LEVEL 2

WJEC Level 2 Additional Mathematics

Approved by Qualifications Wales

Guidance for Teaching: Unit 5

Teaching from 2026
For award from 2027

This Qualifications Wales regulated qualification is not available to centres in England.

Made for Wales.
Ready for the world.

WJEC would like to thank the students and teachers of Fitzalan High School, Cardiff and Llanwern High School, Newport for their participation in the creation of these covers.

Contents

Introduction

WJEC Level 2 Additional Mathematics has been approved by Qualifications Wales and is available to all centres in Wales. It will be awarded for the first time in Summer 2027, using grades Pass, Merit or Distinction.

Aims of the Guidance for Teaching

The principal aim of the Guidance for Teaching is to support teachers in the delivery of WJEC Level 2 Additional Mathematics and to offer guidance on the requirements of the qualification and the assessment process. The Guidance for Teaching is **not intended as a comprehensive reference**, but as support for teachers to develop stimulating and exciting courses, tailored to the needs and skills of their learners. The guide offers possible classroom activities and links to useful resources (including our own, freely available digital materials and some from external sources) to provide ideas for immersive and engaging lessons.

Additional ways that WJEC can offer support:

- sample assessment materials and mark schemes
- professional learning events
- examiners' reports on each unit
- direct access to the subject officer
- free online resources
- Exam Results Analysis
- Online Examination Review.

Qualification Structure

WJEC Level 2 Additional Mathematics consists of six units (two mandatory, four optional). The qualification is unitised and does not contain tiering. There is no hierarchy to the order the units should be taught.

	Unit title	Type of Assessment	Weighting
Mandatory Units			
Unit 1	Algebra	Written examination	33⅓%
Unit 2	Calculus	Written examination	33⅓%
Optional Units			
Unit 3	Geometry and Trigonometry	Written examination	33⅓%
Unit 4	Statistics	Written examination	33⅓%
Unit 5	Mechanics	Written examination	33⅓%
Unit 6	Discrete and Decision Mathematics	Written examination	33⅓%

To be awarded the qualification, learners must complete **three** units:

- **two** mandatory units
- **one** optional unit.

Learners who complete fewer than three units will receive unit certification for the successful completion of each unit.

Unit 5 Summary of Assessment

Unit 5: Mechanics **Written examination: 50 minutes** **33⅓% of qualification** **40 marks**
The paper will comprise a number of short and longer, both structured and unstructured, questions. A calculator will be allowed in this paper.

Overview of Unit 5

Mechanics
(33⅓% of the qualification)

The purpose of this unit is to introduce and develop an understanding of topics and concepts relating to mechanics and be able to apply them in different contexts.

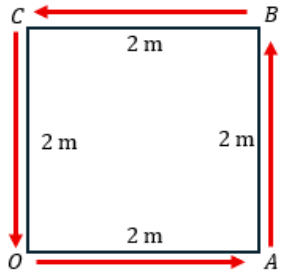
A calculator will be allowed in this examination.

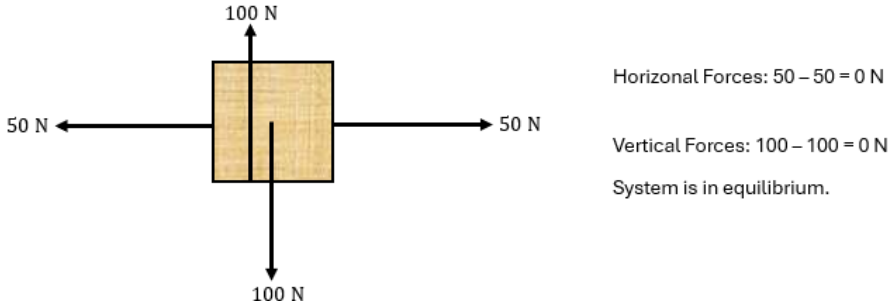
In this unit, learners will develop knowledge, skills and understanding in:	
5.1	Vector and Scalar Quantities
5.2	Forces
5.3	Rectilinear Motion

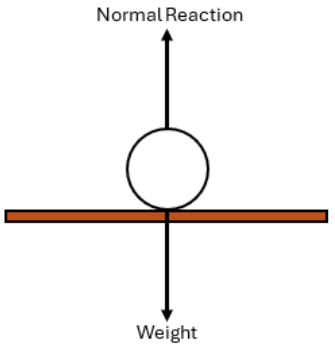
Unit 5 Assessment objectives and weightings

AO1	Recall and use their knowledge of the prescribed content.	18⅓%
AO2	Select and apply mathematical methods.	6⅔%
AO3	Interpret and analyse problems and use mathematical reasoning to solve them.	8⅓%

Unit 5 Teacher Guidance

5.1 Vector and Scalar Quantities		
	Content Amplification	**Teacher Guidance**
5.1.1 Distinguish between scalar and vector quantities	Learners should know: • the fundamental difference between vectors quantities and scalar quantities. Learners should be able to: • provide physical examples of scalar quantities and vector quantities. The use of the unit vectors **i** and **j** is not included.	A scalar quantity is one which has only magnitude. A vector quantity has both direction and magnitude. For example: • distance, time, speed, and mass are scalar quantities • displacement, velocity, acceleration, force, and weight are vector quantities.  Distance travelled after going from O to A to B to C and back to O is 8 metres. Displacement after going from O to A to B to C and back to O is 0 metres.

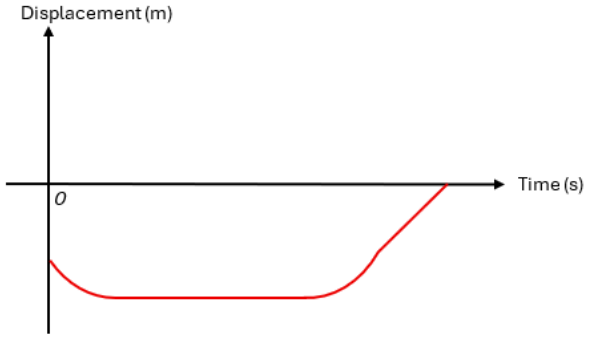
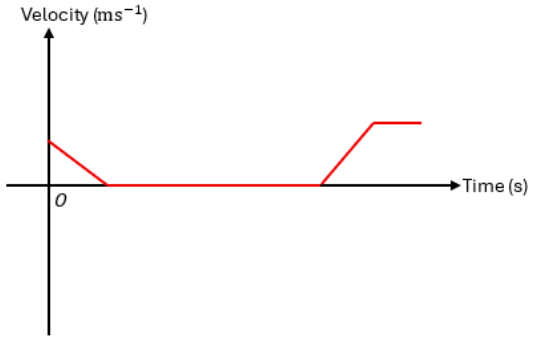
5.2 Forces		
5.2.1 Different types of forces and their characteristics	Learners should be able to identify: • contact forces, such as a normal reaction • non-contact forces, such as weight, where weight is the force of gravity acting on an object. Learners should be able to: • indicate one or more relevant forces on a diagram, including weight. Learners should know: • how these forces affect the motion of an object, either in a static state or whilst in motion.	All forces will be given in Newtons (N). Learners need to understand that weight is a force where, $W = mg$ (N). For example: • indicate forces acting on a car driving along a straight horizontal road • indicate forces acting on an object in freefall. Learners should know that the direction of the resultant force and the direction of the acceleration are the same.
5.2.2 The nature of forces and their effects on objects	Learners should be able to: • explain how forces can affect the motion of an object.	
5.2.3 Analysing situations involving balanced and unbalanced forces	Learners should be able to: • calculate resultant forces of unbalanced systems in one dimension only • calculate the force needed to bring a system into equilibrium, either in a static state or whilst in motion.	Learners need to understand that being in equilibrium means that the resultant force on an object is zero. **Example Question** A particle at rest on a horizontal plane with no external forces 

		<u>Learners will only be expected to find the resultant of two or more forces in one-dimension.</u>
5.2.4 The principles of Newton's three laws of motion	Learners should know that: • balanced forces result in no change in motion • objects require an unbalanced force to change their velocity • acceleration depends on the magnitude of force and the mass of the object • the direction of the net force determines the direction of acceleration • action and reaction forces are equal in magnitude and opposite in direction. Learners should be able to: • use free-body diagrams to represent forces • apply Newton's second law ($F = ma$) to calculate force, mass or acceleration.	Learners should understand the following with regards to Newton's laws of motion: • Newton's First Law (N1L) – An object moving with a constant velocity continues to move with a constant velocity unless acted upon by a resultant force • Newton's Second Law (N2L) – The acceleration of an object is directly proportional to the resultant force acting on it and is inversely proportional to the mass of the object • Newton's Third Law (N3L) – Every action has an equal but opposite reaction. For example: 

5.2.5 Applying Newton's laws to analyse and solve problems involving forces and motion.	Learners should be able to: • solve problems using $F = ma$.	Learners should be familiar with a range of scenarios involving motion in one dimension which require the use of Newton's laws of motion, including, but not limited to: • objects moving along smooth horizontal surfaces • objects falling freely under their own weight. Learners should be familiar with the idea of a frictional force but will not be expected to work with the formula for friction. Learners should know and use the fact that a resistive force opposes the direction of motion.

5.3 Rectilinear Motion		
5.3.1 Quantities and units	Learners should know: • key quantities: displacement, distance, velocity, speed, acceleration and time, and associated units.	Learners should be familiar with the standard SI units of measure and be able to convert between units where appropriate: • displacement/distance – metres (m), kilometres (km) • velocity/speed – metres per second (ms^{-1}), kilometres per hour (kmh^{-1}) • acceleration – metres per second per second or metres per second squared (ms^{-2}) • time – seconds (s), minutes, hours (h). Learners should be able to distinguish the difference between distance travelled and displacement from a starting point.
5.3.2 Uniform and non-uniform motion	Learners should know that: • rectilinear motion is motion along a straight line • uniform motion is motion with constant velocity • non-uniform motion is motion involving acceleration.	Learners should know that a constant velocity could be zero. Learners should know that if an object has zero velocity, this does not mean that the object is in equilibrium, e.g., an object which is thrown vertically and comes to rest at its highest point is not in equilibrium but is at rest.

5.3.3
Problems involving displacement, velocity, acceleration, and time
	Learners should be able to:
	• apply the following equations to motion under constant acceleration (a)
	  • $v = u + at$
	  • $s = ut + ½at^2$
	  • $v^2 = u^2 + 2as$
	  • $s = \frac{1}{2}(u + v)t$
	
	Learners should also be able to apply these equations to vertical motion under gravity, where acceleration due to gravity is g=9.8ms^{-2} (to one decimal place).
		Learners may be required to use the quadratic formula to solve problems
		
		Learners may be expected to interpret the solutions of quadratic equations in the context of the question (for example, rejecting negative values of time). Learners may use the equation $s = vt - \frac{1}{2}at^2$.
		
		Learners may assume that g is constant but should be aware that it is not a universal constant.
		Learners may be expected to work with g algebraically.

5.3.4
Motion graphs (displacement-time, velocity-time)
	Learners should know that:
	• for displacement-time graphs:
	  • gradient represents velocity
	  • straight line segments mean uniform velocity
	  • curved segments mean acceleration or deceleration
	• for velocity-time graphs:
	  • gradient represents acceleration
	  • area under the graph represents displacement.
	
	Learners should be able to:
	• interpret motion graphs
	• sketch motion graphs based on given information.
		Graphs may include negative displacements/velocities.
		
		For example:
		
		A car reverses from a point away from *O*, comes to rest, and then accelerates forwards before reaching a constant velocity at *O*
		
		 
		 
		
		Axes should be labelled with appropriate units.

Learning Experiences

Learners should be encouraged to consider the following learning experiences and skills to further develop their understanding, appreciation and awareness of the subject content. Information in the table below provides opportunities for teachers to integrate the learning experiences into delivery.

Learning Experience	Exemplification of Learning Experience
Work both independently and collaboratively.	Learners should be given ample opportunities to work independently on examples and questions which deepen their understanding of a range of problems in mechanics. This should include labelling force diagrams, solving for unknown quantities and balancing forces. Learners should be encouraged to collaborate on tasks which require the exploration of new concepts. For example, learners could work collaboratively to draw and interpret a wide range of displacement-time and velocity-time graphs.
Gain experience and appreciation of the role mathematics plays in other subjects and areas of the curriculum.	Learners should be aware of the links between mechanics and the discipline of Physics within the Science and Technology Area of Learning and Experience. and Key Stage 3, Key Stage 4, and Key Stage 5 Physics. For example, the study of Forces, Motion & The Universe in GCSE The Sciences (Double Award) links closely with learning in Module 5.2 of this unit.
Gain awareness and appreciation of some of the different careers and work-related areas that draw upon mathematics.	Knowledge of forces and motion are fundamental to careers in engineering, sports science and energy conservation.
Access rich tasks that invoke curiosity, build resilience and require *Learners* to be resourceful.	Make appropriate use of STEM activities for exploring real life scenarios. For example: • Distance-time Graph • Velocity-time Graph • Balanced or Unbalanced Forces • Scalar or Vector?
Undertake practical work that allows learners to apply their mathematical skills inside and outside of the classroom setting.	Possible experiments could be set up to demonstrate mathematical skills. For example, Newton's First Law can be demonstrated with the use of an air table.

Encounter familiar, unfamiliar and complex problems.	Motion on an air hockey table can be used to demonstrate Newton's Laws of motion. Freefall of a skydiver can be used to demonstrate the use of the equation of constant acceleration as well as the principle of Newton's First Law. Motion of a lift can be used to demonstrate Newton's Laws of Motion and could be the subject of the drawing/interpreting of a displacement-time or velocity-time graph.

Opportunities for embedding elements of the Curriculum for Wales

<table>
<tr><th colspan="4">Curriculum for Wales Strands</th></tr>
<tr><th colspan="4">Cross-cutting Themes</th></tr>
<tr><td rowspan="3">Local, National & International Contexts</td><td colspan="3">There are many opportunities to include Local, National and International Contexts in Level 2 Additional Mathematics. These opportunities are important to learners because Mechanics encourages learners to think about environmental issues and the impacts of communities in Wales, the United Kingdom and the wider world.

Below is an example of how Local, National & International Contexts can be embedded into teaching and learning:</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example</td></tr>
<tr><td>5.3.3</td><td>Problems involving displacement, velocity, acceleration, and time</td><td>Teachers could explore the impact of Wales reducing the national speed limit from 30mph to 20mph in built up areas on time taken for journeys. Learners could calculate the time difference between travelling at the two different speeds and consider the impact of the change.</td></tr>
<tr><td>Sustainability</td><td colspan="3">There are many opportunities to include Sustainability in Level 2 Additional Mathematics. These opportunities are important to learners because mechanics is about understanding forces, motion, and energy – the same principles that underpin how cars move, planes fly, wind turbines spin, and even how we walk or cycle. These are the exact areas where society faces sustainability challenges: energy use, fuel efficiency, emissions, and resource consumption.

Below is an example of how Sustainability can be embedded into teaching and learning:</td></tr>
</table>

<table>
<tr><td></td><td>Specification Reference

5.3.3

5.3.4</td><td>Amplification

Problems involving displacement, velocity, acceleration, and time

Motion Graphs (displacement-time, velocity-time)</td><td>Example

Learners could explore the time taken for an electric car and a petrol car to accelerate from rest to 30 ms-1 by using the equations of constant acceleration. The two motions could then be plotted, interpreted and discussed.</td></tr>
<tr><td rowspan="3">Careers and Work-Related Experiences</td><td colspan="3">There are many opportunities to include Career and Work-Related Experiences (CWRE) in Level 2 Additional Mathematics. These opportunities are important to learners because many learners will go on to have careers in areas dominated by problem solving and analysing complex situations.

Below is an example of how CWRE can be embedded into teaching and learning:</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example</td></tr>
<tr><td>5.2.2</td><td>The nature of forces and their effects on objects</td><td>Learners will need to think about how forces interact with everyday situations which will help to enhance perceptions of careers in engineering, physical sciences and beyond.</td></tr>
</table>

Cross-curricular Skills – Literacy			
	There are many opportunities to include Literacy in Level 2 Additional Mathematics. These opportunities are important to learners because they help develop the ability to interpret technical language, explain problem-solving processes clearly, and communicate complex ideas about forces and motion in real-world contexts. **Below are some examples of how literacy can be embedded into teaching and learning:**		
Listening	***Specification Reference*** 5.2.2	***Amplification*** The nature of forces and their effects on objects	***Example*** Learners could listen to a short video explaining how high-speed trains reduce air resistance with their design. Learners could then extract the key information about the forces acting on the train (e.g., drag, thrust, weight, normal reaction) and how they influence the motion.
Reading	***Specification Reference*** 5.3.4	***Amplification*** Motion Graphs (displacement-time, velocity-time)	***Example*** Learners could be given a written description of a journey and then asked to pick out key information before being asked to illustrate this information as a graph
Speaking	***Specification Reference*** ***5.3.3***	***Amplification*** Problems involving displacement, velocity, acceleration, and time	***Example*** Learners can explain their solution to a Mechanics problem and justify each step. Learners should look to build confidence in using technical language and answer and clarifying questions.

	Specification Reference	***Amplification***	***Example***
Writing	5.3.4	Motion Graphs (displacement-time, velocity-time)	Learners could be given a motion graph and asked to write down what the graph could represent, using as much technical language as possible.

Cross-curricular Skills – Numeracy			
	There are many opportunities to include Numeracy in Level 2 Additional Mathematics. These opportunities are important to learners because they allow them to apply mathematical skills in real-life contexts, deepen their understanding of motion and forces, and build confidence in handling numbers, graphs, and equations that they will need in further study and everyday problem-solving. **Below are some examples of how numeracy can be embedded into teaching and learning:**		
Developing Mathematical Proficiency	***Specification Reference*** 5.3.3	***Amplification*** Problems involving displacement, velocity, acceleration, and time	***Example*** Learners could calculate unknown quantities in calculations involving the motion of an object. Such calculations will reinforce their calculation skills with negative numbers, involving vector quantities which oppose motion.
Understanding the number system helps us to represent and compare relationships between numbers and quantities	***Specification Reference*** 5.2.3	***Amplification*** Analysing situations involving balanced and unbalanced forces	***Example*** Learners will look at problems with unbalanced forces. These problems will allow learners to compare and interpret problems based upon the direction of the resultant force.

	Specification Reference	***Amplification***	***Example***
Learning about geometry helps us understand shape, space and position and learning about measurement helps us quantify in the real world	5.3.4	Motion graphs (displacement-time, velocity-time)	Learners could interpret the area under a velocity-time graph as the displacement. In order to calculate this displacement, learners will need to find the areas of rectangles, triangles and trapezia.

Cross-curricular Skills – Digital Competence			
	There are many opportunities to include Digital Competence in Level 2 Additional Mathematics. These opportunities are important to learners because they enable them to use technology to model motion, analyse data, and interpret graphs, helping them develop essential skills for further study, future careers, and understanding how digital tools are applied in real-world problem-solving. **Below are some examples of how Digital Competence can be embedded into teaching and learning:**		
Producing	***Specification Reference*** 5.3.4	***Amplification*** Motion graphs (displacement-time, velocity-time)	***Example*** Learners could produce a displacement-time or a velocity-time graph using a spreadsheet (e.g. excel or sheets) by inputting relevant data.
Data and Computational Thinking	***Specification Reference*** 5.2.4	***Amplification*** The principles of Newton's three laws of motion	***Example*** Learners could time an object moving along a fixed distance, measuring the distance travelled at fixed time intervals. The data collected could then be input into a spreadsheet alongside data used to calculate other quantities, e.g. velocities, accelerations.

<table>
<tr><th colspan="4">Integral Skills</th></tr>
<tr><td rowspan="2">Creativity and Innovation</td><td colspan="3">There are many opportunities to include Creativity and Innovation in Level 2 Additional Mathematics. These opportunities are important to learners because they encourage them to think imaginatively and find new ways to represent and communicate mathematical ideas, helping them develop problem-solving skills and a deeper understanding of real-world motion.

Below is an example of how Creativity and Innovation can be embedded into teaching and learning:</td></tr>
<tr><td>Specification Reference

5.3.4</td><td>Amplification

Motion graphs (displacement-time, velocity-time)</td><td>Example

Learners could be asked to create their own journey for which they then must produce a displacement-time or velocity-time graph. The journey could incorporate many different elements (e.g., uniform motion, non-uniform motion, negative displacements).</td></tr>
<tr><td rowspan="2">Critical Thinking and Problem Solving</td><td colspan="3">There are many opportunities to include Critical Thinking and Problem Solving in Level 2 Additional Mathematics. These opportunities are important to learners because they help them analyse situations, identify patterns, and apply logical strategies to solve real-world problems which will strength their understanding of forces, motion, and mathematical relationships.

Below are some examples of how Critical Thinking and Problem Solving can be embedded into teaching and learning:</td></tr>
<tr><td>Specification Reference

5.3.4</td><td>Amplification

Motion graphs (displacement-time, velocity-time)</td><td>Example

Learners can identify key features of different motion-graphs (e.g. object is stationary, object is accelerating uniformly, object is decelerating non-uniformly).</td></tr>
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<table>
<tr><td></td><td></td><td></td><td>Learners could be given part of a velocity-time graph and asked to complete the graph such that it satisfies a specific criterion (e.g., displacement is 1000 m).</td></tr>
<tr><td rowspan="3">Planning and Organisation</td><td colspan="3">There are many opportunities to include Planning and Organisation in Level 2 Additional Mathematics. These opportunities are important to learners because it helps them structure their approach to solving problems, manage information and calculations effectively, and develop logical steps to tackle complex motion and force scenarios, improving both understanding and accuracy.

Below is an example of how Planning and Organisation can be embedded into teaching and learning:</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example</td></tr>
<tr><td>5.3.3</td><td>Problems involving displacement, velocity, acceleration, and time</td><td>Learners need to be organised in their attempts at problems involving the equations of constant acceleration. Learners should be encouraged to identify which quantities are known and unknown to enable them to carry out their calculations effectively.</td></tr>
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<tr><td rowspan="3">Personal Effectiveness</td><td colspan="3">There are many opportunities to include Personal Effectiveness in Level 2 Additional Mathematics. These opportunities are important to learners because they help them take responsibility for their own learning, develop confidence in applying mechanical principles, work independently, and reflect on their progress, which builds skills that are valuable, both in school and in real-world problem-solving.

Below are some examples of how Personal Effectiveness can be embedded into teaching and learning:</td></tr>
<tr><td>Specification Reference</td><td>Amplification</td><td>Example</td></tr>
<tr><td>5.1.1</td><td>Distinguish between scalar and vector quantities</td><td>Learners could be asked to reflect on their prior knowledge (from GCSE Physics) to independently decide whether quantities are scalars or vectors.</td></tr>
</table>

Glossary for Unit 5

Term	Definition
Acceleration	The rate of change of velocity.
Direct proportion	Two quantities are described as being directly proportional if the two quantities vary at the same rate.
Displacement	The distance and direction of an object from its starting point.
Displacement-time graph	A graph showing how an object's position changes over time.
Distance	The total path length travelled by an object.
Force	A push or pull that can cause an object to accelerate.
Inverse proportion	Two quantities are described as being inversely proportional if as one of the quantities increases, the other quantity decreases proportionally.
Mass	The amount of matter in an object.
Normal reaction	The perpendicular force a surface exerts on an object
Resultant force	A single force which has the same effect as the application of two or more forces.
Speed	The rate at which an object moves.
Velocity-time graph	A graph showing how an object's velocity changes over time.
Weight	The force of gravity acting on an object.