Guidance on the use of past paper questions for Advanced Higher Mathematics of Mechanics

The Curriculum for Excellence Advanced Higher Courses draw on the strengths of popular areas of study from existing Advanced Higher with the introduction of some new content. The purpose of this support document is to help centres and departments to identify suitable past paper questions/items that could be used, or possibly amended, to support learners in their preparation for sitting question papers (exams) as part of the Advanced Higher Course assessment. The advice in this document reflects questions selected from **2010**–**2014** past papers.

When utilising any past paper questions, you need to take into account the following:

- You must select questions that provide the learners with the same level of challenge as those in the Advanced Higher Specimen Question Paper.
- You may be able to use questions as published or with amendments as suggested in the columns below.
- You must use questions that adhere to the Advanced Higher General Marking Principles and reflect the form of Detailed Marking Instructions as published in the Advanced Higher Specimen Question Paper.

If any change to a question/items is necessary, you must ensure that:

- The style and structure matches the Specimen Question Paper for Advanced Higher.
- Marking of the learner's response to the question adheres to the General Marking Principles in the Advanced Higher Specimen Question Paper.
- Marking Instructions are amended to reflect the style of the Advanced Higher Detailed Marking Instructions.

The details below should be read in conjunction with the relevant: Mandatory documentation: ♦ Course Specification ♦ Unit Specifications ♦ Course Assessment Specification Advice and guidance: ♦ Course and Unit Support Notes Assessment: ♦ Question Paper Component: — general assessment information — general marking principles and detailed marking instructions Related Information as provided in the relevant N5-Advanced Higher Course Comparison Document.	**Key for the section below:** C — amend context as required S — amend source as required St — amend question style Str — amend structure of the question Not all topic/areas of study will appear every year due to the sampling techniques used in producing question papers.

Information from the Course Assessment Specification The purpose of the question paper is to assess mathematical skills and their application to mechanics. A calculator may be used. The question paper will sample the skills, knowledge and understanding that are contained in the 'Further mandatory information on Course coverage' section at the end of the Course Assessment Specification. The question paper will consist of a series of short and extended response questions set in contexts that require the application of skills developed in the Course. Learners will be expected to communicate responses clearly and to justify solutions. The paper will have 100 marks.	**The columns below identify additional support questions from Advanced Higher Past Papers 2010 to 2014** **Advanced Higher** Use question as published
Force, Energy and Periodic Motion	
1.1 Applying skills to principles of momentum, impulse, work, power and energy	
Working with impulse as the change in momentum, and/or force as the rate of change of momentum.	2014 QA1 2013 QA2 2010 QA5
Working with the concept of conservation of linear momentum.	2014 QA1 2012 QA7(b) 2011 QA1
Determining work done by a constant force in one or two dimensions, or a variable force during rectilinear motion.	2014 QA3 2013 QA3 2013 QA4 2011 QA6
Using the concepts of kinetic (E_K) and/or potential (E_P) energy to applying the work-energy principle.	2014 QA3
Using the concepts of kinetic (E_K) and/or potential (E_P) energy within the concept of conservation of energy	2014 QA8 2013 QA8 2012 QA7(a) 2010 QA11
1.2 Applying skills to motion in a horizontal circle with uniform angular velocity	
Applying equations to motion in a horizontal circle with uniform angular velocity	2014 QA4 2013 QA6 2012 QA1

	2011 QA3 2010 QA2
Using equations for horizontal circular motion alongside Newton's Inverse Square Law of Gravitation	2012 QA6
1.3 Applying skills to Simple Harmonic Motion	
Working with the concept of Simple Harmonic Motion (SHM).	2014 QA2 2012 QA10b 2011 QA5
Applying Hooke's Law to problems involving SHM.	2013 QA7 2012 QA4b 2012 QA10a 2010 QA6 2010 QA8
1.4 Applying skills to Centres of Mass	
Determining the turning effect of force	This is a new topic
Using moments to find the centre of mass of a body.	This is a new topic
Linear and Parabolic motion	
1.1 Applying skills to motion in a straight line☐	
Working with time dependent graphs	2011 QA2
Working with rates of change with respect to time in one dimension	2014 QA9a i 2012 QA3 2010 QA4
Using equations of motion in one dimension under constant acceleration	2014 QA7 2013 QA2 2010 QA1
1.2 Applying skills to vectors associated with motion	
Using vectors to define displacement, velocity and acceleration	2013 QA1 2012 QA8a 2010 QA10a&b
Finding resultant velocity, relative velocity or relative acceleration of one body with respect to another	2013 QA9 2012 QA8c
Applying understanding of relative motion	2014 QA6

	2012 QA8b 2011 QA4 2010 QA10c
1.3 Applying skills to projectiles moving in a vertical plane.	
Establishing the conditions of motion in horizontal and vertical directions involved in parabolic motion	This topic has not appeared in recent past papers due to sampling requirements.
Using the equations of motion and parabolic flight	2014 QA9a ii 2014 QA9b 2013 QA10 2012 QA2 2011 QA9 2010 QA9
1.4 Applying skills to forces associated with dynamics and equilibrium.	
Using Newton's first and third laws of motion to understand equilibrium	2012 QA4a 2011 QA7
Understanding the concept of static friction, dynamic friction and limiting friction	2013 QA5
Using Newton's Second Law of motion	2014 QA5 2013 QA4 2013 QA5 2012 QA5 2011 QA8 2010 QA3 2010 QA8
Mathematical Techniques for Mechanics	
1.1 Applying algebraic skills to partial fractions	
Expressing rational functions as a sum of partial fractions (denominator of degree at most 3 and easily factorised)	2014 QB6b 2012 QB4(a)
1.2 Applying calculus skills through techniques of differentiation	
Differentiating exponential and logarithmic functions	2012 QB2b
Differentiating functions using chain rule	2013 QB1 2011 QB1b
Differentiating functions given in the form of a product and/or in the form of a quotient	2014 QB1 2012 QB2a

	2011 QB1a 2010 QB1a&b
Finding the derivative of functions defined implicitly	This topic has not appeared in recent past papers due to sampling requirements.
Finding the derivative of functions defined parametrically	2013 QB6a&c 2011 QB3
1.3 Applying calculus skills through techniques of integration	
Integrating expressions using standard results	2014 QB5b 2014 QB6b 2010 QB3
Integrating using a substitution when the substitution is given	2011 QB5
Integrating by parts	2014 QB3 2013 QB3
Applying integration to a range of physical situations	2012 QB4(b)
1.4 Applying calculus skills to solving differential equations	
Finding a general solution of a first order differential equation with variables separable	2014 QA10 2014 QB6 2013 QA11 2012 QA9 2012 QB5 2011 QA10 2010 QA7 2010 QB4
Solving a simple first order linear differential equation using an integrating factor	2013 QB5 2011 QB6
Solving second order homogeneous equations	This is a new topic.
Resources	

SQA past papers www.sqa.org.uk/pastpapers/findpastpaper.htm	Additional assessment support material is available here: Education Scotland www.educationscotland.gov.uk/ Glow www.educationscotland.gov.uk/usingglowandict/ Glow Log-in https://secure.glowscotland.org.uk/login/login.htm