

Instructions for the mathematics and science reports (Form 4 attachment 1)

Candidates must submit evidence of their work in the following sections:

Section 1. Mathematics problem solving

Section 2. Mathematics inquiry-based report

Section 3. Science inquiry-based report

This evidence can be in the form of photographs or digital scans of work from your school assignments or independent work conducted over the last year, or you may create a new piece of work for this application. The evidence can be pasted in the boxes provided in this document or uploaded as separate A4 PDF files.

Form 4 attachments include:

- Formula Booklet (see attachment 2)
- Mathematical Inquiry and Modelling (see attachment 3)
- Scientific Method (see attachment 4)

Formula Booklet (Form 4 attachment 2)

Please use at least one of mathematics formulae in section 1 and section 2 of this form.

Name of formulae	Formulae
① Equation of a straight line	① $y = mx + c ; ax + by + d = 0$
② Gradient/slope formula between two points (x_1, y_1) and (x_2, y_2)	② $m = \frac{y_2 - y_1}{x_2 - x_1}$
③ Distance between two points (x_1, y_1) and (x_2, y_2)	③ $d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$
④ Solutions of a quadratic equation	④ $(x - \alpha)(x - \beta) = 0 \Rightarrow x = \alpha, x = \beta$ $ax^2 + bx + c = 0$ $\Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, a \neq 0$
⑤ Equation of a quadratic function	⑤ $f(x) = ax^2 + bx + c, a \neq 0$
⑥ Equation of the axis of symmetry of a quadratic function	⑥ $f(x) = ax^2 + bx + c, a \neq 0 \Rightarrow x = -\frac{b}{2a}$
⑦ Volume of a sphere	⑦ $V = \frac{4}{3}\pi r^3$, where r is the radius
⑧ Volume of a cone and pyramid	⑧ $V = \frac{1}{3}\pi r^2 h$, where r is the radius and h is the height
⑨ Pythagorean Theorem	⑨ $c^2 = a^2 + b^2$, where c is the hypotenuse of a right triangle
⑩ Area and volume ratio of similar triangles	⑩ With a similarity ratio of $\frac{m}{n}$, \Rightarrow the ratio of areas is $\left(\frac{m}{n}\right)^2$ \Rightarrow the ratio of volumes is $\left(\frac{m}{n}\right)^3$
⑪ Probability of an event A	⑪ $P(A) = \frac{\text{number of outcomes in } A}{\text{total number of outcomes}}$
⑫ Complementary events	⑫ $P(A') = 1 - P(A)$
⑬ Combined events	⑬ $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
⑭ Independent events	⑭ $P(A \cap B) = P(A) \times P(B)$
⑮ Conditional probability	⑮ $P(A B) = \frac{P(A \cap B)}{P(B)}$
⑯ Mean of a set of data	⑯ Mean = $\frac{\text{sum of the values}}{\text{total number of values}}$
⑰ Interquartile range (IQR)	⑰ IQR = upper quartile – lower quartile $= Q_3 - Q_1$

Mathematical Inquiry and Modeling (Form 4 attachment 3)

Please use one of the following descriptors when you write a mathematics report.

<Descriptors for mathematical inquiry>

	Descriptors
Exploration	Research a topic to be studied, state the problem being explored and the desired end result.
Planning	Propose one or more mathematical processes to find the solution to the problem.
Testing	Show, with working, the processes chosen. Define all variables and units being used if appropriate. Clearly show the final solution.
Justification	Determine if the answer found is correct or incorrect, with relevant working or explanations shown. Describe what it means in the context of the topic.
Conclusion	Extend the results to further applications, reflect on the reliability of the work done, or explain any problems and complications faced.

<Descriptors for mathematical modelling>

	Descriptors
Exploration	Research a topic to be studied and state the systems or patterns to be modelled.
Modelling	Show the pattern being observed and develop a mathematical model to represent it. Clearly define all variables and units as appropriate.
Testing	Test whether the model holds true for observed data, discussing any error or differences that may arise.
Application	Apply the model to other situations and describe the relevance of the results.
Extension	Explain the use of the model or the importance of the results. Reflect on the reliability of the work done or explain any problems and complications faced.

Scientific Method (Form 4 attachment 4)

Please use these scientific method descriptors when you write your science report.

<Descriptors for the scientific method>

	Descriptors
Observation	Use observation to raise questions about natural things and phenomena.
Question	Write a research question to explore the observation.
Hypothesis	Write a testable hypothesis.
Method and Design	Outline the method and controls to accurately test the hypothesis.
Experiment	Collect and tabulate data.
Data analysis	Analyze data, draw graphs and create tables.
Conclusion and evaluation	Compare the results with the hypothesis, and discuss your experiment, hypothesis, and the validity of your results.