Transferable Skills International GCSE Subject Mapping: Further Pure Mathematics

Transferable skills will help students cope with the different demands of degree study and provide a solid skills base that enables them to adapt and thrive in different environments across educational stages; and ultimately into employment. A good international education should enable students to start developing transferable skills as early as possible. Developing these transferable skills where they naturally occur as part of the International GCSE curriculum can help build learner confidence and embed the importance of this well-rounded development.

Our approach to enhancing transferable skills in our International GCSEs ensures that it is not only the academic and cognitive skills that are developed, but those broader elements that universities highlight as being essential for success. Skills such as self-directed study, independent research, self-awareness of own strengths and weaknesses and time-management are skills that students cannot learn from a textbook but have to be developed through the teaching and learning experience that can be provided through an international curriculum.

In the tables below, we have taken a framework of skills and provided mapping to suggest where each skill can be assessed, and where each skill could be developed for this subject. This will enable teachers and learners to understand where they are developing each skill, and examples of how they can develop each skill through this International GCSE.

NRC framework skill	Skill interpretation in this subject	Examples of where the skill is covered in content	Examples of where the skill is explicitly assessed in examination	Opportunity for the skill to be developed through teaching and learning approach
Cognitive skills				
Cognitive Processes and Strategies				
Critical thinking	Using **many** different pieces of mathematical information (sometimes seemingly unrelated) and synthesising this information to arrive at a solution to a mathematics-based problem.	e.g. 10 C (3D trig and Pythagoras) 10 H (trig equations) 2 C (roots of equations)	Paper 1 Qu 3 (10 H) Qu 5 (algebra and calculus) Qu 10 (10C), Qu 9 (2C) Paper 2 Qu 4(9A, 3A, B, C)	Yes
Problem solving	Translating problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes and solve them.	Most topics have some application here.	e.g. Paper 1 Qu 11(a) (9A) Paper 2 Qu 11 (9A, G, 10 C)	Yes
Analysis	Examining and understanding different elements of a mathematical context or different mathematical processes.	e.g. (study of shape of graphs, turning points, roots etc 4A, B and 9 D, E)	e.g. Paper 1 Qu 11	Yes
Reasoning	Making abstract deductions and draw conclusions from mathematical information.	e.g. Use of discriminant (2B) and roots of equations (9C) and vectors (9F)	Paper 2 Qu 9 (2A) Paper 1 Qu 9 (9C)	
Interpretation	Analysing mathematical information and understanding the meaning of that information, for example interpreting straight line conversion graphs.	Most topics cover this. e.g. 9C (Kinematics) 3 E (Inequalities and linear programming)	e.g. Paper 1 Qu 4 (9C) Qu 1 (3 E)	
Decision Making	Selecting a mathematical process from a series of mathematical processes to solve a problem.	e.g. Selection of appropriate method in Trig and Pythagoras problems (10 C) Use of rules of logarithms (1 B)	e.g. Paper 1 Qu 10 (10 C) Paper 2 Qu 6 (1B)	e.g. Use of discussion in whole class contexts or in small groups.
Adaptive learning	Adapting a mathematical strategy to solve a context based mathematical problem.	Not many examples here as the focus is on Pure Mathematics. An example linking 3C and 9E	e.g. Paper 1 Qu 5 (3C & 9E)	
Executive function	Planning how to solve a problem, carrying out the plan and reviewing the outcome.	Questions in calculus and connected rates of change (9 G) require candidates to select the appropriate stages (i.e. “plan”?)	e.g. Paper 2 Qu 11 (9 G)	

Creativity				
Creativity	Using own learning to apply mathematical processes and link these together to prove and validate mathematical concepts	We use “Show that” style of questions where candidates have to give something approaching a	e.g. Paper 2 Qu 5(a) (10 G) Paper 1 Qu 5(a) (3 C)	Yes May be evidenced in homework tasks

	Uses a different, unexpected mathematical process to arrive at an answer.	proof e.g. with trigonometric formulae (10 G) Also 7 F requires simple ideas of proof using vectors	Qu 9(b) (2 C) Qu 10(d) (trigonometry and surds)	
Innovation	Using a novel strategy to solve a previously unseen mathematical problem.	There is scope here in the area of turning points on curves (sections 9 D and 9 E and links to 2 C)	Hard to explicitly assess but candidates may produce solutions not on mark scheme. e.g. to find the *x*-coordinate of the minimum on $y = 3x^2 - 9x + 5$ the candidate uses ideas of symmetry and the mid-point of the roots. They may then use a knowledge that the sum of the roots is $-\frac{b}{a}$ to write down the answer as $\frac{1}{2} \times \frac{9}{3} = \frac{3}{2}$ rather than using calculus.	Yes See example.

NRC framework skill	Skill interpretation in this subject	Examples of where the skill is covered in content	Examples of where the skill is explicitly assessed in examination	Opportunity for the skill to be developed through teaching and learning approach
Intrapersonal skills				
Intellectual openness				
Adaptability	Ability to select and apply knowledge and understanding of mathematical processes (that which is not prompted or provided) to unseen mathematical problems.	Many questions would assess this	Yes Any question where we do not specify the method to use e.g. Paper 2 Qu 11	
Personal and social responsibility	Using mathematical knowledge and skills to solve a problem for which one is accountable.	The spec. is based on just Pure mathematics however: 3 E has the option of simple linear programming questions 9 C relates calculus to simple kinematics		Yes e.g. students organise a disco and need to determine price of tickets
Continuous learning	Planning and reflecting on own learning- setting goals and meeting them regularly			Yes Students identify areas where they need extra help or practice.
Intellectual interest and curiosity	Identifying a problem under own initiative, planning a solution and carrying this out.	e.g 4 B Student uses graphical techniques to solve more complex equations.	e.g. Paper 1 Qu 7	Yes e.g. student tries to solve $\log_2(4x - 6)^2 - x^2 = 2$
Work ethic/conscientiousness				
Initiative	Using mathematical knowledge, independently (without guided learning), to further own understanding.			Yes Reading magazines such as “Plus” published by The Mathematical Association.
Self-direction	Planning and carrying out mathematical-based problem-solving under own direction.			Yes
Responsibility	Taking responsibility for any errors or omissions in own work and creating a plan to improve.	e.g. using a calculator to check answers	e.g. Paper 2 Qu 8 candidate uses a calculator to compare their final aapproximation with calculator value. Paper 1 Qu 11(b) candidate uses a	Yes Teaching style can encourage candidates to ask if an answer is “reasonable” or estimate.

			calculator (or approx area of triangle as 0.5x4x30) to check final answer.	
Perseverance	Actively seeking new ways to continue and improve own learning despite setbacks.			Yes
Productivity	Using mathematical strategies and problem solving skills fluently (?)	Some of the longer questions that require several steps would assess this.		Yes
Self-regulation (metacognition, forethought, reflection)	Developing and refining a strategy over time for solving a problem, reflecting on the success or otherwise of the strategy			Yes
Ethics	Producing output with a specific moral purpose for which one is accountable.			Yes
Integrity	Taking ownership for own work and willingly responds to questions and challenges.			Yes
Positive Core Self Evaluation				
Self-monitoring/self-evaluation/self-reinforcement	Planning and reviewing own work as a matter of habit.			Yes

NRC framework skill	**Skill interpretation in this subject**	**Examples of where the skill is covered in content**	**Examples of where the skill is explicitly assessed in examination**	**Opportunity for the skill to be developed through teaching and learning approach**
Interpersonal skills				
Teamwork and collaboration				
Communication	Able to communicate a mathematical process or technique (verbally or written) to peers and teachers and answer questions from others.			Yes e.g. in group discussion
Collaboration	Carrying out a peer review to provide supportive feedback to another.			Yes
Teamwork	Working with other students in a maths-based problem solving exercise.			Yes
Co-operation	Sharing own resources and own learning techniques with other students.			Yes
Interpersonal skills	Using verbal and non-verbal communication skills in a dialogue about mathematics.			Yes
Leadership				
Leadership	Leading others in a group activity to effectively solve a mathematical problem			Yes
Responsibility	Taking responsibility for the outcomes of a team exercise even if one is not solely responsible for the output.			Yes
Assertive communication	Chairing a debate, allowing representations and directing the conversation to a conclusion.			Yes
Self-presentation	Presenting a mathematical problem to an audience to seek solutions.			Yes