Student's Name: _____

Grade 11th

مدارس البكالوريا
BACCALAUREATE SCHOOLS

13th November, 2025

Q1) A new solar panel system is installed on a school rooftop. Due to dust buildup and gradual wear, the panel's energy output (in kWh per day) decreases over time.

- On installation day, the output is **60 kWh/day**.
- After **30 days**, the output drops to **54 kWh/day**, and after **90 days**, it's **42 kWh/day**.

Assume the decrease in energy output follows a **quadratic pattern** over time.4

a. Find a quadratic equation $E(t) = at^2 + bt + c$modeling the energy output, where $t$is days since installation.
b. Predict after how many days the output will drop below **30 kWh/day**.
c. Interpret what this means in terms of maintenance scheduling.

Q2) A ride-share company charges fares based on both time and distance.

- For the first 5 km, the cost increases linearly at a rate of 2.5 currency units per km.
- Beyond 5 km, the company adds a congestion fee that grows quadratically with distance due to traffic conditions.

The additional cost is $0.1(x-5)^2$, where x is the total distance traveled (km).

a. Construct a **piecewise function** for the total cost $C(x)$.
b. Graph the function for $0 \leq x \leq 15$.
c. Find the distance at which the **rate of increase** in cost (the derivative) first exceeds **4 currency units per km**, and explain its meaning for long trips.

Q3) A farmer has 800 meters of fencing and wants to build a rectangular pen divided into two equal smaller pens by one internal fence parallel to one side.

The area of the total enclosure depends on how she allocates the fencing.

a. Express the total area Aas a quadratic function of the width w.
b. Determine the dimensions that maximize the area.
c. Explain how the result would change if one internal fence were removed.

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Q4) An engineer is designing a parabolic section of a roller coaster.

- The car enters the section at ground level at $x = 0$, rises to a maximum height of 30 meters at $x = 50$meters, then descends back to ground level at $x = 100$meters.

a. Write the quadratic function $h(x)$representing the height of the car.
b. Determine the slope (rate of ascent/descent) at $x = 25$and $x = 75$.
c. If the car must never exceed a **slope magnitude of 1.2**, determine if this design meets the safety requirement.

Q5) A tech startup's monthly **revenue** and **costs** are modeled as follows:

- Revenue grows **linearly** with time: $R(t) = 50{,}000t + 80{,}000$, where $t$is in months.
- Costs grow **quadratically** due to scaling expenses: $C(t) = 10{,}000t^2 + 60{,}000$.

a. Find the month when the company breaks even.
b. Determine the time interval during which the company operates at a loss.
c. Discuss how changing the rate of revenue growth would shift profitability (qualitatively).