

Mathematics Standard 2

HSC Marking Feedback 2023

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:

- accurately read the graph and state the correct answer
- identify the actual time when the heart rate was reached.

Areas for students to improve include:

- interpreting the question correctly as the time reached not the time taken.

Question 17

In better responses, students were able to:

- accurately draw a network diagram and label the paths using the values provided in the table
- calculate the distance from Hobart to Darwin via Sydney by highlighting the path and adding the two distances together.

Areas for students to improve include:

- identifying key components of the question, including labelling all paths
- using working techniques to ensure accuracy, for example, marking off on the table once a path has been drawn or using a highlighter to visualise the path
- calculating the required distances showing all their working.

Question 18

In better responses, students were able to:

- use mathematical language, for example, symmetrical, mode, median, mean
- understand that normal distributions are Unimodal
- state that normal distributions fit a bell-shaped curve.

Areas for students to improve include:

- identifying that the mode, mean and median are approximately equal for data arising from a random variable that is normally distributed.

Question 19

In better responses, students were able to:

- identify and draw the shortest path including the sum of the weights to calculate the value of the shortest path (a)
- use the spanning tree diagram to identify the shortest path (b).

Areas for students to improve include:

- ensuring the path they have selected is the shortest
- including each vertex (node) that is on their path
- understanding the shortest path does not have to include all the vertices (nodes) in the network
- providing numerical support for the paths
- drawing the minimum spanning tree if unable to write the reasons for the answer.

Question 20

In better responses, students were able to:

- find the maximum height reached by the ball from the graph
- correctly substitute $t = 2$ into the formula to calculate the answer
- draw a horizontal line on their graph at $h = 18$ and then two perpendicular lines which came down at $t = 3$ seconds and $t = 1$ seconds on the time axis.

Areas for students to improve include:

- checking the solution lies within the boundary of the graph and axes
- calculating solving equations with a negative coefficient multiplied by a squared value correctly
- interpreting what each axis represents in the given equation.

Question 21

In better responses, students were able to:

- interpret the question to provide the missing value in the table
- draw a straight-line graph accurately from a table of values
- find the point of intersection from a graph and identify the value from the correct axis
- interpret the question using the graph and mathematical reasoning to determine which provider was the cheaper option and by how much.

Areas for students to improve include:

- plotting points from a table onto a grid and accurately drawing a linear relationship using a ruler
- using a highlighter or underlining to assist in identifying parts of the question that need to be addressed such as 'which provider' and 'by how much'.

Question 22

In better responses, students were able to:

- substitute values into the equation to find the value of k and rewrite the equation
- correctly change the subject of the equation to k by doing 20 divided by 50 squared
- substitute their ' k ' value from part (a).

Areas for students to improve include:

- recognising the conversion of values is not needed. Reading the definitions of values in the formula that are written in the question
- taking care to rewrite the equation carefully and inputting into the calculator correctly.

Question 23

In better responses, students were able to:

- identify that the probability that Hazel wins both prizes is 'without' replacement
- multiply the two probabilities together.

Areas for students to improve include:

- understanding what type of questions are 'with' or 'without' replacement
- identifying when to multiply the probabilities together rather than adding them
- drawing a probability tree or some other diagram to assist with working.

Question 24

In better responses, students were able to:

- identify the trapezoidal rule and show correct substitution as well as the addition of the two applications if performed in two parts
- identify the correct height of the trapezium from the diagram by dividing the full length by two (for example $8.0 \div 2 = 4m$)
- use the correct area from part (a) to calculate the volume and then multiply by 3.52 to obtain the weight
- round the final solution to two significant figures.

Areas for students to improve include:

- using the stipulated method given in the question to find the approximate area of the cross-section of the wall
- calculating the correct height of each trapezium when there is a total height spanning over multiple trapeziums
- understanding the difference between rounding to two significant figures compared to two decimal places
- knowing how to calculate the volume of a prism ($V = A \times h$).

Question 25 (a)

In better responses, students were able to:

- use the table provided to determine the factor 13.181 and then divide \$450 000 by 13.181
- identify the interest factor from the table provided
- divide the FV by the interest factor.

Areas for students to improve include:

- recognising that identification of this factor is the use of the rate and periods so that these do not need to be used again in the calculation of the solution
- setting up an equation to help identify when there should be division or multiplication
- highlighting the interest factor in the table

- using compound interest formula or geometric series correctly.

Question 25 (b)

In better responses, students were able to:

- demonstrate the conversion of the rate and the periods to four times a year
- select the correct factor from the table and multiply it by \$8535
- convert the period to 40 and interest rate to 1.5% or equivalent
- identify the interest factor from the table.

Areas for students to improve include:

- identifying that every three months is four times a year
- using the converted rate and period to identify the factor from the table
- making use of the table of factors provided, not making errors in creating/using a geometric series.

Question 26

In better responses, students were able to:

- identify and calculate areas of composite shapes
- work with ratios to determine the size of each part and hence the number of bags required to build a path around a garden
- convert tonnes into kilograms.

Areas for students to improve include:

- understanding how to break composite areas into simple shapes and showing this on the diagram to help with working towards a solution
- understanding the difference between perimeter, area and volume
- using the unitary method to find the value of one part of a ratio.

Question 27

In better responses, students were able to:

- transfer the given information correctly to the diagram
- apply Pythagoras theorem correctly to find the side after using the trigonometric ratios
- recognise they could use the rules for right-angled triangles rather than sine or cosine rules
- recognise that the bearing should be between 180 and 270
- find a missing acute angle and using this to find a bearing.

Areas for students to improve include:

- recognising when the use of the trigonometric ratios should apply to solving the question
- identifying and using right angle trigonometry to solve the question

- identifying adjacent, opposite and hypotenuse correctly in a right triangle
- labelling the diagrams with given information
- understanding and using bearings in different configurations.

Question 28

In better responses, students were able to:

- apply both depreciation formulas correctly and interpret the results justifying conclusions using mathematical reasoning

Areas for students to improve include:

- knowing and understanding how to use the formulas on the Reference Sheet
- understanding what depreciation is and what the formulas calculate
- comparing and calculating two types of depreciation
- copying formulas correctly from the Reference Sheet.
- understanding what salvage value means.

Question 29

In better responses, students were able to:

- recognise the table interest factors were 'per \$1000' borrowed and accordingly divided \$520 000 by \$1000
- understand the amount being repaid per month needed to be divided by 8.99 (not multiplied by 8.99) and multiply the result by 1000 (not by $12 \times 15 = 180$ months) (b).

Areas for students to improve include:

- knowing monthly repayments must be multiplied by 12 then the number of years (12×25) to get correct final answer (a)
- not subtracting the original amount borrowed at the end of the question because this calculates the amount of interest paid rather than the total repaid for the loan
- interpreting what the table values are representing.

Question 30

In better responses, students were able to:

- able to multiply the GST amount by 10
- identify the receipt total included items without GST, with GST and the GST amount
- recognise that the \$3.86 needed to be subtracted in addition to the \$38.60 from the total.

Areas for students to improve include:

- understanding how GST is calculated
- understanding that GST does not apply to all items consumed

- knowing when GST has already been included and does not need to be added on to the calculation
- understanding and applying the percentage calculations of varying amounts. Multiplying by 10% and subtracting 10% of an amount give two different values.

Question 31

In better responses, students were able to:

- find the critical paths
- draw the route on the diagram with a highlighter
- use forward and backward scanning to determine the earliest starting time (EST) and latest starting time (LST) for each activity and use boxes on the network to clearly show this
- understand that if a question states that there are two critical paths then there will be two paths of the same length
- name the task, from part (a) and give the time with reasoning
- identify the need to reduce an activity by 3 means the activity had to be greater than 3.

Areas for students to improve include:

- recalling how to find the EST and LST
- understanding when to use minimum cut or spanning tree or LST / EST
- understanding the task needed to be greater than 3.

Question 32

In better responses, students were able to:

- apply the compound interest formula and subtract the principal amount to find the interest
- Converting the interest rate of 13.5% per annum into a daily interest rate
- remember to subtract the principal to find the interest only.

Areas for students to improve include:

- knowing when to use compound interest or simple interest
- understanding that the interest rate needs to be divided by 365 and 100
- identifying the compound interest formula gives the future value, not the interest
- understanding how to convert between fractions or decimals to a percentage.

Question 33

In better responses, students were able to:

- interpret the question correctly to identify the main parts and evaluate the length of arc PQ and the length of line segment PQ

- set their working out clearly and identify the parts they were calculating, and show their rounded answers to at least three decimal places to assist the calculation for the perimeter
- identify the arc length was $110/360$ of a circle and not a semi-circle
- correctly substitute values into the correct formulas (the sine or cosine rule for line segment PQ and arc length formula for arc PQ) and show full substitution
- round the final solution to 1 decimal place.

Areas for students to improve include:

- selecting and demonstrating appropriate substitutions into the required formula from the Reference Sheet
- understanding that the question requires the calculation of the perimeter of the shape, therefore no area formulas were needed
- using the square root when using the cosine rule
- realising the arc PQ has a radius of 2.1 m and is not a semi-circle with interval PQ as the diameter
- writing the formula they are using before substituting
- adding all sections when calculating the perimeter.

Question 34 (a)

In better responses, students were able to:

- calculate both means showing all calculations
- accurately plot the coordinates of the means and y -intercept
- use correct mathematical notation.

Areas for students to improve include:

- reading the question carefully to determine the means for each quantity
- accurately plotting coordinates on the intersection of the grid lines
- recognising that the initial quantity is the y -intercept
- reading the grid scale correctly.

Question 34 (b)

In better responses, students were able to:

- calculate the gradient using $\frac{\text{rise}}{\text{run}}$
- recognise the y -intercept
- correctly substitute into $y = mx + c$.

Areas for students to improve include:

- writing an equation not an expression
- not interpreting the data as bivariate and attempting to use the calculator to find the equation of the regression line

- using the two coordinates from their graph to find the gradient of the line and not reading two inaccurate coordinates off their regression line.

Question 34 (c)

In better responses, students were able to:

- comment on the prediction of gas usage being negative, which is not possible
- recognise and explain that using extrapolation is inaccurate.

Areas for students to improve include:

- relating their answer to the context of the question, that is, gas usage and temperatures
- providing an accurate explanation relevant to the regression line.

Question 35

In better responses, students were able to:

- find the missing angle by using the angle sum of a triangle
- annotate on the diagram additional information calculated
- identify the correct formula from the Reference Sheet and substitute the correct values from the diagram showing clear and concise working
- identify the need to use the sine rule to find a side and apply to the question.

Areas for students to improve include:

- recognising the difference between a side and an angle in the use of the sine rule and area of a triangle
- adding any relevant/missing information like the missing angle 95°
- using $A = \frac{1}{2}ab \sin C$ and choosing the correct two sides and the included angle.

Question 36

In better responses, students were able to:

- rearrange the correctly substituted equation to solve for the value of H
- convert a decimal value into hours and minutes
- clearly show how they subtracted time to find what time Cameron began drinking.

Areas for students to improve include:

- rearranging formulae/equations with fractions to find the value of H
- converting decimals to time
- after each step of rearranging the equation, calculating the value of this rearrangement before moving the next value
- subtracting time involving hours and minutes correctly using a calculator.

Question 37

In better responses, students were able to:

- calculate the amount of tax paid correctly
- provide an efficient, concise solution in each stage, including solving an equation rather than a longer sequence of short operations
- correctly deduce the 4th tax bracket was to be used with the given taxable income.

Areas for students to improve include:

- working mathematically to find missing elements of the table, such as the tax rate or the tax paid at the top of each bracket
- not including a Medicare levy into their working when it says 'exclude any levies'
- selecting the correct tax bracket from the taxable income given in the question.

Question 38

In better responses, students were able to:

- calculate the correct z -score using the formula provided on the Reference Sheet
- use the table to obtain the correct probability
- correctly find the proportion of koalas greater than 11.93kg, recognising that the value from the table represents the probability of the weight being less than 11.93kg
- find the number of koalas with weight greater than 11.93kg.

Areas for students to improve include:

- accessing the provided table to find the probability after calculating the z -score
- knowing when to use the z -score formula and table given opposed to using the normal distribution (empirical rule) to calculate an area under a curve
- completely answering the question by reading what was required, that is, the number of koalas greater than 11.93kg.