

Mathematics Standard 2

HSC Marking Feedback 2022

Question 16

Students should:

- read the question carefully, underlining key data in the question
- be able to use the formula
- be able to find the percentage of an amount.

In better responses, students were able to:

- perform the subtraction correctly
- show their working out before they wrote their answer.

Areas for students to improve include:

- finding the percentage of an amount.

Question 17

Students should:

- complete the tree diagram using Bob's outcomes of 2, 4, 6
- use the tree diagram to determine that Bob wins 6 out of the 9 outcomes and calculate the probability
- use the probability from (a) to calculate the expected wins by multiplying by 30.

In better responses, students were able to:

- understand the difference between an outcome and a probability
- correctly fill in the tree diagram, identify the winning outcomes and write the probability of Bob winning
- use a probability value to calculate the number of expected outcomes from a given number of trials.

Areas for students to improve include:

- understanding the difference between an outcome and a probability
- completing a partially completed tree diagram
- knowing that a probability has a value between zero and one
- checking the reasonableness of their answer, for example, if there are only 30 trials, Bob cannot win more than 30 times.

Question 18

Students should:

- know how to calculate a z-score using the formula provided
- be able to draw a normal distribution (bell curve) with seven markings representing the z-scores
- use the Reference Sheet to work out the percentages of each section on a normal distribution
- realise that above 5% of scores were outside 2 standard deviations and that they needed half of this, as they only wanted the percentage above 90 (2.5%).

In better responses, students were able to:

- work out that 90 had a z-score of 2
- calculate that 5% of scores were outside 2 standard deviations from the mean
- halve 5% to get 2.5% of scores higher than 90.

Areas for students to improve include:

- finding a z-score
- using a diagram to help calculate z-scores and percentages
- referring to the Reference Sheet for normally distributed data questions.

Question 19

Students should:

- be able to understand how pareto charts are constructed
- be able to calculate cumulative frequency and cumulative percentages from a table.

In better responses, students were able to:

- calculate cumulative frequency for A and cumulative percentage for B showing working
- identify the types of complaints that represented 80%.

Areas for students to improve include:

- practise using and drawing pareto charts to understand how they are constructed.

Question 20

Students should:

- draw and label the network representing the data in each table
- find the minimum spanning tree and calculate its length.

In better responses, students were able to:

- correctly draw the network diagram with weights
- construct the minimum spanning tree including weightings and calculate its length
- demonstrate understanding of the terms from the network topic.

Areas for students to improve include:

- ensuring there is an understanding of the terminology used in the topic, for example, the difference between a spanning tree and a minimum spanning tree
- completely answering the question by checking all components have been addressed,

such as labelling weightings and calculating the length.

Question 21

Students should:

- be able to perform percentage calculations
- understand and operate with the concept of commission.

In better responses, students were able to:

- calculate 2% of the first 800 000 and 1.5% of the other 700 000, then add to find the total commission.

Areas for students to improve include:

- understanding the concept of commission and the need to apply different percentages to different components of the sale price
- calculating the percentage of an amount.

Question 22

Students should:

- be able to substitute values into an equation and evaluate.

In better responses, students were able to:

- correctly substitute into both parts of the question
- substitute and rearrange the formula.

Areas for students to improve include:

- understanding how to rearrange equations
- finding the information in a question that is relevant
- recognising when responses are unrealistic for the scenario.

Question 23

Students should:

- be able to plot points correctly from a table
- draw and read from the line of best fit by eye.

In better responses, students were able to:

- plot points correctly
- draw a straight line of best fit by eye using a ruler and read accurately from it.

Areas for students to improve include:

- reading points correctly from a table
- drawing a correct line of best fit by eye using a ruler
- providing a single value for the estimated value from their line, rather than a range of possible values.

Question 24 (a)

Students should:

- identify and highlight the key words in the question, in this case 'inverse variation'
- know that the formula for inverse variation is $y = \frac{k}{x}$
- substitute values into the formula to find the value of k and re-write the equation.

In better responses, students were able to:

- write an inverse variation equation and replace x and y with M and T
- calculate the constant of proportionality.

Areas for students to improve include:

- understanding an inversely proportional relationship
expressing a relationship as an equation, using variables provided.

Question 24 (b)

Students should:

- be able to use a rule to complete a table of values
- know how to plot points and draw a smooth curve through these points.

In better responses, students were able to:

- use their equation from part (a) to complete the table of values
- plot the points from the table of values accurately on the given number plane and draw a smooth curve.

Areas for students to improve include:

- plotting points and connecting the points using a curve
- reading the scales of axes correctly.

Question 25

Students should:

- identify the correct value from the future value table of annuities
- know how to calculate interest from an amount deposited.

In better responses, students were able to:

- use the table accurately and understand what the values in the table represent
- calculate the yearly amount by dividing by the correct interest factor from the table.

Areas for students to improve include:

- understanding the difference between an annuity and compound interest
- finding values from a future value of an annuity table.

Question 26

Students should:

- be able to identify the 2 right-angled triangles from the diagram

- be able to use trigonometric ratios correctly
- be able to use trigonometry to find a missing side in a triangle, and then use this value to perform subsequent calculations in the second triangle.

In better responses, students were able to:

- perform simple right-angled trigonometric calculations
- use the angle sum of a triangle and supplementary angles.

Areas for students to improve include:

- practising algebra skills to perform a correct rearrangement of the trigonometric ratio to calculate the missing side and angle, particularly with the unknown on the denominator
- practising two-triangle problems
- using the labels from the diagram to identify the side or angle they are finding.

Question 27

Students should:

- understand the components of a declining-balance depreciation formula
- understand the difference between declining-balance and straight-line depreciation
- be able to calculate the annual depreciation amount for straight-line depreciation when given as a percentage of the original value.

In better responses, students were able to:

- determine where 0.8 comes from, that is $(1 - 0.2) = 0.8$
- substitute the original value and 3 years into the equation to calculate a depreciated amount
- find the annual depreciation amount for the straight-line depreciation
- substitute correctly into the straight-line depreciation formula
- equate the straight-line depreciation formula to the previously calculated value.

Areas for students to improve include:

- understanding the difference between a rate and an amount of depreciation
- converting from a decimal to a percentage
- calculating the value for D in the straight-line depreciation formula
- checking the reasonableness of their answer, for example over 20 000 years isn't a realistic timeframe for a \$50,000 machine to depreciate.

Question 28

Students should:

- use the area rule for a non-right-angled triangle
- know the difference between volume and capacity
- know how to calculate the volume of a triangular prism.

In better responses, students were able to:

- convert from cubic metres to litres
- calculate the area of the base isosceles triangle by using trigonometric formulas.

Areas for students to improve include:

- understanding that to find capacity, volume needs to be calculated and not surface area
- identifying the correct area formula to use from the Reference Sheet.

Question 29

Students should:

- be able to calculate time difference between two cities using their Coordinated Universal Time (UTC)
- know how to add and subtract hours and minutes.

In better responses, students were able to:

- provide the correct day and time of landing
- show clear working either as a correct numerical expression on a timeline, grid or otherwise to support a realistic time and day for the plane to land in New York after taking off in Sydney.

Areas for students to improve include:

- adding flight time to gain the correct landing time
- stating the time and day as required in the question.

Question 30

Students should:

- be able to understand the difference between a lump sum investment and an annuity
- recognise when to use a formula and when to use a table
- be able to convert interest rates for different compounding periods.

In better responses, students were able to:

- use the future value formula from the Reference Sheet with correct interest rate and time period to calculate the future value of the single amount invested
- recognise that Option 2 was an annuity and find the correct number from the table to calculate the future value
- find the difference of the future values.

Areas for students to improve include:

- recognising the difference between an annuity and a lump sum investment
- recognising when to use a formula and when to use a table
- being able to convert interest rates for corresponding time periods
- showing all working.

Question 31

Students should:

- know that maximum flow = minimum cut
- be able to calculate the flow capacity of a cut.

In better responses, students were able to:

- find and display the minimum cut on the network diagram and explain its significance
- correctly identify a path which could be increased and state by how much.

Areas for students to improve include:

- knowing the difference between a path and a vertex/node
- calculating the capacity of a cut.

Question 32**Students should:**

- be able to apply two applications of the trapezoidal rule
- show all working.

In better responses, students were able to:

- identify the correct height of the trapezium from the diagram
- identify the correct formula from the Reference Sheet and substitute the correct values from the diagram showing clear and concise working
- apply the trapezoidal rule without error
- calculate the area of a semi-circle
- recognise that (a) and (b) were related (using 'Hence' or otherwise)
- find the total area of the shape and subtract their answer from (a) to find the shaded area.

Areas for students to improve include:

- using the trapezoidal rule correctly by understanding what the variables in the formula represent
- knowing how to calculate the area of a semi-circle
- using the Reference Sheet to identify the correct formula for the trapezoidal rule.

Question 33**Students should:**

- be able to use a bearing to calculate an angle
- be able to substitute values into the sine rule formula to find the value of an angle
- use the correct rule when directed to as stated in the question.

In better responses, students were able to:

- substitute correctly into the cosine rule, calculate the answer and then take the square root of that answer to show it equalled the given value
- understand and use bearings
- calculate an angle in a triangle given a bearing and copy it onto the diagram.

Areas for students to improve include:

- using algebraic techniques to solve the equation formed for sin
- learning how to use "shift sin" or \sin^{-1} on the calculator to get the angle
- understanding how true and compass bearings can be written
- using the correct rule when directed to as stated in the question.

Question 34**Students should:**

- use the Reference Sheet to select the correct formulae to calculate the surface area of an

open cylinder and a hemisphere

- convert diameter to radius for both the cylinder and hemisphere.

In better responses, students were able to:

- select the correct formula for the curved surface area of a cylinder, calculate the area of the circle at the top of the cylinder, and halve the surface area of a sphere formula
- break the shape into parts, correctly state the formula for finding the surface area or area of each section and then calculating
- clearly label the part of the solid when calculating, to avoid confusion.

Areas for students to improve include:

- distinguishing between area formulae and volume formulae
- converting diameter to radius for use in formulas.

Question 35

Students should:

- be able to describe and interpret data from a scatter plot in the context that it is given
- know how to use the descriptions on the axes to describe the relationship between two variables
- be able to calculate summary statistics from a set of points
- know how to use the correlation coefficient to describe the relationship between two variables using the language from the syllabus
- recognise that a four-mark question is likely to require four unique facts
- understand interpolation and extrapolation.

In better responses, students were able to:

- make more than one unique statement regarding the given data
- be able to determine measures of centre and spread and relate them to the given context
- use mathematical terminology to describe the relationship
- substitute into the formula and explain why extrapolation was not possible

Areas for students to improve include:

- understanding the difference between strong, moderate and weak correlation
- understanding that skewness is not related to the correlation coefficient
- understanding the difference between interpolation and extrapolation
- describing and interpreting data in a given context.

Question 36

Students should:

- understand that interest is added to the principal and repayments are subtracted
- understand how to use a table showing Principal, Interest, Repayments and Balance.

In better responses, students were able to:

- show all working out
- calculate the amount repaid, including the lump sum payment (196 months), then subtract this from the original amount to be paid, to get the amount of money saved.

Areas for students to improve include:

- recognising it is not always necessary to use the future value formula
- clearly showing working out when finding the interest rate per period and calculating balances.

Question 37

Students should:

- understand the normal distribution
- use a diagram to help them understand where the values are placed within the normal distribution
- be able to combine information from z-score tables and normal distribution probabilities from the Reference Sheet.

In better responses, students were able to:

- find the z-score and associated percentages from the Reference Sheet and combine this with the information from the table using symmetry, then present the solution with working that included clearly labelled diagrams
- use all information provided in the question to form a solution.

Areas for students to improve include:

- practise using z-score tables and calculating z-scores
- using and labelling normal distribution diagrams clearly showing relevant information from the Reference Sheet.

Question 38

Students should:

- know how a quantity is divided into a given ratio.

In better responses, students were able to:

- convert a ratio with decimals into integer values
- clearly identify cordial and water values throughout their solution.

Areas for students to improve include:

- knowing simplified ratios must be written as integers.