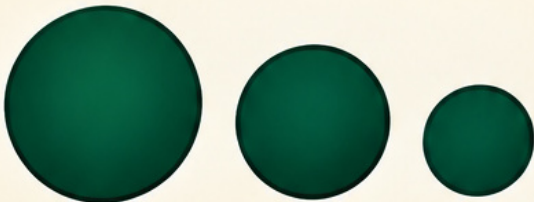


CLASS 16**Patterns and Sorting
with Numbers and Shapes**

Recognize. Sort. Extend. Create.

**2****4****6****8****10**

Discover the rules. Build your thinking.

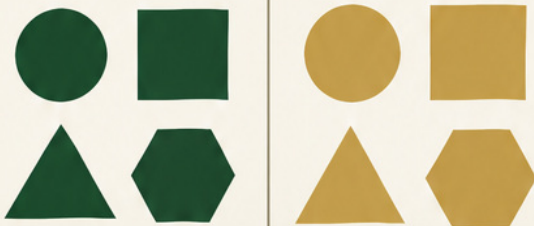
CLASS 16:

Patterns and Sorting with Numbers and Shapes

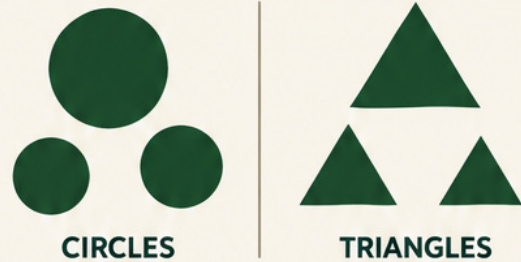
1. Sorting by Attributes

Group objects by color, shape, size, or number of sides.

COLOR



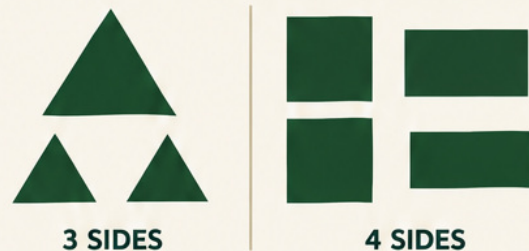
SHAPE



SIZE



NUMBER OF SIDES



Your turn:

Sort a collection of shapes in two different ways.

Image 1 practice: Sorting by attributes

Q1. You have a red circle, a blue circle, a red triangle, and a blue square. Sort them into a red group and a blue group.

Q2. Sort a circle, a triangle, a square, and a rectangle that is not a square into groups with 0, 3, and 4 straight sides.

Q3. A collection has a small triangle, a large triangle, a small circle, and a large circle. Sort by size.

Q4. A square card is turned so that one corner points up. Does it still belong in the four-sided group?

Q5. Choose everything that belongs in a group labeled “small and blue”: a small blue square, a large blue square, a small red circle, and a small blue triangle.

CLASS 16:

Patterns and Sorting with Numbers and Shapes

2. Sorting Numbers

Group numbers by a rule.

ODD OR EVEN

EVEN

2 4 6 8 10

Can be grouped into pairs.



6 is even.

ODD

1 3 5 7 9

One is left over when making pairs.



5 is odd.

COMPARE WITH 10

LESS THAN 10

3 6 9

GREATER THAN 10

12 15 18

10 is equal to 10, so it belongs in neither group.

Your turn:

Sort 7, 12, 5, 18, 9, and 4 into odd and even groups.

Image 2 practice: Sorting numbers

Q6. Sort 3, 8, 11, and 16 into odd and even groups.

Q7. Draw 7 dots and circle pairs. Is 7 odd or even? How many dots are left unpaired?

Q8. Sort 4, 10, 13, and 19 into "less than 10," "equal to 10," and "greater than 10."

Q9. From 6, 10, 14, and 17, choose every number that is even and greater than 10.

Q10. A tray has 9 counters. One more counter is added. Is the new total odd or even? Explain with pairs.

CLASS 16:

Patterns and Sorting with Numbers and Shapes

3. Recognizing Repeating Patterns

Find the smallest unit that repeats.

AB PATTERN



Repeating unit:
circle, square

AAB PATTERN



Repeating unit:
triangle, triangle, circle

ABC PATTERN



Repeating unit:
circle, square, triangle

A repeating pattern follows the same order again and again.

Your turn: What comes next?



Image 3 practice: Recognizing repeating patterns

Q11. Find the smallest repeating unit: triangle, square, triangle, square, triangle, square.

Q12. Find the smallest repeating unit: circle, circle, square, circle, circle, square.

Q13. Find the smallest repeating unit: square, triangle, circle, square, triangle, circle.

Q14. Continue the repeating pattern with two more numbers: 4, 7, 4, 7, 4, __, __.

Q15. Nora says the smallest unit is “triangle, square, triangle, square” in triangle, square, triangle, square, triangle, square. Is there a smaller unit?

CLASS 16:

Patterns and Sorting with Numbers and Shapes

4. Completing Patterns

Use the rule to find what is missing.

NUMBER PATTERN

2**4****?****8****10****Rule:** Add 2 each time.**Missing number:** 6

SHAPE PATTERN

**?****Rule:** Repeat circle, square.**Missing shape:** circle

YOUR TURN

Fill in each missing part.

A.**5****10****?****20****25****B.****?**

Look before and after the gap. Check that the same rule works throughout.

Image 4 practice: Completing missing parts

Q16. Add 2 each time. Fill the gap: 3, 5, __, 9, 11.

Q17. Subtract 2 each time. Fill the gap: 14, 12, __, 8, 6.

Q18. Repeat "square, triangle." Fill the gap: square, triangle, square, __, square, triangle.

Q19. Repeat "circle, square, square." Fill both gaps: circle, __, square, circle, square, __.

Q20. Add 3 each time. Fill both gaps: 2, __, 8, __, 14.

CLASS 16:

Patterns and Sorting with Numbers and Shapes

5. Extending Number Patterns

Find the rule, then continue the sequence.

COUNT FORWARD BY 2

2 $\xrightarrow{+2}$ 4 $\xrightarrow{+2}$ 6 $\xrightarrow{+2}$ 8 $\xrightarrow{+2}$ 10 $\xrightarrow{+2}$ 12

The next two numbers are 10 and 12.

ADD 5 EACH TIME

5 $\xrightarrow{+5}$ 10 $\xrightarrow{+5}$ 15 $\xrightarrow{+5}$ 20 $\xrightarrow{+5}$ 25 $\xrightarrow{+5}$ 30

The next two numbers are 25 and 30.

SUBTRACT 3 EACH TIME

18 $\xrightarrow{-3}$ 15 $\xrightarrow{-3}$ 12 $\xrightarrow{-3}$ 9 $\xrightarrow{-3}$ 6 $\xrightarrow{-3}$ 3

The next two numbers are 6 and 3.

YOUR TURN: Write the next two numbers.

A. 10 , 20 , 30 , 40 , ? , ?

B. 20 , 18 , 16 , 14 , ? , ?

Check that the same rule works at every step.

Image 5 practice: Extending number patterns

Q21. Add 2 each time. Write the next two numbers: 1, 3, 5, 7, __, __.

Q22. Add 5 each time. Write the next two numbers: 2, 7, 12, 17, __, __.

Q23. Subtract 2 each time. Continue: 19, 17, 15, 13, __, __.

Q24. Start at 6 and add 10 each time. Write the next three numbers.

Q25. The rule is "add 3." Correct the last number, then write one more: 4, 7, 10, 14.

CLASS 16:

Patterns and Sorting with Numbers and Shapes

6. Exploring Growing Patterns

Describe what changes from one step to the next.

ADD ONE SQUARE

Step 1



1 square

Step 2



2 squares

Step 3



3 squares

Step 4



4 squares

Rule: Add 1 square each time.



Gold shows the new square.

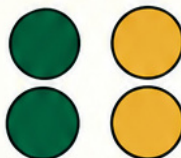
ADD TWO CIRCLES

Step 1



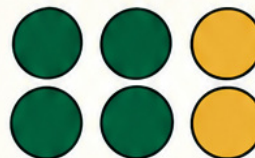
2 circles

Step 2



4 circles

Step 3



6 circles

Rule: Add 2 circles each time.



Gold shows the two new circles.

YOUR TURN: Draw the next step in each pattern.

1. How many squares will Step 5 have?

2. How many circles will Step 4 have?

Image 6 practice: Exploring growing patterns

Q26. Step 1 has 2 squares. Add 1 square at each new step. How many squares are in Step 2 and Step 3?

Q27. Step 1 has 3 circles. Add 2 circles at each new step. Draw Step 2 and Step 3.

Q28. A growing pattern adds the same number of squares each step. Its first three totals are 4, 7, 10. How many are added, and what is the Step 4 total?

Q29. Step 1 has 1 triangle. Add 2 triangles at each new step. How many triangles does Step 5 have?

Q30. Step 1 has 4 squares, and the rule is "add 2 squares each step." Eli says Step 3 has 10 squares. Correct him.

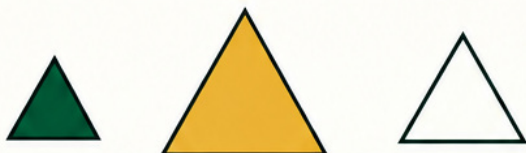
CLASS 16:

Patterns and Sorting with Numbers and Shapes

7. Finding the Sorting Rule

What do all the members of a group have in common?

LOOK AT THE SHAPES



**Rule: Every shape has
3 sides.**

Color and size can be different.

LOOK AT THE NUMBERS

2 4 6 8

**Rule: Every number
is even.**

Each number can be grouped
into pairs.

TEST THE RULE

Rule: Shapes with 4 sides

BELONGS



DOES NOT BELONG



YOUR TURN: Explain the rule.

11 13 15 17

What do these numbers have in common?

Choose a rule that works for every member of the group.

Image 7 practice: Finding and testing the sorting rule

Q31. A group contains a small red circle and a large blue circle. Which rule fits: "all red," "all small," or "all circles"?

Q32. A number group contains 12, 16, and 20, but excludes 13 and 17. Which rule fits: "even numbers" or "numbers greater than 10"?

Q33. The rule is "shapes with four straight sides." Which do not belong: square, triangle, circle, rectangle?

Q34. The rule is "numbers less than 15." The group is 8, 12, 15, 14. Which number should be removed?

Q35. A group contains a red triangle, a red square, and a blue square. Sam says the rule is "all red." Does that rule work? Give one rule that fits every shape.

CLASS 16:

Patterns and Sorting with Numbers and Shapes

8. Creating Patterns

Design a pattern and explain its rule.

CREATE A SHAPE PATTERN

Example:



My rule: Repeat circle, triangle.

Your pattern:

--	--	--	--	--	--

My rule:

CREATE A NUMBER PATTERN

Example:

3 6 9 12 15 18

My rule: Start at 3 and add 3 each time.

Your pattern:

--	--	--	--	--	--

My rule:

SHARE AND CHECK

1

Show your pattern to a partner.

2

Ask your partner to continue it.

3

Explain how your rule works.

Challenge: Create a growing shape pattern.

Draw three steps. What will the next step look like?

Step 1



Step 2



Step 3

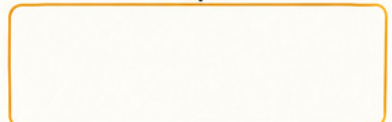


Image 8 practice: Creating and explaining patterns

Q36. Create an AB pattern using a square and a circle. Draw 6 shapes and state your rule.

Q37. Create an AAB pattern using two different shapes. Draw 9 shapes and name the repeating unit.

Q38. Create a number pattern that starts at 4 and adds 4 each time. Write the first 5 numbers.

Q39. Create a growing square pattern with 2 squares at Step 1 and 3 more squares at every new step. Draw Steps 1, 2, and 3.

Q40. Create a 4-number pattern that starts at 5. Choose either "add 2" or "add 5" and use your rule every time. Then write a fifth number for a partner to check.

Homework review: R1–R5

R1. Sort a green triangle, a yellow circle, a yellow triangle, and a green circle by shape.

R2. Sort 2, 7, 14, and 19 into even and odd groups.

R3. Find the smallest repeating unit: triangle, circle, circle, triangle, circle, circle.

R4. Add 4 each time. Fill the gap: 1, 5, __, 13, 17.

R5. Subtract 5 each time. Write the next two numbers: 28, 23, 18, __, __.

Homework review: R6–R8

R6. Step 1 has 5 circles. Add 2 each step. How many circles are in Step 4?

R7. The rule is “odd numbers greater than 10.” Which of 9, 11, 14, and 15 belong?

R8. Create a 6-shape ABC pattern using a circle, a square, and a triangle. State the unit you chose.

Homework word problems: W1–W5

W1. Mia has a red square button, a blue square button, and a red round button. She sorts by color. Which buttons go together?

W2. A teacher has 5 triangle cards and 3 square cards. She sorts them by number of sides. How many cards are in each group?

W3. Ten children stand in pairs for a game. How many pairs can they make? Is anyone left without a partner?

W4. Nine socks are laid out in pairs. How many complete pairs can be made, and how many socks are left?

W5. A bracelet repeats “blue bead, yellow bead.” Its first five beads are blue, yellow, blue, yellow, blue. What are beads 6 and 7?

Homework word problems: W6–W10

W6. A wall border repeats “square, square, circle.” The first six shapes make two complete units. What are shapes 7, 8, and 9?

W7. House numbers on one side of a street start 11, 13, 15, 17 and increase by 2. What are the next three house numbers?

W8. An elevator is on floor 16. It goes down 3 floors at each stop. What floors are its next three stops?

W9. A block tower has 3 blocks at Step 1. Noah adds 2 blocks at each new step. How many blocks are in Step 4?

W10. A shop puts number cards into a box labeled “even and less than 15.” Which of 8, 13, 14, and 16 should go in the box?

Homework word problems: W11–W12

W11. A garden adds the same number of flowers at every step. Step 1 has 2 flowers, Step 2 has 5, and Step 3 has 8. What is the rule, and how many flowers are in Step 5?

W12. A dance repeats “clap, clap, tap.” Leo writes the first eight moves as clap, clap, tap, clap, tap, tap, clap, clap. Which move must change, and what is move 9?