

Mechanics: worked examples

HSC Mathematics Extension 2

These examples show assessable skills, not an official HSC topic weighting or prediction. The 2024 NSW syllabuses have their first HSC examination in 2027; students sitting the 2026 HSC continue under the applicable 2017 syllabus.

Worked example 1 | 2 marks

Catalog reference: ext2_jr25_acceleration_from_position_velocity | seed 41001 | mapping ext2-mechanics-1

Acceleration from velocity as a function of position

A particle has $v = (3x+2)/(2x-1)$ for $x \geq 1$. Find its acceleration when $x=3$.

(a) Find the acceleration in metres per second squared. [2 marks]

Answer: $-77/125$

Differentiate Velocity: $\frac{dv}{dx} = -7/(2x-1)^2$.

Acceleration Chain Rule: $-77/125$

Worked example 2 | 1 marks

Catalog reference: ext2_cssa25_shm_maximum_acceleration | seed 41001 | mapping ext2-mechanics-1

Maximum acceleration in SHM

A particle moves in simple harmonic motion with $v^2 = 2304 - 48x - 2x^2$. What is the maximum magnitude of its acceleration?

- A. 24 metres per second squared.
- B. 48 metres per second squared.
- C. 72 metres per second squared.
- D. 96 metres per second squared.

(a) Select the acceleration in metres per second squared. [1 mark]

Answer: 72

Solve Quadratic: The turning positions, where $v=0$, are $x=8$ and $x=-16$.

Differentiate Velocity Relation: $a = -8 - 2x$, so the larger endpoint magnitude is 24 .

Worked example 3 | 1 marks

Catalog reference: ext2_ind25_mcq_shm_minute_distance | seed 41001 | mapping ext2-mechanics-1

Distance in simple harmonic motion

A particle satisfies $v^2 = (\pi^2/9)(4^2 - x^2)$. Find the distance travelled in the first 60 seconds.

- A. 80
- B. 96
- C. 160
- D. 192

(a) Select the distance in metres. [1 mark]

Answer: 160

Shm Period: 6

Complete Cycles: 160

Source and methodology

Examples are deterministic curriq catalog generations from existing QDSL archetypes at the published fixed seed. The generator copies only student-facing prompts, mark allocations, topic mappings, display tables or options, checked answers and marking-path results into this resource.

Official syllabus source:

<https://curriculum.nsw.edu.au/learning-areas/mathematics/mathematics-extension-2-11-12-2024/overview/course>

Teacher verification note: check the mathematics, notation, permitted technology and syllabus fit for your cohort before classroom or assessment use.