) = 10.23333 One mark for calculating the square root 3.1989581
- One mark 3.20 to two sig figures.

Answers for activity 1

- | | |
|------------------|------------------|
| 1. 4.567 is 4 | 6. 8.9045 is 8 |
| 2. 0.00234 is 2 | 7. 0.000560 is 5 |
| 3. 0.7621 is 7 | 8. 0.080543 is 8 |
| 4. 0.000032 is 3 | 9. 0.21432 is 2 |
| 5. 0.0452 is 4 | 10. 0.00001 is 1 |

Answers for activity 2

1. 56982 to 1 significant figure: 60000
2. 867543 to 2 significant figures: 870000



3. 0.087365 to 4 significant figures: 0.08737
4. 0.0032490 to 2 significant figures: 0.0032
5. 0.0050181 to 3 significant figures: 0.00502
6. 0.008237 to 1 significant figure: 0.008
7. 0.078241 to 3 significant figures: 0.0782
8. 566064 to 3 significant figures: 566000
9. 0.054215 to 4 significant figures: 0.05422
10. 498210 to 2 significant figures: 500000