Find the Maximum Area

Grade 12 | Mathematics | Visual learning | 40 minutes

Learning target

Optimize a quadratic under a perimeter constraint and interpret its domain and vertex.

Prerequisites and materials

Algebraic substitution and quadratic vertex form; no calculus required. Provide pages 2-3, pencil, and a calculator if needed. These are paper-based analyses of fictional data; no physical experiment is required.

Teaching sequence

7 min: Read the data and vocabulary.

8 min: Trace the diagram or organizer with a partner.

15 min: Complete the four application questions.

7 min: Compare calculations and justify conclusions.

3 min: Identify one limit of the model.

Assessment and access

12 points: 3 per response. Keep calculations, units, and reasoning visible. Allow oral rehearsal, annotate variables, and supply a calculator or worked example with different values during practice. For assessment, clarify directions without giving answers.

Extension

If one side lies along a wall and needs no fencing, derive the new area function before optimizing.

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PREVIEW - first two pages only. Full package includes responses and answer key.



Lesson reference

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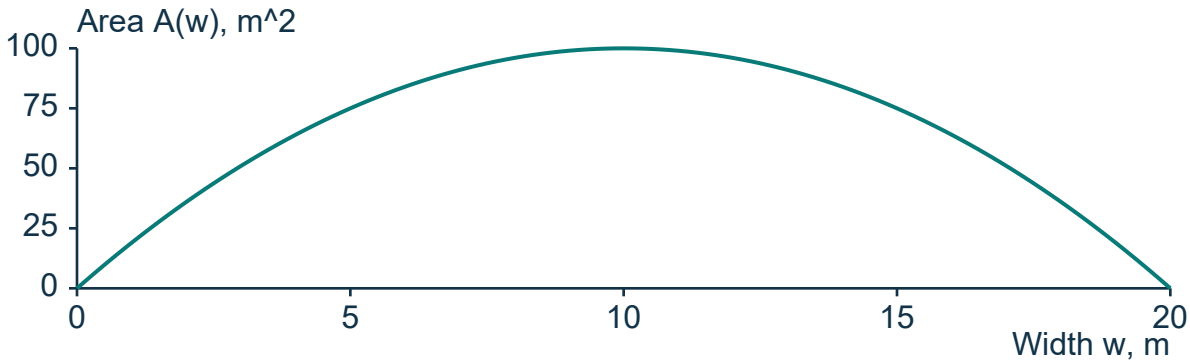
A fictional rectangular garden has exactly 40 m of fencing for all four sides, with no gates. Let width w and length l be positive real numbers. Ignore fence thickness and ground restrictions.

Vocabulary	Meaning
constraint	An equation or inequality restricting the choices.
objective function	The quantity to optimize, expressed using a variable.
maximum	The greatest value within the allowed domain.

Reference data

Relationship	Model
Perimeter	2w + 2l = 40, so l = 20 - w
Area	A(w) = w(20 - w) = -w^2 + 20w
Domain	0 < w < 20; both dimensions must be positive.

Use the visual model



Rules and assumptions

Complete the square: A(w) = 100 - (w - 10)^2. The squared term is nonnegative, so area cannot exceed 100 m^2. Use the graph together with the exact equation; a sketch alone is not a proof.



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