

BLOCKBOTS NUMERACY SUPPLEMENT

ADDING LITERACY AND NUMERACY SUPPLEMENTS TO TINKERS LESSONS

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“Education is all a matter of building bridges.” ~ Ralph Ellison

This unit is designed to supplement the Block Bots section of the 9 Applied Design, Skills and Technology (ADST) Lessons found at <https://digmore.prn.bc.ca/helpful-resources/adst/>. ADST support exists for SD60 teachers, including materials, tools and training. Please contact your administrator if you'd like to access this support.

1. BLOCK BOTS



LEARNING INTENTIONS

LESSON TITLE	LITERACY/ NUMERACY TASKS	BRIEF OVERVIEW OF LESSON
<i>BLOCK-BOTS</i>	Numeracy Task: Area & Multiplication/Division. Show the relationship between Block Bot's area and multiplication/division facts (Gr 5). Curricular Competency: Develop, demonstrate and apply mathematical understanding through play, inquiry, and problem solving	After building a Block Bot, students will show the relationship between Block Bot's area & related division/multiplication facts.

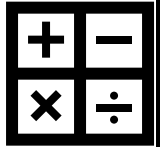
LESSON: AREA & BLOCK BOTS

Target Audience: Grade 5 students (measurement: area).

This lesson is adapted from “Well Played: Building Mathematical Thinking Through Games and Puzzles” (Dacey, Gartland & Lynch, 2015)

PREP WORK:

- Make Block Bot (*Alternatively, you could have randomly sized wooden building blocks for the kids to measure. Squares and rectangles will be easiest to work with, though more advanced students could figure area for L-shaped blocks. Most Kindergarten rooms have wooden blocks that you could borrow.*)
- Print game cards on cardstock (see below)– one set per group of 4.
- Copy 1cm Graph Paper (1 sheet per person)
- Copy Block Bot Math Worksheet (1 per person)



- *It is assumed that students already understand perimeter and have a basic-facts understanding of multiplication & division.*

MATERIALS LIST:

- Ruler
- Pencil
- 1cm Graph Paper (1 sheet per person)
- Block Bot Math Worksheet (1 sheet per person)
- 1 *Five of a Kind* deck of cards per foursome (see below)
- Optional: 1 *Five of a Kind* Directions sheet per group

QUESTION:

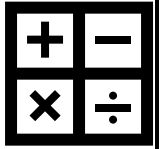
- Why play *5 of a kind* as you teach students about area?
 - Often, students see mathematical operations as separate, unrelated facts. As Mauro *et al* notes, “It is often easier to identify a missing factor in a format such as $9 \times \underline{\quad} = 36$ than to recognize the same relationship expressed in the division format such as $36 \div 9 = \underline{\quad}$ (Mauro, LeFevre, and Morris 2003). To identify that 48 divided by 6 is 8, many adults still think, *What times 6 is 48?* This game emphasizes the important relationships between multiplication and division, as well as provides practice. The goal of the game is to get five cards with equations (at the basic fact level) that have the same missing factor. The game provided includes two sets of cards in the game, one written in the form of missing factors and the other in missing quotients. There are seven matching missing factors or quotients in each set. Playing the same game with two different card formats supports students’ understanding of the relationship between multiplication and division” (Dacey *et al*, 2015).

GRADE 5 CURRICULUM:

- **Big Idea:** *Students will understand that “closed shapes have an area that can be described, measured and compared.”*
- **Curricular Competency:** Develop mental math strategies (for multiplication) and abilities to make sense of quantities.
- **Content:** multiplication and division facts to 100 (emerging computational fluency)

VOCABULARY:

- **Perimeter:** Perimeter is the distance around the outside of a shape. Perimeter is found by adding together the length of all a shape's sides. The lines around the edge of a soccer field show the perimeter of the field.
- **Area:** area can be defined as the space occupied by a flat shape or the surface of an object. The area of a figure is the number of unit squares that cover the surface of a closed figure. The area is measured in square units such as square centimetres.
- **Array:** An array in math is an arrangement of objects, numbers or pictures in columns or rows. The purpose of an array is to help children understand multiplication and division.
- **Quotient:** the number resulting from dividing one number by another, the answer.



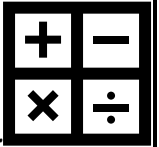
- For example, $15 \div 3 = 5$. The quotient (aka answer) is 5.
- **Factor:** a whole number that divides exactly into another number.
 - A whole number that multiplies with another number to make a third number.
 - For example, $4 \times 5 = 20$. 4 and 5 are factors of 20.

INTRODUCE THE LESSON:

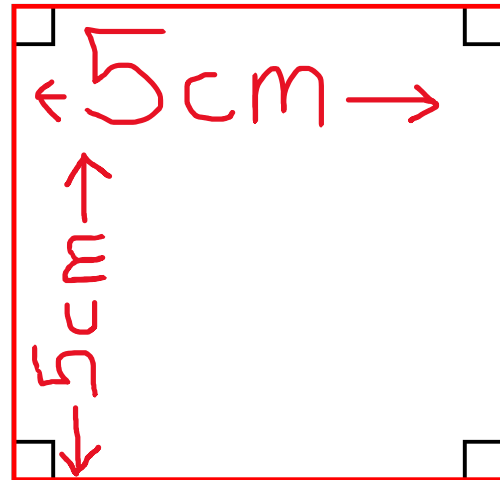
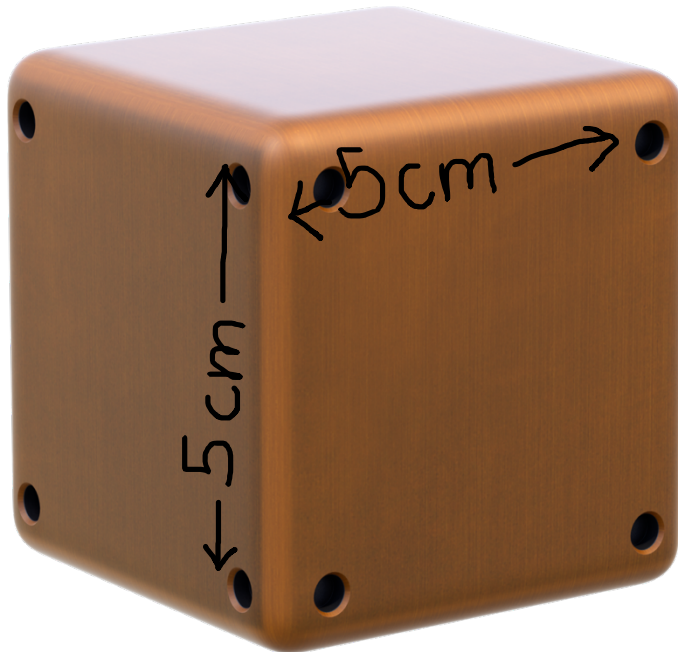
“We know that perimeter is the distance around something. If we wanted to measure how many meters of fence we need to go around the playground, we measure the perimeter. Today we’re learning about area. Area helps us know how much space is covering a flat shape or a surface. If we want to put tiles on a floor, we measure the area of the room. Today we’ll be measuring the face of our Block Bot and then we’ll transfer those measurements onto the graph paper. After that, we’ll play a game so you can practice your basic multiplication and division facts.” This will help us better understand how multiplication *and division* are connected to the area.

TEACH THE LESSON:

1. Pass out worksheets. Prompt: “We’ll just be working on the front side of your worksheet for now. Take out your rulers. Measure the length of your Block Bot’s face (to the nearest centimetre). Record the length on your worksheet.”
2. Prompt: “Measure the width of the Block Bot’s face (to the nearest centimetre). Record the length on your worksheet.”
3. Show this YouTube on [“introduction to the area”](#).
4. Prompt: “How would we draw the area of our block bots on graph paper?” (demonstrate on the projector).
5. Prompt: “To find the **area** of the block bot, we measure in squares. The example on the graph paper provided shows a block bot that is 5 cm long x 5 cm wide. Count the centimetre squares within the shape to find the area. We can cover the Block Bot example with 25 cm squares. We read this as 25 centimetres squared, but we write it as 25 cm^2 .”
6. “Now you find the area of your block bot. Just measure to the nearest centimetre for now.” (Pass out cm graph paper).
7. Ask students to show and tell the length and width of their block bot faces, as well as the multiplication array they made on their graph paper. Help them make connections to $4 \text{ cm} \times 6 \text{ cm} = 24 \text{ cm}^2$.
8. Allow students to walk around the class and see other students’ measurements and arrays.
9. “What connections did you make between your graph paper drawings and what you know about multiplication? When we show our multiplication facts on graph paper, it’s called making an array and it helps us visualize & better understand our multiplication facts.
10. Let’s see if we can figure out the measurements of a Block Bot by just giving you the area. What if my array was 25 cm^2 ? What would the length and width of my Block bot be? Are there any other measurements that might = 25 cm^2 ? (5×5 & 1×25). Explain how you know.
11. “Flip your worksheet over and complete the backside.”



Project this picture onto your whiteboard and/or demonstrate with an actual Block Bot & ruler.



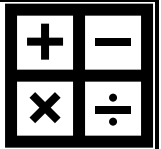
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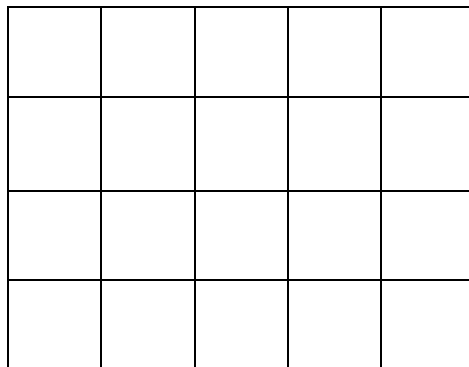
12. Extension: Students who are finished early can calculate the area of their Block Bots in millimeters first by estimating. For example, $(5\text{cm} \times 5\text{cm} = 25\text{cm}^2) = (50\text{mm} \times 50\text{mm} = 2500\text{mm}^2)$.
- More advanced students can measure in millimetres and perform the multiplication calculations for area in millimetres (For example, if the actual measurement of my block bot was $52\text{mm} \times 51\text{mm}$, I calculate $52 \times 51 = 2652\text{mm}^2$).
13. Discuss the relationship between multiplication and division facts. Prompt: "Draw an array that has a length and width of $3\text{cm} \times 5\text{cm}$. The area is 15cm^2 . When we look at the array we've drawn, we think of the following equations:
- $3 \times 5 = 15$ c. $15 \div 5 = 3$
 - $5 \times 3 = 15$ d. $15 \div 3 = 5$
14. Today we're going to play a game to help us practice finding missing factors up to 100. Your goal is to collect 5 playing cards with equations that have the same missing factor. Here are the rules:

"Five of a Kind" Rules

- Four Players sit in a circle.
- Sort the cards by putting cards with the same missing **factor** in the same pile. Choose five cards from each pile to use in the game. Put the other cards aside.
- Shuffle the cards.
- Deal 5 cards to each player.
- At the same time, each player looks at their own cards and decides on one card the player doesn't want. The player places that card facedown in front of the player to the right. All the players pick up their new cards so that each person once again has five cards in his or her hand.
- Players continue to pass and pick up cards, waiting for all players to pick up before the next pass begins.
- The first player to get 5 cards with equations that have the same missing factor says, "FIVE OF A KIND!" and wins.



16. PROJECT/DRAW THIS BLOCK BOT ARRAY AND DISCUSS.



Prompt: “What equations can be represented by this Block Bot’s array?”

Answer:

- $4\text{cm} \times 5\text{cm} = 20\text{cm}^2$
- $5\text{cm} \times 4\text{cm} = 20\text{cm}^2$
- $20\text{cm}^2 \div 4\text{cm} = 5\text{cm}$
- $20\text{cm}^2 \div 5\text{cm} = 4\text{cm}$

Prompt:

Which equations show factors?

Answer = multiplication questions.

- 4 and 5 are FACTORS of 20

Which equations show a quotient?

Answer = division questions.

- When we divide 20 by 4, we get a QUOTIENT of 5.
- When we divide 20 by 5, we get a QUOTIENT of 4.

Prompt:

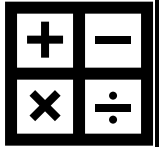
- Write $6x \underline{\quad} = 18$. Ask what FACTOR is missing.
- Write $5x \underline{\quad} = 55$. Ask what FACTOR is missing.
- Play the game just using Factor cards, as per the instructions above.

Gather students’ attention again.

- Write $50 \div 5 = \underline{\quad}$ Ask students to identify the QUOTIENT.
- Write $40 \div 10 = \underline{\quad}$ Ask students to identify the QUOTIENT.
- Play the game just using Quotient Cards.

PRO TIPS:

- Ask one student per team to set the card-passing pace by saying “pass/pick up” as appropriate.
- Some students may need a multiplication table nearby for reference. Student agendas often have these within. Here’s a [free download from nofusstutors.com](https://www.nofusstutors.com)
- Students can make their cards
- You can match facts to students if you have kids that don’t know all of their multiplication & division facts to 100 yet.



- Encourage the need for speed! These facts should be known well by grade 5. Practice makes perfect, but setting a timer for 5 minutes encourages kids to play hard and fast.
- You can combine the decks making sure there are four to six matches for each missing factor or quotient.
- You can use fewer cards for each matching missing number and have students collect 3 or 4 of a kind to win.
- You can use more cards and have students collect six or seven of a kind to win.
- Have students play cooperatively. Hands of cards stay face up for all to see through the game. There is no talking allowed in the game. The goal is to have everyone get a set of matched cards in the fewest number of passes.

END THE LESSON:

Exit slips: Project these questions on the board:

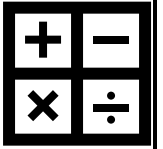
EXIT SLIPS

1. How would you rewrite $7\text{cm} \times \underline{\hspace{2cm}} = 42\text{cm}^2$ as a division problem?
2. What mathematics might you use to find $54 \div 6$ if you couldn't remember this quotient?
3. How can this game help you learn your division facts?
4. What are some tricks you know that help you solve for products and quotients? Be specific. For example, *Think 5,6,7,8 to remember that $56 \div 7 = 8$.*

INFORMAL ASSESSMENT

Play a game with each team and look for these markers of competency:

- Do students recognize inverse relationships?
- How do students determine the missing numbers?
- Do players make good choices when they pass cards? That is, do they pass a card without a match or with fewer matches than other cards they have in their hands?
- Can a student quickly recount their multiplication and division facts when asked?
 - A neat way to assess this is to have students draw two cards from a deck (9 and 3 for example) and then write the products and quotients for those factors.



FIVE OF A KIND FACTOR CARDS

$3 \times \underline{\quad} = 18$

$4 \times \underline{\quad} = 24$

$5 \times \underline{\quad} = 30$

$6 \times \underline{\quad} = 36$

$7 \times \underline{\quad} = 42$

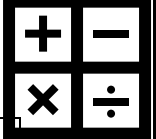
$8 \times \underline{\quad} = 48$

$9 \times \underline{\quad} = 54$

$3 \times \underline{\quad} = 21$

$4 \times \underline{\quad} = 28$

$5 \times \underline{\quad} = 35$



$6 \times \underline{\quad} = 42$

$7 \times \underline{\quad} = 49$

$8 \times \underline{\quad} = 56$

$9 \times \underline{\quad} = 63$

$3 \times \underline{\quad} = 24$

$4 \times \underline{\quad} = 32$

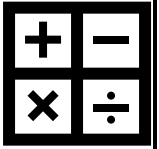
$5 \times \underline{\quad} = 40$

$6 \times \underline{\quad} = 48$

$7 \times \underline{\quad} = 56$

$8 \times \underline{\quad} = 64$

FIVE OF A KIND FACTOR CARDS



FIVE OF A KIND FACTOR CARDS

$$9 \times \underline{\quad} = 72$$

$$3 \times \underline{\quad} = 27$$

$$4 \times \underline{\quad} = 36$$

$$5 \times \underline{\quad} = 45$$

$$6 \times \underline{\quad} = 54$$

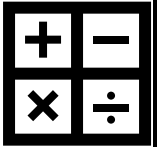
$$7 \times \underline{\quad} = 63$$

$$8 \times \underline{\quad} = 72$$

$$9 \times \underline{\quad} = 81$$

Five of a Kind Factor Cards adapted from:
*“Well Played: Building Mathematical
Thinking Through Games and Puzzles”*
(Dacey, Gartland & Lynch, 2015).

See pp. A33- A35 for original game
cards in “Well Played”.



FIVE OF A KIND QUOTIENT CARDS

$18 \div 3 = \underline{\quad}$

$24 \div 4 = \underline{\quad}$

$30 \div 5 = \underline{\quad}$

$36 \div 6 = \underline{\quad}$

$42 \div 7 = \underline{\quad}$

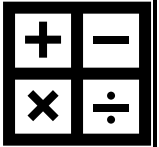
$48 \div 8 = \underline{\quad}$

$54 \div 9 = \underline{\quad}$

$21 \div 3 = \underline{\quad}$

$28 \div 4 = \underline{\quad}$

$35 \div 5 = \underline{\quad}$



FIVE OF A KIND QUOTIENT CARDS

$42 \div 6 = \underline{\quad}$

$49 \div 7 = \underline{\quad}$

$56 \div 8 = \underline{\quad}$

$63 \div 9 = \underline{\quad}$

$24 \div 3 = \underline{\quad}$

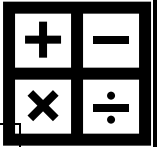
$32 \div 4 = \underline{\quad}$

$40 \div 5 = \underline{\quad}$

$48 \div 6 = \underline{\quad}$

$56 \div 7 = \underline{\quad}$

$64 \div 8 = \underline{\quad}$



$72 \div 9 = \underline{\quad}$

$27 \div 3 = \underline{\quad}$

$36 \div 4 = \underline{\quad}$

$45 \div 5 = \underline{\quad}$

$54 \div 6 = \underline{\quad}$

$63 \div 7 = \underline{\quad}$

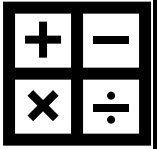
$72 \div 8 = \underline{\quad}$

$81 \div 9 = \underline{\quad}$

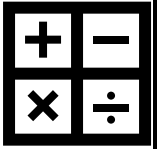
Five of a Kind Quotient Cards adapted from:
*“Well Played: Building Mathematical
Thinking Through Games and Puzzles”*
(Dacey, Gartland & Lynch, 2015).

See pp. A36- A38 for original game
cards in “Well Played”.

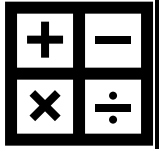
FIVE OF A KIND QUOTIENT CARDS



FIVE OF A KIND BLANK CARDS



FIVE OF A KIND BLANK CARDS



5 OF A KIND DIRECTIONS

MATERIALS:

- 1 Deck of “Five of a Kind” **factor** or **quotient** cards, made from five cards with the same missing factor per group of four players
- Optional: 1 “Five of a Kind” Directions per group

DIRECTIONS

- Four Players sit in a circle.
- Sort the cards by putting cards with the same missing **factor** in the same pile. Choose five cards from each pile to use in the game. Put the other cards aside.
- Shuffle the cards.
- Deal 5 cards to each player.
- At the same time, each player looks at their cards and decides on one card the player doesn't want. The player places that card facedown in front of the player to the right. All the players pick up their new cards so that each person once again has five cards in his or her hand.
- Players continue to pass and pick up cards, waiting for all players to pick up before the next pass begins.
- The first player to get 5 cards with equations that have the same missing factor says, “FIVE OF A KIND!” and wins.

Alternatives

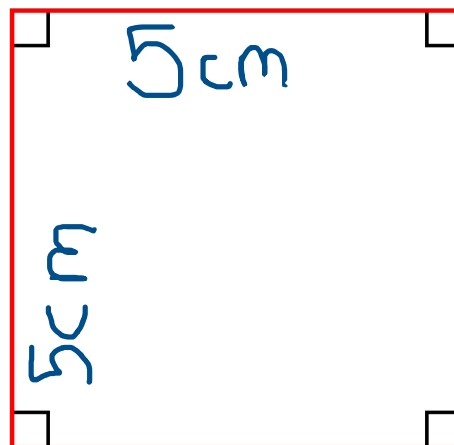
- Play with Quotient Cards instead of Factor Cards.
- Play with both Quotient Cards AND Factor Cards

Name: _____

Date: _____

Block Bots Area Worksheet

Measure the 2-dimensional face of your Block Bot.
Here's an example:



This Photo by Unknown Author is licensed under CC

1. Measure the face of your block to the nearest centimetre. Record the measurements below. Don't forget to indicate that you are measuring squares for area!

Block Bot Face	Centimeters (cm)	Millimeters (mm) <i>(Optional Extension Activity)</i>
Length	Example = 5 cm	Estimate _____ Actual _____
Width	Example = 5 cm	Estimate _____ Actual _____
Area	Example = 25 cm ²	

2. Explain how you know your area is correct. What connections do you make between your drawing on graph paper and what you know about multiplication?

3. Calculate the area:

a. $4\text{cm} \times 8\text{cm} =$ _____

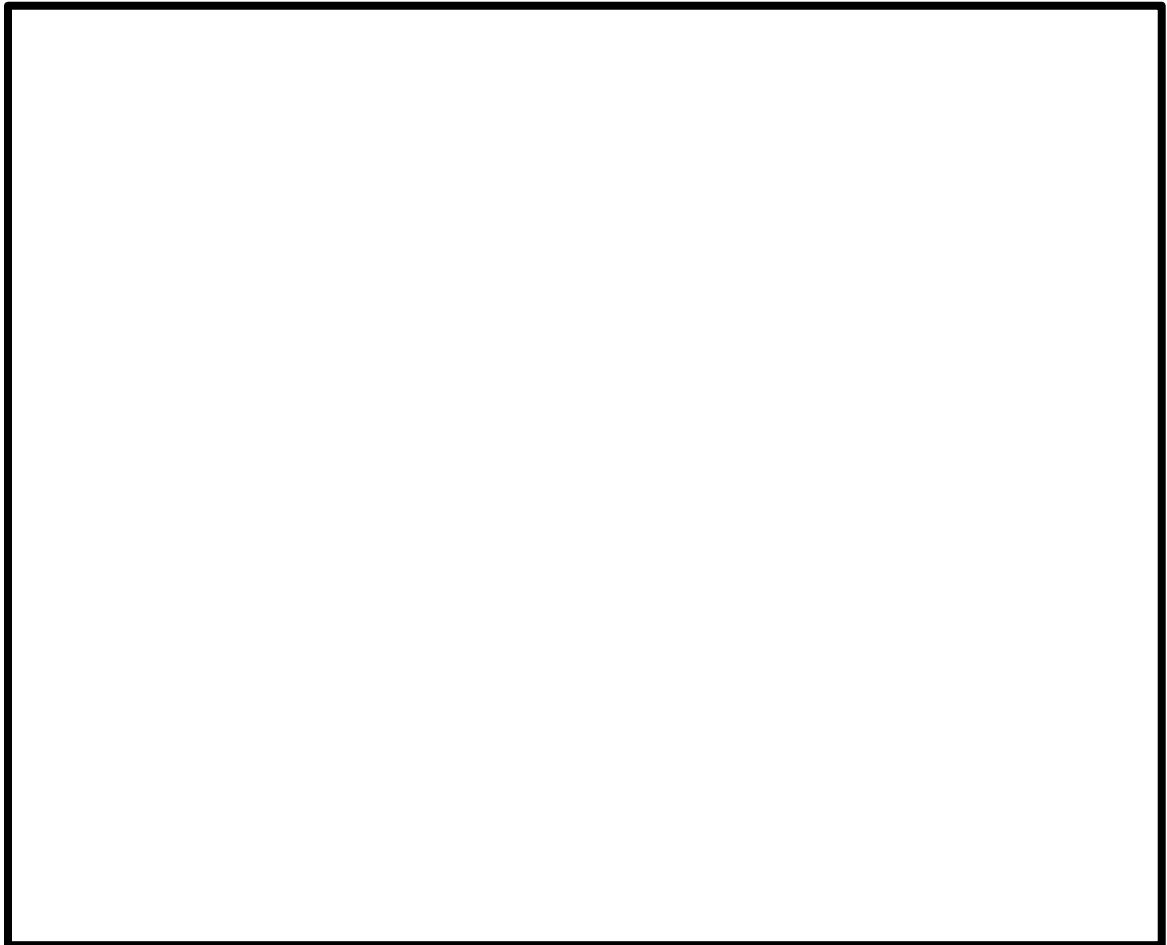
b. $3\text{cm} \times 4\text{cm} =$ _____

c. $6\text{cm} \times 5\text{cm} =$ _____

d. $9\text{cm} \times 6\text{cm} =$ _____

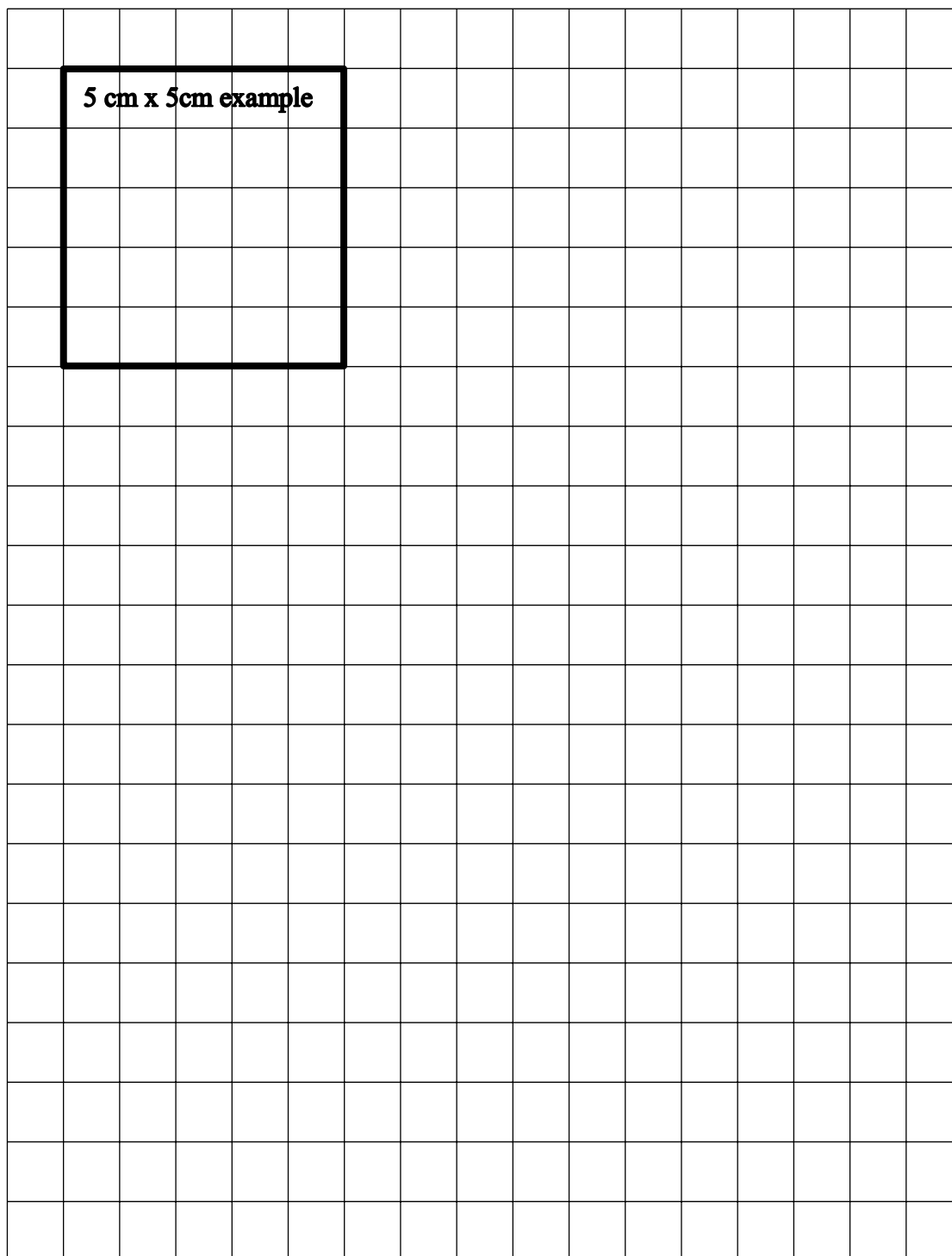
4. If the area of a Block Bot face is 24cm^2 then the length and width might be

_____ (list as many possible answers as you can think of. You may draw in the space below if you wish).



1 cm Graph Paper

One line per centimeter. Black lines.



Teacher Assessment Rubric

NAME:	NYM	MM	M	FM	E
I can demonstrate multiplication and division facts to 100 with emerging fluency					
I can do extension activities and accurately calculate multiplication and division to three digits. I can even divide with remainders.					
I know closed shapes have area and perimeter. I can measure area and perimeter. I can describe the area and perimeter.					
I can make reasonable estimations.					
I can develop my mental math strategies (like my multiplication facts) and play games that allow me to practice these skills.					
I can make sense of quantities like the area of a closed shape.					
I can visualize arrays and the area of a closed shape.					
I can communicate mathematical thinking in various ways					
I can represent mathematical ideas using manipulatives, pictures and equations.					

Teacher Comment:

Here's a sample of my work. *Cut and paste one of your area arrays with the measurements on it for length, width and area.*

Student Self-Assessment Rubric

NAME:	NYM	MM	M	FM	E
I know my multiplication facts to 100					
I know how to correctly multiply 2-digit numbers like 35×50					
I know closed shapes have area and perimeter. I can measure area and perimeter. I can describe the area and perimeter.					
I can make reasonable estimations.					
I can play games that allow me to practice my mental math skills in division and multiplication.					
I can divide a number like $550 \div 50 = \underline{\quad}$.					
I can even divide with remainders, in questions like $652 \div 50 = \underline{\quad}$.					
I can visualize arrays and the area of a closed shape.					
I can communicate mathematical thinking in various ways					
I can represent mathematical ideas using manipulatives, pictures and equations.					

Teacher Comment:

Here's a sample of my work. *Cut and paste one of your area arrays with the measurements on it for length, width and area.*