Mathematics Standard 2

HSC marking feedback 2024

General feedback

Students should:

- show relevant mathematical reasoning and/or calculations
- read the question carefully to ensure that they do not miss important components of the question
- have a clear understanding of key words in the question and recognise the intent of the question and its requirements, such as show, solve, evaluate, hence, calculate
- use the Reference Sheet where appropriate
- ensure the solution is legible and follows a clear sequence
- engage with any stimulus material provided and refer to it in their response when required by the question
- check their solution answers the question
- round off numerical solutions only at the final step of the solution
- construct graphs neatly, with precision and display all relevant information as required by the question
- interpret information presented in graphs across a range of contexts
- understand when to use relevant calculator functions
- carefully note any information in the questions which supplies units of measurement.

Section II

Question 16

In better responses, students were able to:

- identify the correct path and its weight
- correctly label a path using letters
- understand the difference between identifying a path and calculating its length

  find the 2 paths and then clearly showed the vertices which related to the shortest path.

Areas for students to improve include:

- following the path they are trying to state and ensuring vertices are not missed
- including the start and end points when labelling a path
- understanding that diagrams are not to scale and a shorter path may appear longer on the network diagram.

Question 17

In better responses, students were able to:

- correctly convert both the electricity usage and cents to dollars
- round to 2 decimal places.

Areas for students to improve include:

- knowing the correct conversion, for example, 1 kW = 1000 W
- converting cents to dollars
- understanding that this question involves two conversions.

Question 18

In better responses, students were able to:

- draw the correct minimum spanning tree (using a ruler) with weighted edges in their diagram
- calculate the correct weight of their spanning tree
- identify either FC and BC in the correct minimum spanning tree as having the same weight.

Areas for students to improve include:

- writing down the weighted edges, for example, weights on each edge of their tree
- identify two edges with the same weight that could be swapped.

Question 19

In better responses, students were able to:

- calculate the gradient and y-intercept from graph
- express the equation in terms of x and y
- understand the least-squares regression line in the context of the question.

Areas for students to improve include:

- using the graph rather than calculator function to produce the equation of the line
- finding two clear points to calculate gradient accurately
- ensuring there is a subject to the equation of the least-squares regression line
- if using the calculator in statistics mode, identify that B is the gradient and A is the y-intercept in their equation leading to $y = A + Bx$.

Question 20

In better responses, students were able to:

- correctly identify the value of 10.0266 from the table and use it to calculate the future value of Ken's investment
- correctly identify the table value of 5% and 8 periods as 10.0266 and multiplied this decimal by the $200 annuity to calculate the correct future value
- note the 'compounded 6 monthly' and adjusted interest rates and time periods accordingly (b).

Areas for students to improve include:

- understanding when to divide by the interest factor and when to multiply
- realising that if a question has a table provided, the solution requires the table to be used to calculate the solution and not a formula.

Question 21

In better responses, students were able to:

- fill in the table correctly and ensuring correct rounding
- link the higher interest charge to an increasing balance
- calculate the monthly interest rate
- explain the impact of a greater interest charge (or lower repayment) on the balance of a loan.

Areas for students to improve include:

- interpreting the first row of the table to determine when to add or subtract cells from each other
- understanding what impact a repayment lower than the interest being charged will have on the balance of a loan.

Question 22

In better responses, students were able to:

- correctly read the initial value of population B from the graph
- determine the population when $x = 50$
- understand that 1.055 meant a growth of 5.5% and 0.97 was a decrease of 3%
- interpret the exponential growth, base > 1, relate to a standard annualised percentage increase as $(1 + r)$ compound growth per time-period, and interpret the exponential decay, base < 1, relate to a standard annualised percentage decrease as $(1 - r)$ compound growth per time-period.

Areas for students to improve include:

- distinguishing between the percentage change and the factor $(1 \pm r)$
- identifying which line in the diagram was *W* and which was *K* by interpreting the information given
- understanding that 5.5% increase is not 105.5% and understanding that 3% decrease is not 97%.

Question 23

In better responses, students were able to:

- calculate the time-and-a-half rate of $67.50
- understand that overtime hours are different to equivalent normal hours
- calculate the amount paid for overtime
- total earnings for the week.

Areas for students to improve include:

- understanding the difference between overtime rates and normal hourly rates.

Question 24

In better responses, students were able to:

- convert 1.2 standard drinks in one glass of wine to (1.2×3) standard drinks in three glasses of wine
- substitute the given values into the blood alcohol content (BAC) formula correctly
- utilise the degree/minutes button on the calculator and correctly interpret the answer to the nearest minute.

Areas for students to improve include:

- converting a decimal to time in hours and minutes
- using the calculator and the rounding to 3 decimal places
- ensuring all values are correctly substituted into the formula, recognising there are some mathematical calculations required prior to substituting.

Question 25

In better responses, students were able to:

- know the difference between simple interest and compound interest
- compare Alex and Jun's future values or compare their interest values from the simple interest and compound interest calculations
- write a concluding statement
- recognise that they were calculating different values for each person and then make the appropriate adjustment.

Areas for students to improve include:

- converting the rate and periods into the compounding periods stated in the question, particularly for interest compounding quarterly
- understanding that interest or future values should be compared to see the difference in interest earnt for questions with two different interest type questions
- identifying the compound interest formula gives the future value, not the interest
- identifying the simple interest formula gives the interest not the future value.

Question 26

In better responses, students were able to:

- view the parabola as symmetrical to find the value halfway between 0 and 40
- substitute $x = 20$ into the equation to find the maximum area
- use the area formula for a rectangle to find the height.

Areas for students to improve include:

- making markings in the middle of the parabola on the horizontal axis
- linking values on the horizontal axis (variable) to the formula and substituting values into the given quadratic equation
- understanding the symmetry of a parabola.

Question 27

In better responses, students were able to:

- calculate the 5, 7 and 10 year repayment totals showing all relevant working out
- compare the 5 and 7 year total from the 10 year total
- use the original loan with the 5 and 7 year total and then again with the 10 year total to calculate the interest accrued in each scenario and then finally compare the differences.

Areas for students to improve include:

- finding annual totals by multiplying by 12
- calculating total repayments for different periods of time.

Question 28

In better responses, students were able to:

- explicitly compare the skewness, central tendency, and spread of the data from each garden
- interpret the boxplots to use specific values for median, range or inter-quartile range to support their comparisons
- use specific language to describe the shape of a distribution, for example, ‘positively skewed’ or ‘negatively skewed’.

Areas for students to improve include:

- ensuring that the three areas of skewness, central tendency, and spread were addressed in their response
- recognising that the median is the only measure of central tendency that can be deduced from a box-plot
- identifying positive and negative skew in data and understanding the difference between the two.

Question 29

In better responses, students were able to:

- calculate the salvage value for the straight-line depreciation component
- substitute the salvage value from the straight-line method at the end of the 4 years into the declining-balance formula as the initial value
- subtract the final salvage value from the original value to calculate the total depreciation.

Areas for students to improve include:

- knowing the difference between straight line and declining balance depreciation
- selecting the correct formula from the reference sheet and using it correctly
- understanding the salvage value at the end of the 4 years is the initial value of the next part of the calculation
- understanding that ‘depreciation’ is the loss in value.

Question 30

In better responses, students were able to:

- successfully list at least three unique observations about anacondas
- interpret the scatterplot to make observations about lengths, growth rates, and trends before and after maturity
- use clear mathematical language in their response – for example, increasing at a decreasing rate.

Areas for students to improve include:

- recognising that the data cannot be used to make predictions about the length of anacondas after 10 years
- understanding that the data represents the lengths of many different anacondas, and not a single anaconda over time
- ensuring that they provide observations that were unique from one another
- understanding how to take an observation from a scatterplot about the subject of the data rather than the data itself.

Question 31

In better responses, students were able to:

- use the correct formula for complimentary events
- understand that a biased coin changes the probability of obtaining a head
- create tree diagrams to support their finding.

Areas for students to improve include:

- constructing a correct tree diagram
- simplifying probability values
- understanding the probability scale and that the range of probability is $0 \leq probability \leq 1$
- understanding the difference between 'calculating' and 'describing' probabilities and when to use them to represent a solution.

Question 32

In better responses, students were able to:

- use correct formulas for circle and area of triangle
- round correctly to 2 significant figures
- use the area to find the shaded region of the circle.

Areas for students to improve include:

- creating a clear sequence of mathematical calculations
- understanding the difference between rounding significant figures compared to decimal places.

Question 33

In better responses, students were able to:

- convert between different units
- recognise that units need to be the same to calculate time
- apply the unitary method with correct conversions.

Areas for students to improve include:

- understanding the relationship between speed, distance and time and knowing the formula correctly
- making sure that the units for distance, speed and time are connected, for example, distance in km, speed in km/h and time in h, or distance in m, speed in m/s and time in s.

Question 34

In better responses, students were able to:

- convert the original measurements into metres before calculating the surface area
- convert measurements to metres prior to calculating their surface area
- recognise the open cylinder, rather than closed and understand that two hemispheres are equal to a sphere.

Areas for students to improve include:

- converting cm^2 to m^2
- using the most efficient methods and calculations to communicate their responses.

Question 35 (a)

In better responses, students were able to:

- calculate the correct z-score using the formula provided
- use the table to obtain the correct probability
- recognise that 50% of the scores lie below the mean.

Areas for students to improve include:

- understanding that a z-score does not represent a probability
- recognising the relevance of the score of 58 in relation to the score 70
- understanding that the empirical rule cannot be used to solve problems with non-integer z-scores.

Question 35 (b)

In better responses, students were able to:

- compare data points in relation to the symmetry of a normal distribution
- use mathematical terminology, such as ‘symmetry’ or ‘even function’ in their response
- use diagrams to demonstrate their understanding.

Areas for students to improve include:

- incorporating appropriate calculations with worded responses
- understanding the meaning of a negative z-score in relation to a normal distribution
- recognising the symmetrical nature of the normal distribution, and how it relates to the proportion of scores on either side of the mean
- understanding z-score are not only integer values and probabilities are not just the empirical values.

Question 35 (c)

In better responses, students were able to:

- identify a z-score with a cumulative probability of approximately 90%
- substitute into the z-score formula to calculate a score.

Areas for students to improve include:

- applying complementary probabilities
- understanding that a probability is not a z-score, and vice versa.

Question 36

In better responses, students were able to:

- apply the sine rule to calculate the length of BE and round their answer to one decimal place
- find the length of BX using trigonometric ratios and subtract this answer from their answer from (a) and correctly rounded their answer to one decimal place
- substitute into the sine rule
- label angles in triangle CBX correctly
- use geometrical properties to find angles in triangle BCX.

Areas for students to improve include:

- working with shapes with multiple triangles that require both right angled and non-right-angled trigonometry
- understanding what values/lengths they have found
- recognising that only the sine rule can be used to calculate the length EB
- recognising that to calculate the length in a right-angled triangle, when only given one side they will need to use trigonometric ratios.

Question 37

In better responses, students were able to:

- demonstrate a 20-hour flight time equates to a −20 or 13-hour time difference as +13
- demonstrate that −3 [Coordinated Universal Time (UTC)] and +10 (UTC) result in a 13-hour difference
- keep track of days when adding and subtracting time.

Areas for students to improve include:

- knowing how to calculate the time change
- converting each time zone step-by-step breaking up the problem.

Question 38

In better responses, students were able to:

- select and apply the correct formula for volume of cylinder
- use the ratio correctly to obtain the total volume.

Areas for students to improve include:

- selecting and applying the correct formula for volume of cylinder and cone
- applying unitary method for ratios
- interpreting worded questions to perform the correct calculation.

Question 39

In better responses, students were able to:

- correctly identify the path either written or on the diagram
- make the allowance for float times when working out a critical path
- determine the earliest starting time (EST) and latest starting time (LST) for each activity and use boxes on the network to clearly show this.

Areas for students to improve include:

- writing their final response in the space provided, not just drawing on the diagram
- taking into consideration EST and LST
- knowing and understanding forward and backward scanning.

Question 40

In better responses, students were able to:

- recognise they need to use the cosine rule first to then work out the other angles
- use radial survey bearings to find the remaining angles and how to calculate bearing
- work towards a final answer with the little scaffold given in the question.

Areas for students to improve include:

- knowing how to read the bearings given on the radial survey
- recognising they should use cosine rule to help find unknown angle first
- knowing what angles on a straight-line amount to.

Question 41

In better responses, students were able to:

- convert the time periods and interest rate to monthly values
- identify the appropriate interest factors from the table
- break down the calculations for the different withdrawals using values from the table
- use geometric series to model the two different withdrawals.

Areas for students to improve include:

- understanding that the table was provided to assist with calculations
- understanding the concept of present value
- completing more practice in solving financial problems using tables.