



H04-30min Standard Deviation: 30-minute Pack

EDEXCEL 1ST0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** The resistance, in ohms, of 5 electrical components is measured:

18, 22, 19, 21, 20

- (a) Write down the formula that connects the variance of a data set to its standard deviation. (1)

- (b) Calculate the variance of the 5 resistance readings. (2)

- (c) Hence write down the standard deviation of the resistance readings, correct to 3 significant figures, stating its units. (2)

- (d) Give one advantage of using the standard deviation, rather than the variance, to describe the spread of the resistance readings. (1)

(Total for Question 1 is 6 marks)

2 The masses, in grams, of 5 packages are:

1024, 1031, 1019, 1028, 1022

The masses, x , are coded using $y = x - 1020$.

(a) Explain why coding the data using $y = x - 1020$ makes the values easier to work with. (1)

(b) Show that the mean of the coded data, y , is 4.8. (2)

(c) Hence write down the mean mass, x , of the original packages. (1)

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(d) Calculate the standard deviation of the coded data, y , giving your answer correct to 3 significant figures. (3)

.....
(e) Write down the standard deviation of the original masses, x , giving a reason for your answer. (1)

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(Total for Question 2 is 8 marks)

3 A bakery manager wants to compare the consistency of loaf weights, in grams, produced by two ovens.

(a) Plan: Give one reason why the manager should weigh a sample of several loaves from each oven, rather than comparing just one loaf from each. **(1)**

(b) Collect: Give one step the manager should take when collecting the two samples to make the comparison fair. **(1)**

(c) Process: She weighs 5 loaves from each oven (grams): **(8)**

Oven A: 798, 802, 805, 797, 803

Oven B: 780, 815, 790, 810, 805

Show that the mean loaf weight is 801 g for Oven A and 800 g for Oven B, and calculate the standard deviation of each sample, giving your answers correct to 3 significant figures.

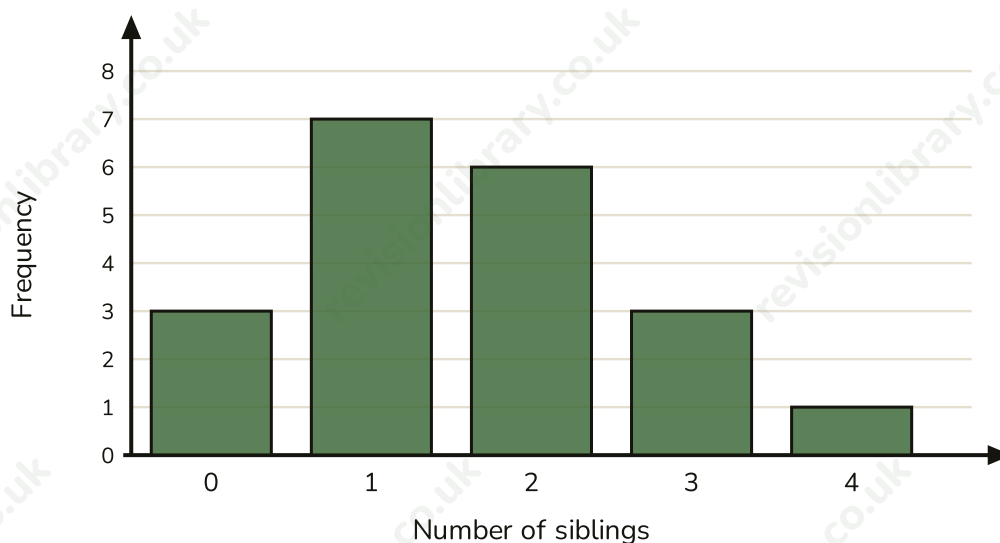
(d) Interpret: Using the standard deviations, write a conclusion comparing the consistency of loaf weights produced by the two ovens. **(2)**

(Total for Question 3 is 12 marks)

- 4 The bar chart shows the number of siblings for each of 20 pupils in a class survey.

Number of siblings	0	1	2	3	4
Frequency	3	7	6	3	1

Key formula for frequency data: standard deviation = $\sqrt{\text{sum of } fx^2 / \text{sum of } f - \text{mean}^2}$



- (a) Write down the modal number of siblings. (1)
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- (b) Show that the sum of fx for this data is 32. (2)
- (c) Hence write down the mean number of siblings for this class. (1)
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- (d) Show that the sum of fx^2 for this data is 74. (2)
- (e) Using the formula above, calculate the standard deviation of the number of siblings, giving your answer correct to 3 significant figures. (3)

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(Total for Question 4 is 9 marks)

Mark scheme · H04-30min Standard Deviation: 30-minute Pack

Question 1

- (a) **B1** variance = (standard deviation)², oe (e.g. standard deviation = $\sqrt{\text{variance}}$)
- (a) **Answer: variance = (standard deviation)²**
- (b) **M1** deviations -2, 2, -1, 1, 0, so sum of (x-mean)² = 10, oe
- (b) **A1** variance = 2 cao
- (b) **Answer: 2 (ohms squared)**
- (c) **M1** $\sqrt{2}$, ft their variance from (b)
- (c) **A1** 1.41 ohms (awrt), with correct unit (not ohms squared)
- (c) **Answer: 1.41 ohms**
- (d) **B1** the standard deviation is in the same units as the original data (ohms), so it is easier to interpret and compare directly with the data values, unlike the variance, which is in squared units, oe
- (d) **Answer: The standard deviation is in the same units as the data (ohms), making it easier to interpret than the variance (ohms squared).**

Question 2

- (a) **B1** the coded values are much smaller, single or two-digit numbers, which are easier to square and sum than the original 4-digit masses, oe
- (a) **Answer: The coded values are much smaller and simpler to work with than the original 4-digit masses.**
- (b) **M1** 4+11-1+8+2 (=24), oe
- (b) **A1** 24/5 = 4.8
- (b) **Answer: 4.8**
- (c) **B1** 1024.8 (g), ft (1020+their 4.8)
- (c) **Answer: 1024.8 g**
- (d) **M1** deviations -0.8, 6.2, -5.8, 3.2, -2.8, so sum of (y-mean)² = 90.8, oe
- (d) **M1** 90.8/5 (=18.16)
- (d) **A1** 4.26 (awrt)
- (d) **Answer: 4.26**
- (e) **B1** 4.26 (g), ft, because subtracting a constant from every value does not change how spread out the data is, oe
- (e) **Answer: 4.26 g**

Question 3

- (a) **B1** one loaf from each oven might not be typical; a sample of several loaves reduces the effect of one unusually heavy or light loaf and gives a fairer comparison, oe
- (a) **Answer: A single loaf may not be typical; a sample of several loaves gives a fairer comparison.**
- (b) **B1** weigh the same number of loaves from each oven, made using the same recipe and weighed on the same scales, oe
- (b) **Answer: Weigh equal-sized samples from each oven, made the same way and weighed on the same scales.**
- (c) **B1** Oven A mean: $(798+802+805+797+803)/5 = 4005/5 = 801$
- (c) **B1** Oven B mean: $(780+815+790+810+805)/5 = 4000/5 = 800$
- (c) **M1** Oven A: deviations -3,1,4,-4,2, so sum of $(x-\text{mean})^2 = 46$, oe
- (c) **M1** $46/5 (=9.2)$
- (c) **A1** Oven A: 3.03 g (awrt)
- (c) **M1** Oven B: deviations -20,15,-10,10,5, so sum of $(x-\text{mean})^2 = 850$, oe
- (c) **M1** $850/5 (=170)$
- (c) **A1** Oven B: 13.0 g (awrt)
- (c) **Answer: Oven A: mean 801 g, SD 3.03 g. Oven B: mean 800 g, SD 13.0 g.**
- (d) **B1** Oven A has the smaller standard deviation (3.03 g compared with 13.0 g), ft
- (d) **B1** so Oven A produces more consistent (less variable) loaf weights than Oven B, oe
- (d) **Answer: Oven A produces more consistent loaf weights, since its standard deviation (3.03 g) is much smaller than Oven B's (13.0 g).**

Question 4

- (a) **B1** 1 cao
- (a) **Answer: 1**
- (b) **M1** 0, 7, 12, 9, 4, oe (correct fx products)
- (b) **A1** 32 cso
- (b) **Answer: 32**
- (c) **B1** 1.6 cao (ft)
- (c) **Answer: 1.6**
- (d) **M1** 0, 7, 24, 27, 16, oe (correct fx^2 products)
- (d) **A1** 74 cso
- (d) **Answer: 74**
- (e) **M1** $74/20 - 1.6^2 (=3.7-2.56)$, oe
- (e) **M1** = 1.14
- (e) **A1** 1.07 (awrt)
- (e) **Answer: 1.07**