MATHWRIGHT / GRADES 6–7 / GEOMETRY

Courtyard Design Challenge

Design a school courtyard with three activity zones and a $350 budget.

Name _____ Date _____

G GARDEN

4 m × 3 m

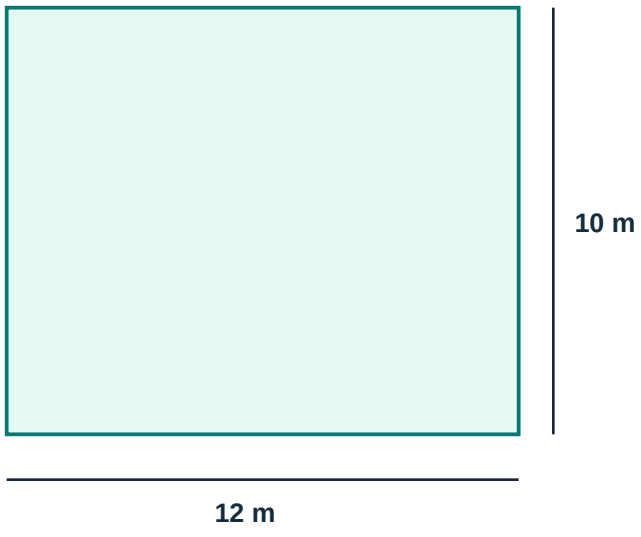
S STAGE

Right triangle

Q QUIET ZONE

L-shaped patio

The school has a rectangular site that is 12 m long and 10 m wide. You will draw a scaled plan, calculate how much material you need, and pitch a design.



The design brief

Fit all three zones inside the site with no overlap.

Use grass on every part of the site outside the three zones.

Stay within $350, including any optional upgrade.

1 Predict which zone will cover the most ground. The quiet zone is a 4 m by 4 m square with a 2 m by 2 m corner cut out. Explain your guess.

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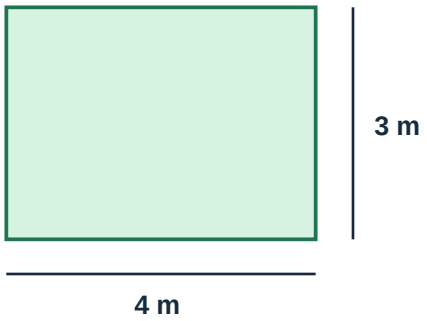
Measure the site and garden

Decide when to count square meters and when to count meters.

MEASURE THE RIGHT THING

Area measures the space inside a shape in square meters. Perimeter measures the distance around the outside in meters.



Put edging along all four sides of the garden. The courtyard itself already has an outside fence.

2a Find the area and perimeter of the entire courtyard. Label each answer with the correct units.

2b Find the area of the garden and the length of edging needed. Show each calculation.

2c A student orders 12 meters of edging because 4 × 3 = 12. Explain what the 12 actually measures.

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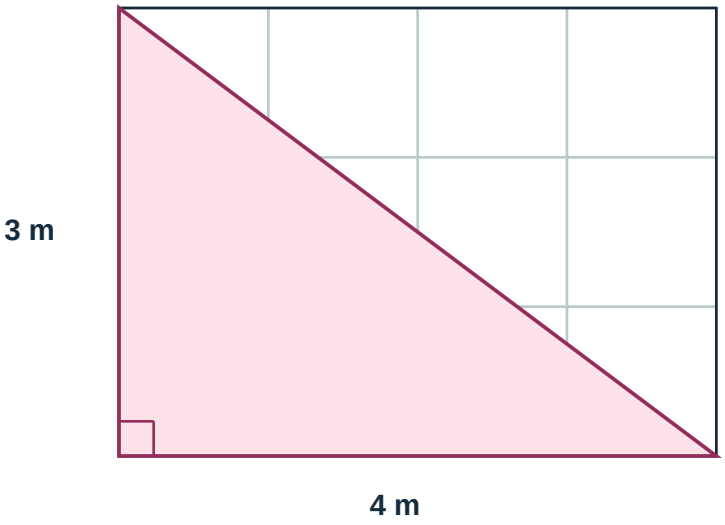
Build a triangular stage

Use a rectangle to explain the area of a right triangle.

The stage is the shaded part.



The stage has perpendicular sides of 4 m and 3 m. The light grid shows the full rectangle.

3a Find the area of the full rectangle and then the area of the stage. Explain how the diagonal helps you.

3b Suppose the 4 m side stays the same, and the perpendicular side changes to 6 m. What is the new stage area? Describe what changed.

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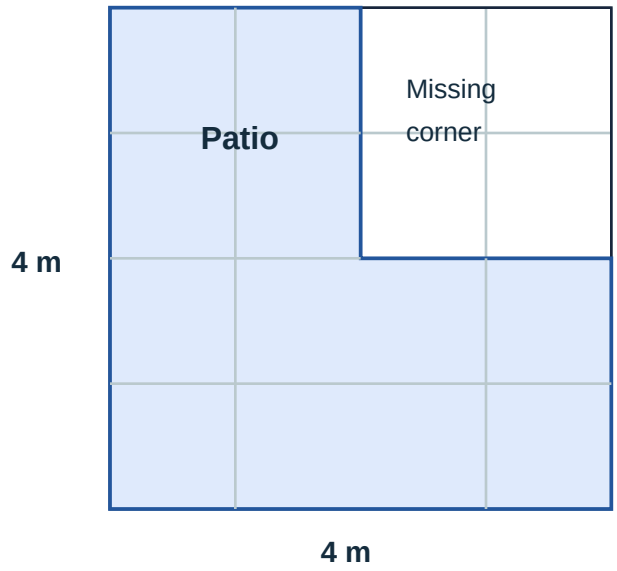
Tile an L-shaped quiet zone

Find the area of a composite shape in two ways.

The quiet zone fits inside a 4 m by 4 m square with a 2 m by 2 m corner removed. Each grid square represents 1 square meter.



4a Start with the full square. Subtract the missing corner to find the patio area.

4b Draw a line on the diagram to split the patio into two rectangles. Label their dimensions and use both areas to check your answer.

4c How much fence would go around all six edges of the patio? Use the grid to include the two edges beside the missing corner.

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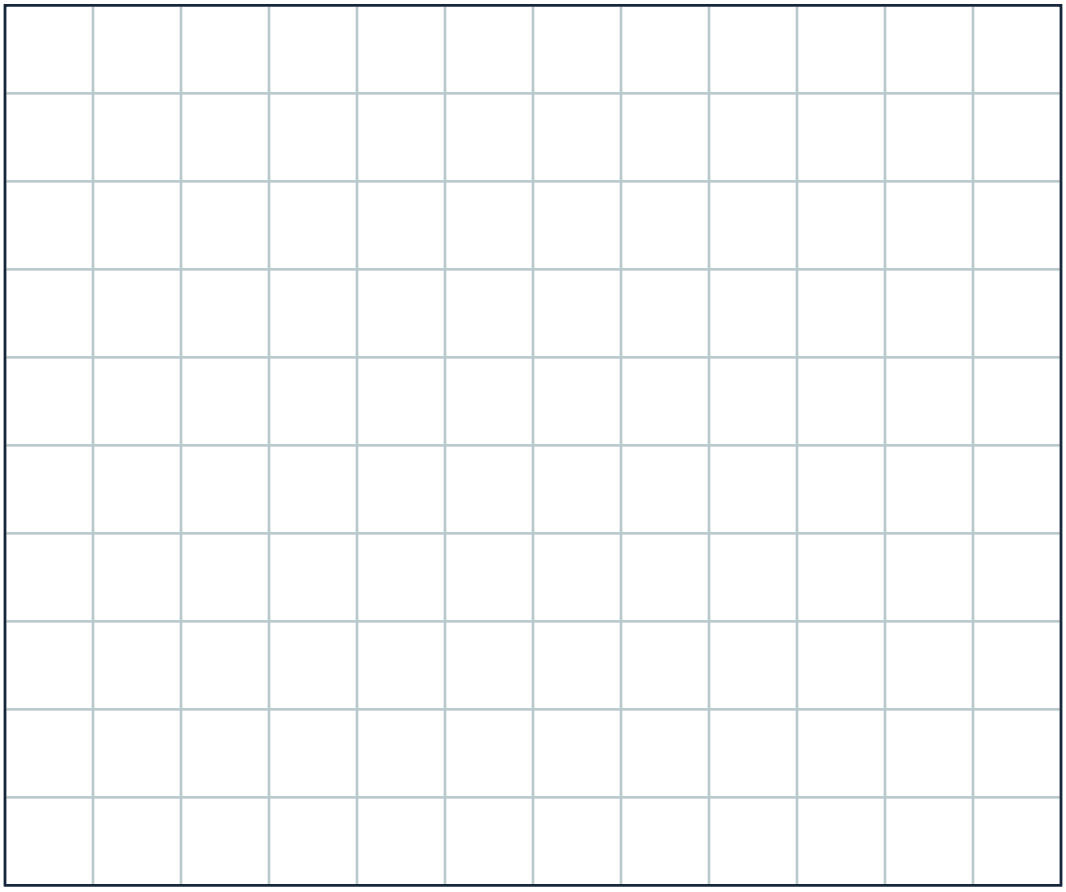
Draw your courtyard plan

Use the grid to turn your measurements into a design.

Draw and label the garden (G), stage (S), and quiet zone (Q). Match the dimensions on pages 2–4. You may turn or flip any zone. Keep every zone inside the site with no overlap. Label the remaining space as grass.



Each square represents 1 m by 1 m.

5a How many square meters of grass will you need? Use the entire site area and the areas of the three zones.

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Shop within the budget

Turn your measurements into a cost estimate.

Material	Unit price	Quantity	Cost
Garden edging	$3 per m		
Stage flooring	$8 per square m		
Patio tiles	$5 per square m		
Grass	$2 per square m		

6a Fill in the quantities and costs. Show how you calculated the total and how much of the $350 budget remains.

OPTIONAL UPGRADES

Bench for $18 **Shade sail for $24**

6b Which upgrade, if any, fits the original budget? How much money would remain afterward?

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Pitch and revise your design

Use your measurements to support a recommendation.

THE SCHOOL COUNCIL WANTS SHADE

The council raises the budget to $360. It wants the same three zones and a shade sail. It also asks whether you can add the bench.

7a Can the school add the shade sail only? Can it add both upgrades? Show both totals and compare them with $360.

7b Write a short pitch for your design. Include the grass area, the upgrade you recommend, and the final cost. Explain one reason for your layout.

7c Swap plans with a partner. Ask them to check the scale, zone sizes, and total cost. Record one thing they checked.

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MATHWRIGHT / WORKED SOLUTIONS

Site and zone measurements

Worked solutions for student pages 1–4

Page 1 / Predict

1 Sample prediction. The garden might cover the most ground because its full 4 m by 3 m rectangle is filled. Accept any reasonable prediction. The garden and quiet zone tie at 12 square meters.

Page 2 / Site and garden

2a Courtyard area = 12 × 10 = 120 square meters. Perimeter = 2 × (12 + 10) = 44 meters.

2b Garden area = 4 × 3 = 12 square meters. Edging length = 4 + 3 + 4 + 3 = 14 meters.

2c The 12 measures the area inside the garden in square meters. Edging follows the outside and takes 14 meters.

Page 3 / Stage

3a The full rectangle covers 4 × 3 = 12 square meters. Its diagonal divides it into two equal triangles, so the stage covers 12 ÷ 2 = 6 square meters.

3b The new area is (4 × 6) ÷ 2 = 12 square meters. Doubling the perpendicular side doubles the area when the other side stays fixed.

Page 4 / Quiet zone

4a The full square covers 4 × 4 = 16 square meters. The missing corner covers 2 × 2 = 4 square meters. The patio covers 16 minus 4 = 12 square meters.

4b Example split. Use a 4 m by 2 m bottom rectangle and a 2 m by 2 m top-left square. Add 8 and 4 to get 12 square meters.

4c Starting at the bottom and tracing counterclockwise, add 4 + 2 + 2 + 2 + 2 + 4 = 16 meters.

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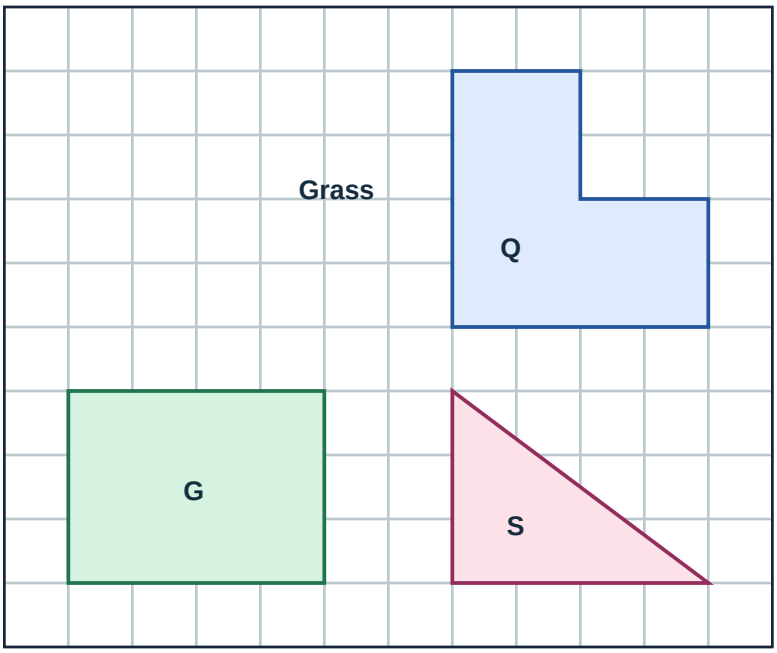
Sample plan and estimate

Worked solutions for student pages 5–6

Page 5 / One possible plan



G = Garden

S = Stage

Q = Quiet zone

Unshaded = Grass

Check each zone’s dimensions and make sure the outlines stay inside the site and do not overlap.

Each square represents 1 m by 1 m.

5a Grass area = 120 minus (12 + 6 + 12) = 90 square meters.

Page 6 / Original budget

Material	Quantity	Calculation	Cost
Garden edging	14 m	14 × $3	$42
Stage flooring	6 square m	6 × $8	$48
Patio tiles	12 square m	12 × $5	$60
Grass	90 square m	90 × $2	$180

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Budget and design pitch

Worked solutions for student pages 6–7

Page 6 / Total and optional upgrades

6a Base cost = $42 + $48 + $60 + $180 = $330. The original budget leaves $350 minus $330 = $20.

6b The $18 bench fits. The total is $348, with $2 remaining. The $24 shade sail on its own would bring the total to $354, which is $4 over the original budget.

Page 7 / Revise the design

7a Shade sail only. $330 + $24 = $354. This is $6 below the $360 budget. Both upgrades. $330 + $24 + $18 = $372. This is $12 over budget.

7b Sample pitch. Our design leaves 90 square meters of grass. We recommend the shade sail, bringing the total to $354. The garden is on the left, with the stage and patio on the right, leaving a large open grass area in the upper left.

7c Sample partner check. My partner counted 4 by 3 grid squares for the garden, checked that no zones overlap, and re-added the costs to get $354.

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