

Student Name

Mathematics Stage 5 Core

DATA ANALYSIS A

Book 1 Examine standard deviation as a
measure of spread

Version: 260207

Report mistakes & suggest improvements:
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OVERVIEW

SYLLABUS CONTENT

MA5-DAT-C-01 compares and analyses datasets using summary statistics and graphical representations

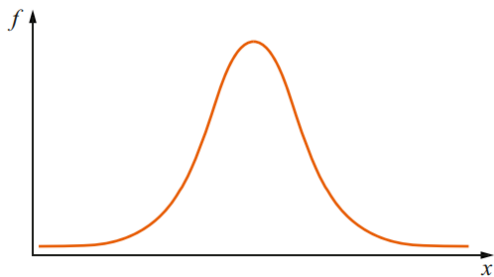
Examine standard deviation as a measure of spread

- Identify standard deviation as a measure of spread
- Calculate the standard deviation of a small dataset using digital tools
- Compare small datasets using standard deviation

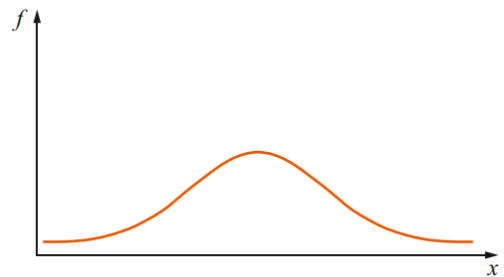
STANDARD DEVIATION

- **Standard deviation** shows how far data is spread from the **mean**.
- A larger standard deviation means more **spread** in the data.

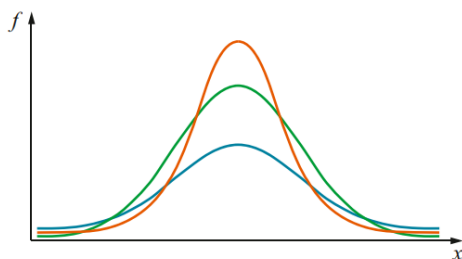
Small standard deviation



Large standard deviation



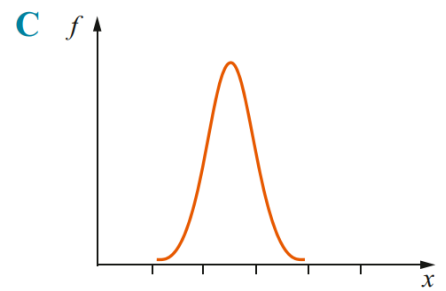
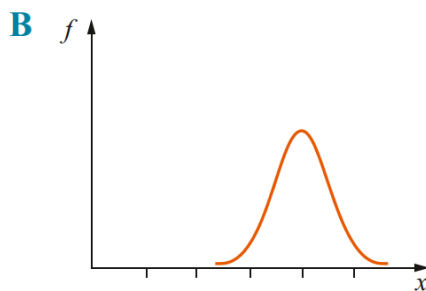
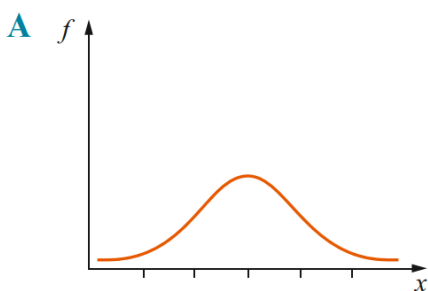
**Same mean
Different standard deviation**



**Different mean
Same standard deviation**



- 1 The normal curves below are drawn with the same scale on each horizontal axis and the same scale on each vertical axis.



Which distribution has the:

- Largest standard deviation?
- Smallest standard deviation?
- Largest mean?
- Smallest mean?

A

C

B

C

TWO TYPES OF STANDARD DEVIATION

- σ_x **population** standard deviation. (σ is the Greek letter lowercase sigma)
- s_x **sample** standard deviation.
- Always calculate population standard deviation σ_x , unless you are specifically asked to calculate sample standard deviation.

STANDARD DEVIATION USING A CALCULATOR

CASIO FX-82 AU

1. Set calculator to *Statistics Mode 1-var*: **MODE** **2** **1**
2. A table should show up. If it does not have a frequency column: **SHIFT** **MODE** **▼** **3** **1**
Repeat step 1.
3. Enter your data into the table using numbers, arrows and equals button.
4. Press **AC** to save the data.
5. Calculate standard deviation. **SHIFT** **1** **4**
 σ_x **3** population standard deviation.
 s_x **4** sample standard deviation.
Then press **=**

CASIO FX-8200 AU

1. Set the calculator to Statistics Mode: Home → Statistics → 1 – Variable
2. A table should show up. If it does not have a frequency column:
 - a. Tools → Frequency → On
3. Enter your data into the frequency distribution table.
4. Press EXE → 1 – var results

Example Calculate standard deviation.

Calculate the sample s_x and population standard deviation σ_x of: 1, 3, 5, 7, 9 STAT $\square$ SX 3.16227766 STAT $\square$ σ_x 2.828427125	What does the standard deviation represent? <i>Standard deviation is the distance of every data value from the</i> <i>It is a measure of how out the data is.</i>
---	--

Calculate the sample and population standard deviation of:

a 8, 10, 12

b 18, 20, 22

$$s_x = 2, \sigma_x = 1.63$$

$$s_x = 2, \sigma_x = 1.63$$

c 1, 4, 7, 10, 13

d

Score (x)	Frequency (f)
15	3
16	4
17	6
18	4
19	5

$$s_x = 4.74, \sigma_x = 4.24$$

$$s_x = 1.37, \sigma_x = 1.34$$

Key ideas

1. Standard deviation is a measure of how out the data is.
2. Standard deviation is the average distance of each datapoint from the
3. The greater the standard deviation, the spread out the data is.

1 Calculate the population standard deviation of these datasets.

a 1, 1, 1, 1, 1	e 3, 4, 6, 8, 9	i 0, 0.5, 1, 1.5, 2, 2.5, 3
$\sigma_x =$	$\sigma_x =$	$\sigma_x =$
b 1, 1, 2, 3, 3	f 2, 4, 6, 8, 10	j -3, -2.5, -2, -1.5, -1, -0.5, 0
$\sigma_x =$	$\sigma_x =$	$\sigma_x =$
c 2, 2, 3, 4, 4	g 1, 2, 3, 4, 5	k -1.5, -1, -0.5, 0, 0.5, 1, 1.5
$\sigma_x =$	$\sigma_x =$	$\sigma_x =$
d 4, 4, 6, 8, 8	h 0, 1, 2, 3, 4, 5, 6	l -1.5, -1, -0.5, 0.5, 1, 1.5
$\sigma_x =$	$\sigma_x =$	$\sigma_x =$

2 The results for Molly and Harry in their tests this term is listed below.

Molly	10	19	16	15	7	15	11	3	9	16
Harry	18	16	17	8	14	15	13	10	13	16

- a** What is the mean and population standard deviation for Molly’s results?
.....
- b** What is the mean and population standard deviation for Harry’s results?
.....
- c** Which student had the more consistent results throughout the term? Give a reason.
.....

3 Calculate the population standard deviation from these frequency tables.

a

x	f
1	1
2	1
3	1

$\sigma_x =$

b

x	f
1	5
2	5
3	5

$\sigma_x =$

c

x	f
2	5
3	5
4	5

$\sigma_x =$

d

x	f
-2	5
-3	5
-4	5

$\sigma_x =$

e

x	f
-4	5
-6	5
-8	5

$\sigma_x =$

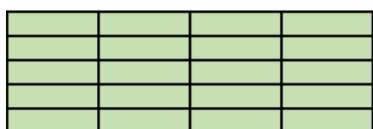
f

x	f
-4	5
-6	5
-8	50

$\sigma_x =$

4 Calculate the mean and population standard deviation from these histograms.
The data values range from 1 to 4.

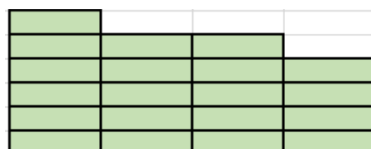
a



Mean =

$\sigma_x =$

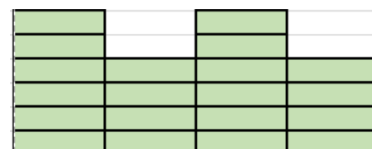
b



Mean =

$\sigma_x =$

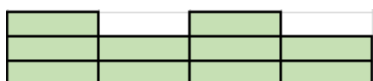
c



Mean =

$\sigma_x =$

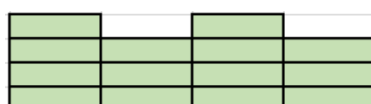
d



Mean =

$\sigma_x =$

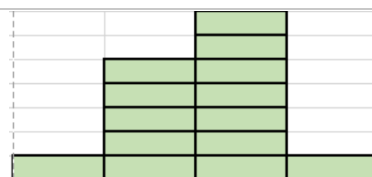
e



Mean =

$\sigma_x =$

f



Mean =

$\sigma_x =$

- 5 During Term 2, Rachel did 9 spelling tests. The tests were scored out of 20. Her mean score is 15 and her standard deviation is 2.54.
- a If Rachel had scored 2 extra marks on every test,
- i What would happen to her mean?
-
- ii Explain why her standard deviation would be unchanged.
-
- b If Rachel had scored 15 on every test,
- i What would happen to her mean?
-
- ii Explain why her standard deviation would be zero.
-
- c What will happen to Rachel's standard deviation if she scores 15 on her next test?
-
- d What will happen to Rachel's standard deviation if she scores 0 on her next test?
-

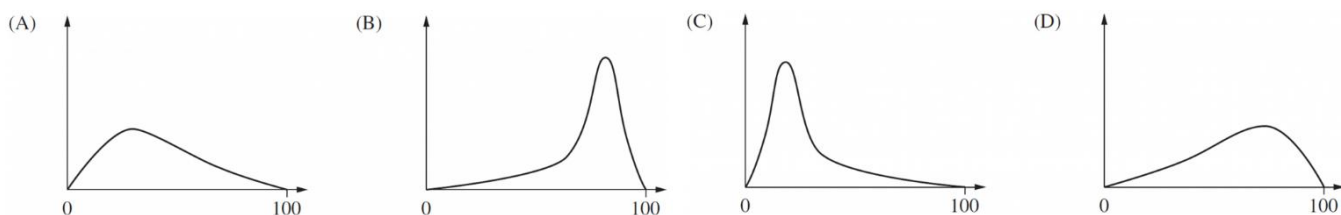
- 6 **2017 HSC Standard 2 Band 5**
- Jamal surveyed eight households in his street. He asked them how many kilolitres (kL) of water they used in the last year. Here are the results.
- 220 105 101 450 37 338 151 205
- Calculate the mean of this data.

What is the standard deviation of this data, correct to one decimal place?

- 7 **NAPLAN A**
- In a small business, the seven employees earn the following wages per week:
\$300, \$490, \$520, \$590, \$660, \$680, \$970
- Calculate the standard deviation for this set of data, giving your answer to one decimal place.
- Each employee receives a \$20 pay increase.
- Explain the effect that this increase will have on the standard deviation.

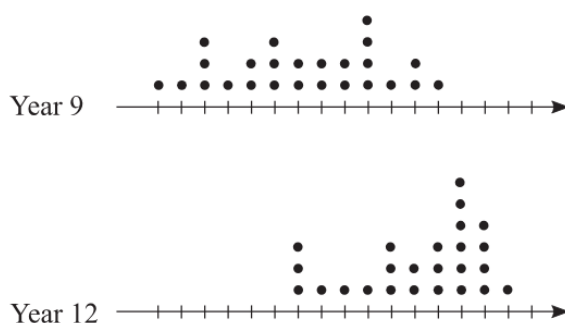
8 2006 HSC Standard 2 Band 5

Which of these graphs best represents positively skewed data with the smaller standard deviation?



9 HSC Standard 2 Sample Question Band 5

The dot plots show the height of students in Year 9 and Year 12 in a school. They are drawn on the same scale.



Which statement about the change in heights when comparing Y9 to Y12 is correct?

- A. The mean increased and the standard deviation decreased.
- B. The mean decreased and the standard deviation decreased.
- C. The mean increased and the standard deviation increased.
- D. The mean decreased and the standard deviation increased.