SECONDARY CURRICULUM

IB DIPLOMA

MATHEMATICS: APPLICATIONS & INTERPRETATION (AI)

OVERVIEW

GRADE 11 – GRADE 12

IB Diploma Programme at Tesla Education

The **International Baccalaureate (IB) Diploma Programme** at Tesla Education, offered to students in **Grades 11 and 12**, represents the pinnacle of their learning journey. Designed to prepare students for success at university and beyond, the DP fosters **academic excellence**, **personal growth**, and a deep sense of **global citizenship**. Through its rigorous and **interdisciplinary curriculum**, students are challenged to think critically, engage with complex local and global issues, and develop an ethical perspective that informs responsible decision-making. The DP nurtures independent inquiry, research, and collaboration, empowering students to become **active, compassionate, and lifelong learners** who can thrive in a rapidly changing world. At Tesla, the DP experience is enriched by our commitment to **innovative teaching**, **personalized learning pathways**, and the integration of **IB Learner Profile attributes** across all subjects. Our graduates leave Tesla equipped with the **skills, knowledge, and mindset** required to succeed in leading universities and to contribute meaningfully to society.

Criteria for Successfully Achieving the IB Diploma Certificate

To be awarded the **IB Diploma**, students must meet the following requirements:

1. Subject Requirements

Students must complete **six DP subjects**, one from each group:

- **Group 1:** Studies in Language and Literature
- **Group 2:** Language Acquisition
- **Group 3:** Individuals and Societies
- **Group 4:** Sciences
- **Group 5:** Mathematics
- **Group 6:** The Arts **OR** a second subject from Groups 1–4

2. Levels

- At least **three subjects** must be taken at **Higher Level (HL)**.
- The remaining **three subjects** are taken at **Standard Level (SL)**.

3. Core Requirements *(Mandatory for All Candidates)*

Students must complete and pass all three components of the **IB Diploma Programme Core**:

- **Theory of Knowledge (TOK):** Assessed through an exhibition and an essay.

- **Extended Essay (EE):** An independent, 4,000-word research paper.
- **Creativity, Activity, Service (CAS):** Successful completion of documented CAS experiences and a final project.

4. Point Requirements

- Minimum total: **24 points** out of **45**.
- Up to **3 bonus points** may be earned based on combined performance in **TOK** and **EE**.
- **CAS** completion is compulsory but does not contribute to points.

5. Minimum Scores Per Level

- A total of **at least 12 points** across the **three HL subjects**.
- A total of **at least 9 points** across the **three SL subjects**.
- No score lower than **2** in any HL subject.
- No score of **"N"** (non-submission) in any subject or core component.

6. Award of the Diploma

- **Maximum score:** 45 points
  - 6 subjects × **7 points** each = **42**
  - **TOK + EE bonus:** up to **3 additional points**
- The **IB Diploma** is awarded if the student:
  - Achieves **24 points or more**.
  - Meets the HL/SL minimum requirements.
  - Completes **TOK, EE, and CAS** successfully.
  - Has **no disqualifying conditions**.

Policy Alignment Statement

This course is delivered in full alignment with Tesla Education's IB-approved policies on assessment, language, inclusion, and academic integrity. These policies ensure that teaching, learning, and evaluation within the course are consistent with the IB Diploma Programme standards and support all students in achieving their personal and academic goals.

Subject Description

The IB Diploma Programme (DP) Mathematics: Applications and Interpretation (AI) course is designed for students who are interested in applying mathematics to real-world contexts using technology, mathematical models, and data analysis. It equips students with quantitative literacy, critical thinking, and problem-solving skills necessary for interpreting and addressing challenges in an increasingly data-driven world.
Students explore mathematical applications across diverse contexts such as statistics, modeling, probability, finance, and technology, developing conceptual understanding alongside practical problem-solving. The course fosters creativity, international-mindedness, and collaboration while integrating Theory of Knowledge (TOK), Creativity, Activity, Service (CAS), and the Extended Essay (EE).

Key Themes of the Course

- Mathematics in Context – applying mathematics to interpret real-world data and trends.
- Modeling and Simulation – creating and analyzing models to make predictions and test hypotheses.
- Statistics and Data Science – understanding large data sets and using technology for exploration and decision-making.
- Interdisciplinary Relevance – connecting mathematics with sciences, economics, design, and global challenges.
- Technology Integration – leveraging graphing calculators, statistical software, and simulation tools.

Course Levels

- Standard Level (SL) – Focuses on foundational mathematical applications, modeling techniques, and statistics, requiring 150 teaching hours.
- Higher Level (HL) – Extends SL content, emphasizing advanced modeling, calculus, and data-driven problem-solving, requiring 240 teaching hours.

Aims

- Develop a curiosity and enjoyment for mathematics through inquiry and application.
- Enable students to apply mathematical techniques to real-world contexts and interdisciplinary problems.
- Foster technological fluency for modeling, simulations, and statistical analysis.
- Encourage students to evaluate ethical, environmental, and social implications of mathematical applications.
- Build collaboration, creativity, and independence through problem-solving and research.

Approaches to Learning (ATL)

ATL Skill	Application in Mathematics AI
Thinking Skills	Formulating models, evaluating results, and testing assumptions.
Research Skills	Collecting, interpreting, and presenting real-world data sets.
Communication	Explaining findings using graphs, diagrams, and mathematical reasoning.
Self-Management	Organizing IA milestones, mock exams, and revision schedules.
Social Skills	Collaborating on group modeling projects and interdisciplinary tasks.

IB Learner Profile

Learner Profile Attribute	How Mathematics AI Develops It
Inquirers	Designing open-ended investigations for the IA and real-world scenarios.
Knowledgeable	Applying concepts from algebra, statistics, and calculus to global problems.
Thinkers	Evaluating complex data sets and constructing multiple models for decision-making.
Communicators	Presenting findings visually, verbally, and symbolically using digital tools.
Principled	Ensuring ethical data collection and maintaining academic integrity in modeling.
Open-minded	Exploring global datasets and comparing diverse perspectives in problem-solving.
Caring	Applying mathematical models to sustainability, inequality, and social justice issues.
Risk-takers	Tackling complex, unfamiliar problems requiring creative solutions.
Balanced	Managing workload across IA, EE, TOK, and other DP subjects effectively.
Reflective	Analyzing solutions, recognizing errors, and refining modeling strategies.

Assessment Criteria and Scale (Internal and External):
Aligned with the IB DP Mathematics Applications and Interpretations Guide
(First Assessment 2021)

All external and internal assessments evaluate the following:

AO	Description	Weighting (SL)	Weighting (HL)
AO1	**Knowledge & Understanding** of concepts, techniques, and mathematical processes. Demonstrate the ability to recall, select, and apply appropriate methods to solve mathematical problems accurately.	**60%**	**50%**

AO2	**Application & Interpretation** in a variety of **real-world contexts**. Use technology effectively, model scenarios, and analyse situations to reach logical conclusions.	**25%**	**30%**
AO3	**Investigative Skills, Reasoning & Justification**. Develop coherent mathematical arguments, evaluate assumptions, assess validity of models, and interpret results with clarity and precision.	**15%**	**20%**

External Assessment – 80% (SL) / 80% (HL)

Component	Duration	SL Weight	HL Weight	Content Assessed	Focus
Paper 1 (No calculator)	SL: 1h30m HL: 2h	40%	30%	Short/extended-response questions	AO1, AO2
Paper 2 (Calculator allowed)	SL: 1h30m HL: 2h	40%	30%	Technology-driven modelling, data interpretation	AO1, AO2, AO3
Paper 3 *(HL only)*	HL: 1h	–	20%	Two extended-response questions	AO3 (investigation & reasoning)

Internal Assessment – Mathematical Exploration (20% SL / 20% HL)

Criterion	Focus	Marks
A: Presentation	Structure, organisation, clarity	4
B: Mathematical Communication	Use of mathematical notation, graphs, technology	4
C: Personal Engagement	Originality, independent thinking, curiosity	3
D: Reflection	Evaluation, discussion of limitations, improvements	3
E: Use of Mathematics	Relevance, depth, sophistication of maths	6
Total	**20 marks** (moderated externally)	

Comparison Table: SL vs HL

Component	SL Weight	HL Weight
Paper 1 *(No calculator)*	40%	30%
Paper 2 *(Calculator allowed)*	40%	30%
Paper 3 *(HL only, Calculator allowed)*	–	20%
Internal Assessment *(Mathematical Exploration)*	20%	20%

Total	**100%**	**100%**

DP Core Integration (ToK, CAS, EE)

The DP Mathematics AI course at Tesla embeds the IB Core — Theory of Knowledge (TOK), Creativity, Activity, Service (CAS), and the Extended Essay (EE) — into teaching, assessment, and inquiry-based learning. These integrations strengthen students' conceptual understanding, promote real-world application, and foster global-mindedness.

1. Theory of Knowledge (TOK) Integration

Mathematics AI encourages students to question how mathematical knowledge is constructed, represented, and applied in real-world contexts. TOK prompts are embedded in each unit and explored through class debates, reflections, and assessment tasks.

Sample TOK Guiding Questions:

- *"How do mathematical models represent reality, and where do they fail?"*
- *"Does mathematical certainty exist, or is it influenced by context?"*
- *"How does technology shape the production of mathematical knowledge?"*
- *"Can statistics and data visualisations mislead as easily as they inform?"*

2. Creativity, Activity, Service (CAS) Integration

Mathematics AI links classroom learning to community action by applying mathematical tools to solve real-life problems. Students collaborate on projects that combine data analysis, modelling, and service-based outcomes.

Examples of CAS-Linked Activities:

- Climate Change Modelling: Predicting future energy usage patterns or Tesla campus carbon footprint.
- Community Surveys: Analysing statistical trends in health, safety, or environmental awareness.
- Financial Literacy Campaigns: Designing tools to help families understand budgeting, savings, and investments.
- Sports Performance Analytics: Collecting and modelling data for Tesla's school teams.

3. Extended Essay (EE) Integration

Students may choose to write their EE in Mathematics AI, focusing on applied research using modelling, statistics, and simulations. EE preparation is scaffolded across the two years, with checkpoints aligned to the course timeline.

Examples of EE Research Questions:

- *"How accurately can regression models predict CO_2 emissions in Ho Chi Minh City?"*
- *"To what extent can optimisation models improve renewable energy production on Tesla's campus?"*

- *"How effectively do Monte Carlo simulations estimate financial market risks?"*
- *"How reliable are logistic growth models when predicting disease outbreaks?"*

Course Overview

Year	Term	Unit Focus	Key Topics	SL/HL Differentiation	Assessment Focus	Core Integration (TOK / CAS / EE)
1	**T1**	**Number & Algebra**	Sequences, financial maths, logarithms	HL adds **compound growth models** & extended binomial analysis	Diagnostic quiz + IA planning	TOK: "Are numbers discovered or invented?"
1	**T2**	**Functions & Modelling**	Linear, exponential, logistic models	HL explores **composite and piecewise models**	Paper 1-style assessment	EE: Modelling disease spread; CAS: Analyzing school energy data
1	**T3**	**Applied Geometry & Trigonometry**	Vectors, transformations, 2D/3D measurement	HL includes **3D navigation modelling** & optimisation	IA proposal + short-response test	CAS: Designing sustainable school layouts
1	**T4**	**Statistics & Probability I**	Descriptive statistics, regression, sampling	HL adds chi-square tests, central limit theorem	IA draft submission	TOK: "Can statistics mislead as easily as they inform?"
2	**T1**	**Statistics & Probability II**	Hypothesis testing, probability distributions	HL integrates Monte Carlo simulations, multi-variable regression	Paper 2 extended-response	EE: Modelling COVID-19 spread scenarios
2	**T2**	**Calculus for Modelling**	Rates of change, integration, optimisation	HL explores **differential equations** & **Taylor approximations**	IA final submission	CAS: Modelling Tesla water usage; TOK: Predictive model limitations
2	**T3**	**HL Extensions & IA Consolidation**	Advanced modelling & IA refinement	HL focuses on **dynamic system simulations** + Paper 3 prep	Full mock exams	EE checkpoint, TOK reflections

2	**T4**	**Exam Preparation**	Applied case studies, modelling past papers	HL includes Paper 3 simulations and modelling workshops	Papers 1–3 mocks	CAS showcase, EE final submission

Scope and Sequence

Year 1 – Grade 11

Term 1 – Number & Algebra / Unit Focus: Sequences, financial mathematics, logarithms

Week	Focus Areas	SL / HL Differentiation	Assessment & IA Milestones	TOK / CAS / EE Integration
1–2	Introduction & diagnostic testing	HL reviews extended number sets & compound growth models	Diagnostic quiz	TOK: "Are numbers discovered or invented?"
3–5	Sequences & series	HL explores extended binomial expansions	Practice tasks	TOK discussion on infinity & convergence
6–7	Logarithms & exponents	HL includes complex logarithmic modelling	Problem-solving set	CAS: Budget planning using financial models
8–9	Financial mathematics	HL applies compound growth & annuity models	Applied practice	CAS: Personal finance awareness project
10	IA orientation	HL selects extended modelling contexts	IA brainstorming	EE topic exploration checkpoint

Term 2 – Functions & Modelling / Unit Focus: Linear, exponential, and logistic models

Week	Focus Areas	SL / HL Differentiation	Assessment & IA Milestones	TOK / CAS / EE Integration
1–2	Linear models	HL develops composite & piecewise models	Paper 1-style assessment	EE: Regression models for energy efficiency
3–5	Exponential & logistic models	HL integrates multi-variable systems	IA context selection	CAS: Modelling campus energy use
6–7	Function transformations	HL explores dynamic simulations	Formative check	TOK: Limitations of modelling human behaviour
8–9	Technology-driven modelling	HL applies Desmos, GeoGebra, and Excel	Practical activity	CAS: Predicting school resource consumption
10	IA proposal workshop	HL refines IA methodologies	IA proposal submission	EE proposal approval checkpoint

Term 3 – Applied Geometry & Trigonometry / Unit Focus: Vectors, transformations, 2D/3D measurement

Week	Focus Areas	SL / HL Differentiation	Assessment & IA Milestones	TOK / CAS / EE Integration
1–3	Vectors in 2D	HL applies 3D navigation modelling	Practical task	CAS: Designing sustainable school layouts
4–6	Transformations & scaling	HL explores geometric optimisation	IA methodology check	TOK: "Do models simplify or distort reality?"
7–8	Trigonometric modelling	HL integrates advanced trig applications	Short-response assessment	CAS: Modelling roof solar panel installations
9–10	IA reflection	HL drafts IA introduction & plan	IA refinement	EE literature review checkpoint

Term 4 – Statistics & Probability I / Unit Focus: Descriptive statistics, regression, sampling

Week	Focus Areas	SL / HL Differentiation	Assessment & IA Milestones	TOK / CAS / EE Integration
1–3	Descriptive statistics	HL includes chi-square analysis	Practical exercise	TOK: "Can statistics mislead?"
4–6	Regression modelling	HL adds multi-variable regression	IA data preparation	CAS: Survey analysis for community well-being
7–8	Sampling & bias	HL explores central limit theorem	IA draft development	EE: First draft review checkpoint
9–10	Technology-based visualisation	HL integrates advanced simulations	Paper 2-style test	TOK: Accuracy of predictive modelling

Year 2 – Grade 12

Term 1 – Statistics & Probability II / Unit Focus: Hypothesis testing & probability distributions

Week	Focus Areas	SL / HL Differentiation	Assessment & IA Milestones	TOK / CAS / EE Integration
1–3	Hypothesis testing	HL explores Monte Carlo simulations	Problem-solving set	EE: Predicting environmental patterns
4–6	Probability distributions	HL covers multi-variable modelling	Applied practice	CAS: Modelling population growth

7–8	Simulation-driven decision-making	HL integrates computational methods	IA feedback review	TOK: “Can probability predict reality?”
9–10	Consolidation	HL prepares Paper 3 techniques	Paper 2-style test	EE topic refinement checkpoint

Term 2 – Calculus for Modelling / Unit Focus: Rates of change, optimisation, integration

Week	Focus Areas	SL / HL Differentiation	Assessment & IA Milestones	TOK / CAS / EE Integration
1–3	Differentiation basics	HL applies parametric derivatives	Paper 2 extended-response	CAS: Optimising Tesla’s water systems
4–5	Integration for area & volumes	HL introduces Taylor/Maclaurin approximations	Applied investigation	TOK: “Are models ever perfect?”
6–8	Optimisation in modelling	HL covers differential equations	IA finalisation	EE data analysis milestone
9–10	IA submission workshop	HL supports dynamic simulations	IA final submission	EE mid-draft review

Term 3 – HL Extensions & Consolidation / Unit Focus: Advanced modelling, IA refinement

Week	Focus Areas	SL / HL Differentiation	Assessment & IA Milestones	TOK / CAS / EE Integration
1–3	HL modelling simulations	HL focuses on Paper 3 problem-solving	Paper 3 simulations	EE checkpoint
4–6	IA consolidation & review	HL integrates iterative modelling	Full mock exams	TOK: “Limits of model reliability”
7–8	Monte Carlo & dynamic systems	HL extends advanced technology applications	Practical activity	CAS: Renewable energy optimisation
9–10	Revision & strategy workshop	HL emphasises Paper 3 prep	Mock review session	EE finalisation checkpoint

Term 4 – Exam Preparation / Unit Focus: Past paper analysis, applied case studies

Week	Focus Areas	SL / HL Differentiation	Assessment & IA Milestones	TOK / CAS / EE Integration
1–4	Review Papers 1 & 2	HL integrates Paper 3 preparation	Paper 1–3 mock exams	EE final submission

5–7	Exam strategies	HL advanced problem-solving techniques	Feedback workshop	CAS showcase
8–9	Final IB exam preparation	HL consolidation & Paper 3 refinement	Exam simulations	TOK: Reflective modelling discussions
10	Post-exam reflection	HL concludes HL-only simulations	Final IB exams	Graduation reflection

Assessment Calendar

Term	Assessment	Type	Weight	Assesses
Y1 T1	Diagnostic Quiz	Formative	–	AO1
Y1 T2	Paper 1-Style Assessment	Summative	5%	AO1, AO2
Y1 T3	IA Proposal	Internal	–	AO2, AO3
Y1 T4	IA Draft Submission	Internal	–	AO2, AO3
Y2 T1	Paper 2-Style Assessment	Summative	10%	AO1, AO2
Y2 T2	IA Final Submission	Internal	**20%**	AO2, AO3
Y2 T3	Mock Exams *(P1, P2, P3 HL)*	Summative	15%	AO1, AO2, AO3
Y2 T4	Final IB Exams	External	**80%**	AO1, AO2, AO3

Core Integration and Resource Use

The IB DP Mathematics AI curriculum at Tesla integrates Theory of Knowledge (TOK), Creativity, Activity, Service (CAS), and the Extended Essay (EE) throughout all units. Students use a combination of technology, authentic datasets, modelling tools, and simulations to develop practical problem-solving skills and connect mathematical concepts to real-world applications.

1. Resources & Tools

Technology Platforms

- TI-Nspire CX & GDC – Core graphing calculator for Paper 1, Paper 2, and Paper 3.
- Desmos & GeoGebra – Visualising dynamic models, regression, and geometry applications.
- Excel / Google Sheets – Large dataset handling, financial models, and hypothesis testing.
- Python (HL optional) – Simulations for dynamic systems and Monte Carlo modelling.

Databases & Data Sources

- World Bank & IMF Data – Economic modelling and sustainability applications.
- IPCC Climate Reports – Climate projections and environmental modelling.
- Statista & UN Data – Real-life datasets for IA and Paper 2 investigations.
- OECD & WHO Databases – Demographics, population modelling, and health statistics.

Simulations & Learning Platforms

- PhET Interactive – Probability, statistics, and applied modelling experiments.
- InThinking Mathematics AI – IB-specific lesson banks, assessment exemplars, and teaching strategies.
- Khan Academy & IB Math AI Toolkit – Reinforcement of conceptual skills through adaptive practice.
- ExploreLearning Gizmos – Virtual simulations for optimisation, distributions, and regression.

IB-Specific Resources

- IB Mathematics AI Formula Booklet – Compulsory reference for both SL and HL assessments.
- Specimen Papers & Past IB Exam Papers – Practice materials for authentic exam readiness.
- IA Exemplars & Teacher Support Materials (TSM) – Moderation calibration and feedback examples.
- IB Programme Resource Centre (PRC) – Assessment guidance and verified exemplar bank.

Collaborative Planning & Reflection

Tesla's Mathematics AI team works collaboratively across subjects and programmes to ensure conceptual alignment, standardisation of assessments, and authentic interdisciplinary integration.

Vertical Alignment

- Alignment with MYP Mathematics to ensure students enter DP with a solid foundation in algebra, data modelling, and technology-based applications.
- Pre-DP diagnostic tools benchmark student readiness and inform differentiated support strategies.

Horizontal Alignment

- Collaborative planning with Physics, Business Management, and Economics to design interdisciplinary modelling projects (e.g., predicting energy consumption, optimising logistics, or evaluating financial strategies).
- Shared use of datasets and digital tools across subjects to build consistency in analytical approaches.

IA Standardisation & Moderation

- Termly IA moderation meetings to ensure standardisation of marking against IB criteria.
- Cross-marking workshops within the Mathematics team and DP Core to improve feedback quality.
- Use of IB IA exemplars and PRC commentaries for calibration and teacher consistency.

TOK, CAS, and EE Integration Workshops

- Joint planning with the DP Core Team to integrate TOK discussion prompts into modelling-based units.
- EE support sessions for students exploring mathematical modelling within real-world contexts.
- CAS opportunities embedded into IA design, such as modelling school resource consumption or analysing community survey data.

Ongoing Reflection & Professional Development

- End-of-term reflection sessions within the Mathematics team to evaluate unit effectiveness, IA progress, and student outcomes.
- Regular participation in IB regional workshops, IB Math AI educator forums, and cross-campus moderation.
- Updating Tesla's Math AI teaching strategies to align with the latest IB curriculum updates and assessment trends.