



H22-30min Weighted and Geometric Mean: 30-minute Pack

EDEXCEL 1ST0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** The geometric mean of two positive numbers p and q is defined as:

$$\text{geometric mean} = \sqrt{p \times q}$$

- (a)** Find the geometric mean of 8 and 32.

(2)

- (b)** Find the geometric mean of 5 and 20.

(2)

(Total for Question 1 is 4 marks)

- 2** A secondary school is following the statistical enquiry cycle to find a single average GCSE point score across Year 11, combining results from three subjects with different numbers of students entered:

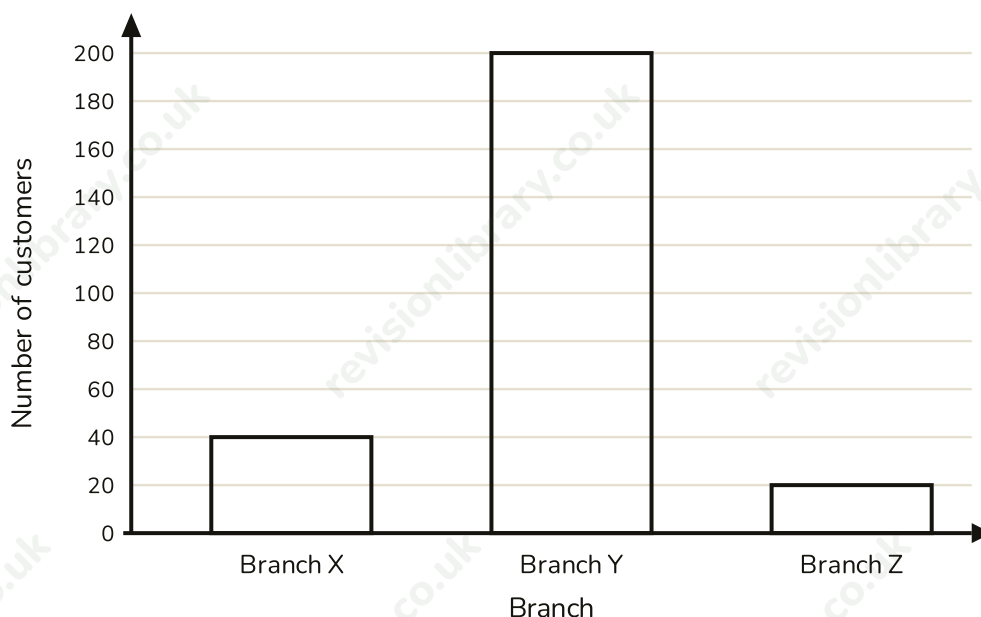
Subject	Number of students	Mean point score
Maths	200	5.4
English	180	5.0
Science	150	4.6

- (a) (Plan) Before combining these three subject means into one overall figure, state two pieces of information the school needs in order to calculate a valid combined average. (2)
- (b) (Process) Calculate the simple (unweighted) mean of the three subject means. (2)
-
- (c) (Process) Calculate the weighted mean point score across all Year 11 students, weighted by the number of students entered for each subject. Give your answer correct to 3 significant figures. (3)
-
- (d) (Interpret) Explain why the weighted mean in part (c) is a more appropriate overall summary than the simple mean in part (b). (1)

(Total for Question 2 is 8 marks)

- 3** A restaurant chain has three branches. Each customer leaves a satisfaction rating out of 5. The mean ratings are: Branch X = 4.8, Branch Y = 4.2, Branch Z = 3.0. The bar chart shows the number of customers who left a rating at each branch.

The regional manager states: "The average rating across the three branches is $(4.8+4.2+3.0)/3 = 4.0$, so the chain is doing well."

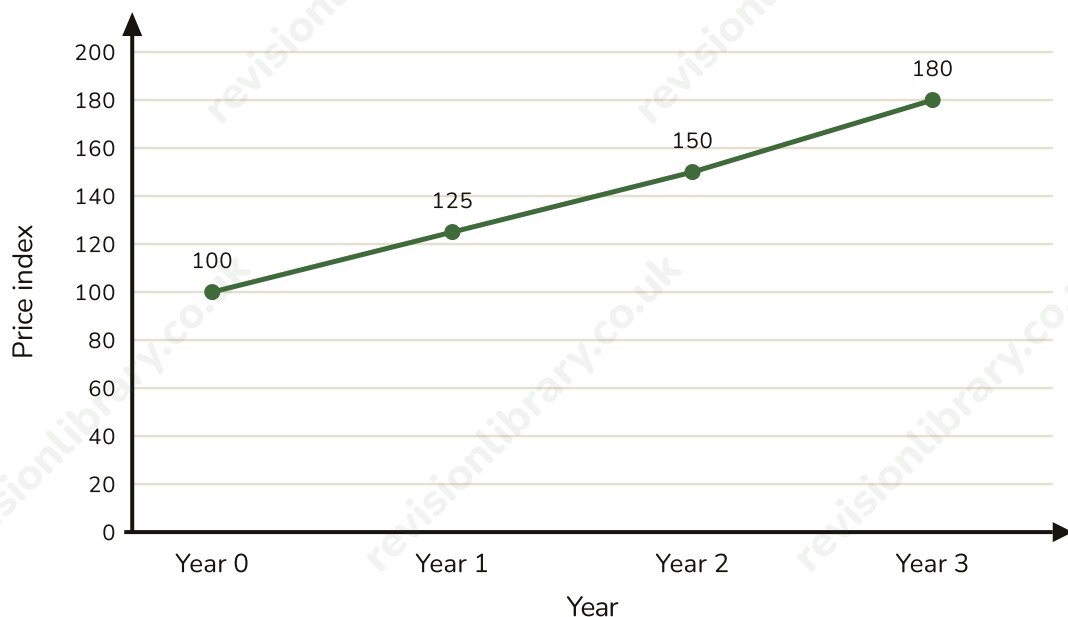


- (a) Use the bar chart to work out the weighted mean satisfaction rating across all customers, weighting by the number of customers at each branch. (3)

- (b) Explain why the regional manager's simple mean of 4.0 is misleading. (2)

(Total for Question 3 is 5 marks)

- 4 A price index for a basket of goods (Year 0 = 100) is recorded at the end of each of the next three years, as shown on the line graph.



- (a) Use the graph to work out the percentage increase in the index from Year 0 to Year 1, from Year 1 to Year 2, and from Year 2 to Year 3. (3)

- (b) Work out the overall percentage increase in the index from Year 0 to Year 3. (2)

- (c) Use the geometric mean of the three yearly growth multipliers (1.25, 1.20 and 1.20) to find the average annual percentage increase in the index, giving your answer correct to 3 significant figures. (3)

(Total for Question 4 is 8 marks)

5 Two students' working is shown below.

Student 1 is finding the geometric mean of 4, 6 and 9:

Step 1: $4 + 6 + 9 = 19$

Step 2: $19 / 3 = 6.33$

Step 3: geometric mean = 6.33

Student 2 is finding the weighted mean of the values 10, 20 and 30, with weights 2, 3 and 5:

Step 1: $(10 \times 2) + (20 \times 3) + (30 \times 5) = 20 + 60 + 150 = 230$

Step 2: weighted mean = $230 / 3 = 76.7$

(a) Identify the error in Student 1's method. (1)

(b) Work out the correct geometric mean of 4, 6 and 9. (2)

(c) Identify the error in Student 2's method. (1)

(d) Work out the correct weighted mean. (2)

(Total for Question 5 is 6 marks)

Mark scheme · H22-30min Weighted and Geometric Mean: 30-minute Pack

Question 1

- (a) **M1** $\sqrt{8 \times 32}$, oe ($=\sqrt{256}$)
- (a) **A1** 16 cao
- (a) **Answer: 16**
- (b) **M1** $\sqrt{5 \times 20}$, oe ($=\sqrt{100}$)
- (b) **A1** 10 cao
- (b) **Answer: 10**

Question 2

- (a) **B1** the mean point score for each subject, oe
- (a) **B1** the number of students entered for each subject, to use as the weights, oe
- (a) **Answer: The mean point score for each subject, and the number of students entered for each subject (to use as weights).**
- (b) **M1** $(5.4+5.0+4.6)/3$, oe
- (b) **A1** 5.0 cao
- (b) **Answer: 5.0**
- (c) **M1** 5.4×200 , 5.0×180 , 4.6×150 ($=1080, 900, 690$), oe
- (c) **M1** $2670 / (200+180+150)$, dep
- (c) **A1** 5.04 (awrt, from 5.0377...)
- (c) **Answer: 5.04 (3 sf)**
- (d) **B1** the weighted mean accounts for the different cohort sizes (200, 180, 150 students), so larger subjects count for more, whereas the simple mean treats each subject's mean as equally important regardless of how many students it represents, oe
- (d) **Answer: The weighted mean is more appropriate because it accounts for the different numbers of students in each subject; the simple mean wrongly treats all three subject means as equally important.**

Question 3

- (a) **M1** 4.8×40 , 4.2×200 , 3.0×20 ($=192, 840, 60$), oe (reads bar heights 40, 200, 20 from the chart)
- (a) **M1** $1092 / (40+200+20)$, dep
- (a) **A1** 4.2 cao
- (a) **Answer: 4.2**
- (b) **B1** the simple mean treats all three branches as equally important even though Branch Y had far more customers (200) than Branch X (40) or Branch Z (20), oe
- (b) **B1** the weighted mean (4.2) is pulled towards Branch Y's rating (4.2) because Branch Y represents most of the customers, giving a truer picture than the simple mean, oe
- (b) **Answer: The simple mean is misleading because it treats each branch equally, ignoring that Branch Y had far more customers; the weighted mean (4.2) correctly reflects that most customers experienced Branch Y's rating.**

Question 4

- (a) **B1** 25 (%), from 100 to 125
- (a) **B1** 20 (%), from 125 to 150
- (a) **B1** 20 (%), from 150 to 180
- **(a) Answer: 25%, 20%, 20%**
- (b) **M1** $(180-100)/100$, oe
- (b) **A1** 80 (%) cao
- **(b) Answer: 80%**
- (c) **M1** $1.25 \times 1.20 \times 1.20 (=1.8)$, oe
- (c) **M1** cube root of 1.8, dep
- (c) **A1** 21.6 (%) awrt, from 1.2164...
- **(c) Answer: 21.6% (3 sf)**

Question 5

- (a) **B1** Student 1 has calculated the arithmetic mean (adding the values and dividing by 3) instead of the geometric mean, which requires multiplying the values and taking the cube root, oe
- **(a) Answer: Student 1 found the arithmetic mean instead of the geometric mean: they should multiply the three values and take the cube root, not add them and divide by 3.**
- (b) **M1** $4 \times 6 \times 9 (=216)$, oe
- (b) **A1** 6 cao
- **(b) Answer: 6**
- (c) **B1** Student 2 divided by the number of values (3) instead of dividing by the sum of the weights ($2+3+5 = 10$), oe
- **(c) Answer: Student 2 divided by the number of values (3) instead of by the sum of the weights ($2+3+5 = 10$).**
- (d) **M1** $230 / (2+3+5)$, ft from (c)
- (d) **A1** 23 cao
- **(d) Answer: 23**