

Plan, Model, Solve

Connect strip diagrams, equations, tables, and formulas.

GRADE 4 • TEKS 4.5

4.5 "Algebraic reasoning. The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to: represent multi-step problems involving the four operations with whole numbers using..."

NAME _____

DATE _____

SHOW THE RELATIONSHIP

A letter can stand for an unknown quantity. A strip diagram shows how parts make a whole; equal sections show equal quantities. An input-output table connects each position with its value. Perimeter measures a boundary; area counts square units. Use the printed dimensions, not a ruler.

WORKED EXAMPLE

Four packs hold 6 tickets each. Then 5 tickets are given away. Let r be the number remaining. Connect the two strips to an equation.

Start	6	6	6	6	} 24 tickets
After	5	r			

- Four equal groups make $4 \times 6 = 24$ tickets. The second strip splits that total into 5 given away and r remaining.
- $4 \times 6 - 5 = r$, so $r = 19$.

Answer: 19 tickets remain.

PRACTICE 4 problems

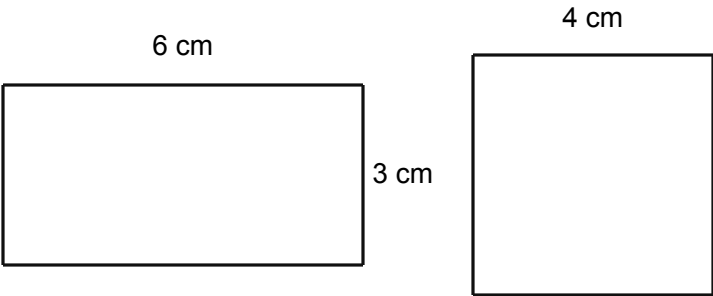
- 1** A booth starts with 5 packs of 8 tickets. After some are given away, 34 remain. Label the blank section of the second strip g for tickets given away. Write an equation using g , solve it, and check.

Start	8	8	8	8	8	} 40 tickets
After		34				

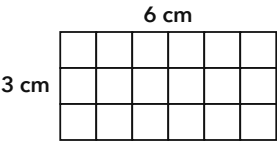
- 2 Jar 1 holds 6 tokens; each next jar holds 4 more tokens than the previous jar. Complete the table. Write a rule using the position n , then use it to find the number in jar 6.

POSITION AND VALUE	
Position n	Tokens in jar
1	6
2	—
3	—
4	—
5	—

- 3 Trace the four sides of the rectangle. Write the perimeter sum, then group equal sides to explain $P = 2l + 2w$. Use the square to explain why its special formula is $P = 4s$. Find both perimeters.



- 4 Each small square is 1 square cm. Use the array to explain why rectangle area is $A = l \times w$. Find this area. Then find the area of an 8 cm by 5 cm rectangle without counting squares one at a time.



APPLY IT Show your work

- 1** The first strip shows 72 beads in 3 equal bags. Each bag uses 8 beads. Label each blank part of the second strip b for beads left in one bag. Write an equation with b that uses division and subtraction. Then find the total left in all 3 bags.

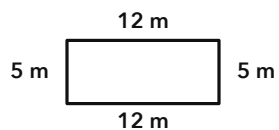
All bags

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72 beads**Each bag**

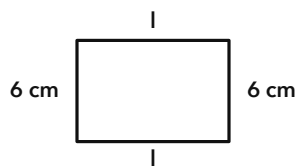
8		8		8	
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- 2** A classroom rug is 12 m by 5 m. Use formulas to find its perimeter and area. Explain why the answers use different units.



CHALLENGE One step up

The rectangle has perimeter 30 cm. Both unlabeled lengths are l and each width is 6 cm. Write an equation with l , solve it, then find the area. Explain why $30 - 12$ is not the length of just one side.



Accept equivalent equations that preserve the unknown and all steps. Jar outputs describe each jar separately, not a cumulative total. Students must connect the array and side-counting models to formulas, not just quote formulas. Both bead strips represent the same total; each bag is split into 8 used and b remaining. Require linear units for perimeter and square units for area.

PRACTICE 1

$5 \times 8 - g = 34$; $g = 6$. Label the blank section g . Check: $40 - 6 = 34$.

PRACTICE 2

Outputs: 6,10,14,18,22. Rule: $6 + 4 \times (n - 1)$, or $4n + 2$. Jar 6 holds 26 tokens.

PRACTICE 3

Rectangle: $6 + 3 + 6 + 3 = 18$ cm = $2 \times 6 + 2 \times 3$. There are two lengths and two widths. Square: $4 \times 4 = 16$ cm because all four sides are s .

PRACTICE 4

Three rows of 6 squares give $6 \times 3 = 18$ square cm. In general, l squares per row times w rows is $l \times w$. The 8 by 5 rectangle has area 40 square cm.

APPLY IT 1

$72 / 3 - 8 = b$, so $b = 16$ beads per bag. Label b . Total left: $3 \times b = 48$ beads.

The second row splits each bag into 8 used and b remaining. Three equal bags total 72; each bag has 24, so b is 16.

APPLY IT 2

$P = 2 \times 12 + 2 \times 5 = 34$ m. $A = 12 \times 5 = 60$ square m. Perimeter is a length; area counts squares.

The perimeter goes around the four sides; the area covers the inside.

CHALLENGE

$2l + 12 = 30$; $2l = 18$; $l = 9$ cm. Area = $9 \times 6 = 54$ square cm. The 18 cm is shared by two equal lengths.