General Mathematics Unit 3 & 4 — Examination 2 (Practice 1) — Answers & Explanations

Answers to the 7 questions in the free preview.

Data analysis

1. (9 marks in total)

a. 50 cm [1 mark]

Ordered, the heights are 30, 42, 45, 47, 50, 51, 55, 58, 62. With nine values the median is the fifth, which is 50.

b. Q1 = 43.5 cm, Q3 = 56.5 cm, IQR = 13 cm [2 marks]

The median splits the ordered data, leaving 30, 42, 45, 47 below and 51, 55, 58, 62 above. The lower group has median (42 + 45) ÷ 2 = 43.5 and the upper group (55 + 58) ÷ 2 = 56.5, so the interquartile range is 56.5 − 43.5 = 13. One mark for the two quartiles, one for the interquartile range.

c. The fences are at 24 cm and 76 cm, and every height lies between them. [2 marks]

An outlier lies more than 1.5 interquartile ranges beyond a quartile, and 1.5 × 13 = 19.5. The lower fence is 43.5 − 19.5 = 24 and the upper fence is 56.5 + 19.5 = 76. The smallest height, 30, is above 24 and the largest, 62, is below 76, so there are no outliers. One mark for computing the fences, one for the comparison.

d. 48.89 cm [1 mark]

The nine heights total 440 cm, so the mean is 440 ÷ 9 = 48.89 cm correct to two decimal places.

e. A slight negative skew — the low value of 30 cm pulls the mean below the median. [1 mark]

The mean is affected by extreme values but the median is not. Here the single low height of 30 cm drags the mean down to 48.89 while the median stays at 50, which indicates a tail towards the lower values, that is a slight negative skew.

f. The median rises only slightly, from 50 cm to 50.5 cm; the mean rises sharply, from 48.89 cm to 52.5 cm. [2 marks]

With ten values the median is the average of the fifth and sixth, that is (50 + 51) ÷ 2 = 50.5, barely changed. The new total is 525 cm, so the mean becomes 525 ÷ 10 = 52.5, a much larger shift. The height of 85 cm is above the upper fence of 76 cm, so it is an outlier, and this illustrates that the median is resistant to outliers while the mean is not. One mark for each measure.

2. (5 marks in total)

a. 68% [1 mark]

The scores 59 and 77 are one standard deviation either side of the mean, because 68 − 9 = 59 and 68 + 9 = 77. By the 68–95–99.7% rule, 68% of values lie within one standard deviation of the mean.

b. z = 2 [1 mark]

The standardised score is z = (86 − 68) ÷ 9 = 2, so the score is two standard deviations above the mean.

c. 2.5% [2 marks]

From part b, 86 is two standard deviations above the mean. The rule says 95% of scores lie within two standard deviations, leaving 5% outside. That 5% is split evenly between the two tails, so 2.5% of students scored above 86. One mark for the 5% outside, one for halving it.

d. 10 students [1 mark]

The score 50 is two standard deviations below the mean, because 68 − 2 × 9 = 50, so 2.5% of students fall below it. That is 0.025 × 400 = 10 students.

3. (6 marks in total)

a. Hours of study [1 mark]

The explanatory variable is the one used to predict the other. Here hours of study is used to predict the test mark, so hours of study is explanatory and mark is the response variable.

b. On average, each extra hour of study is associated with an increase of 3.5 marks. [1 mark]

The slope is the average change in the response variable for a one-unit increase in the explanatory variable, so one more hour of study is associated with 3.5 more marks on average. The answer must name both variables to earn the mark.

c. 75.5 marks [1 mark]

Substituting into the equation gives mark = 44 + 3.5 × 9 = 75.5.

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d. -2 [2 marks]

The predicted mark is $44 + 3.5 \times 10 = 79$. The residual is the actual value minus the predicted value, that is $77 - 79 = -2$. One mark for the predicted value, one for the residual. The negative sign shows the line overpredicts this student's mark.

e. 98.2% of the variation in test mark is explained by the variation in hours of study. [1 mark]

The coefficient of determination gives the proportion of the variation in the response variable explained by the variation in the explanatory variable. Here that is 98.2%, and the answer must name both variables.

4. (4 marks in total)

a. \$110 thousand [1 mark]

The four quarters total 440, so the mean is $440 \div 4 = 110$ thousand dollars.

b. $88 \div 110 = 0.8$ [1 mark]

A seasonal index is the quarter's figure divided by the mean for the year: $88 \div 110 = 0.8$. An index below 1 means quarter 3 is a quieter-than-average quarter.

c. 1.25 [1 mark]

The seasonal index is $137 \div 110 = 1.2455$, which is 1.25 correct to two decimal places. As a check, the four indices must sum to 4.

d. \$128 000 [1 mark]

Deseasonalised figure = actual figure ÷ seasonal index = 160 000 ÷ 1.25 = 128 000 dollars.

Recursion and financial modelling

5. (3 marks in total)

a. $V_0 = 4800$, $V_{n+1} = 0.8V_n$ [1 mark]

Losing 20% of its value each year leaves 80% of the previous value, so the multiplier is 0.8 and the starting value is 4800.

b. \$2457.60 [1 mark]

Applying the multiplier three times gives $4800 \times 0.8^3 = 4800 \times 0.512 = 2457.60$ dollars.

c. \$2342.40 [1 mark]

The total depreciation is the fall in value: $4800 - 2457.60 = 2342.40$ dollars.

6. (4 marks in total)

a. 1.3% [1 mark]

The annual rate is divided by the number of compounding periods in a year: $5.2 \div 4 = 1.3\%$ per quarter.

b. \$19 421.38 [2 marks]

Five years is 20 quarters at a multiplier of 1.013 per quarter, so the value is $15\,000 \times 1.013^{20} = \$19\,421.38$. One mark for identifying 20 periods at 1.3%, one for the value.

c. \$4421.38 [1 mark]

The interest is the growth in the balance: $19\,421.38 - 15\,000 = 4421.38$ dollars.

7. (5 marks in total)

a. $B_0 = 320\,000$, $B_{n+1} = 1.005B_n - 2100$ [1 mark]

The monthly interest rate is $6 \div 12 = 0.5\%$, giving a multiplier of 1.005, and the repayment of 2100 is then subtracted.

b. \$318 997.50 [2 marks]

After one month the balance is $320\,000 \times 1.005 - 2100 = 319\,500$. After two months it is $319\,500 \times 1.005 - 2100 = 318\,997.50$ dollars. One mark for each application of the rule.

c. \$3197.50 [1 mark]

Maya repaid $2 \times 2100 = 4200$ but the balance fell by only $320\,000 - 318\,997.50 = 1002.50$, so the rest went to interest: $4200 - 1002.50 = 3197.50$ dollars.

d. Interest is charged on the outstanding balance, and each repayment reduces that balance. [1 mark]

Each month the interest is 0.5% of whatever is still owed. Because every repayment is larger than the interest charged, the balance falls each month, so the interest charged on it falls too — and a larger share of each repayment goes to the principal.

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PREVIEW

That’s the end of the preview answers

These are the answers to the 7 preview questions. The full answer key covers all 14 questions in General Mathematics Unit 3 & 4 — Examination 2 (Practice 1), with the working behind every mark.

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