

## Investigation

# What's the Secret Number?



Use materials such as counters or a hundred chart.

### Part 1

Ed, Alecia, and Russell chose secret numbers.

My number is even.  
The tens digit is 1. The number  
of ones is greater than  
the sum of 2 and 4.

My number has 6 more  
tens than ones. The number  
of tens plus the number  
of ones is 12.

My number is between 26  
and 54. You say my number when  
you count by 5s, but not when you  
count by 2s. My number does not  
have the same digits as 54.



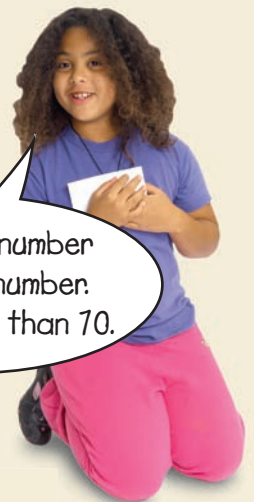
- Find the secret numbers.

### Part 2

Mia chose a secret number and gave these hints.

- Did Mia give enough information? Explain.
- Mia's secret number is 87. What other hints could she give so a friend can find the secret number?
- Trade hints with another pair of classmates. Check each other's work.
- Talk about how different hints can describe the same number.

My secret number  
is an odd number.  
It is greater than 70.



### Part 3

- ▶ Choose a secret number less than 100.
- ▶ Write hints so someone could guess your number.
- ▶ Trade hints with another pair of classmates.  
Find their secret number.



### Display Your Work

Make a poster for your secret number.  
Put the hints on the front of the poster  
and the number on the back.

### Take It Further

Write a secret addition or subtraction sentence.  
Make up hints about your sentence.  
Read the hints to a classmate.  
Have them guess your secret sentence.



# Patterning

## 1

It's a Pattern Party!

### Learning Goals

- identify, extend, create, and compare increasing patterns
- identify, extend, create, and compare decreasing patterns
- describe patterns and pattern rules
- use patterns to solve problems

## Key Words

growing patterns

increasing patterns

pattern rule

shrinking patterns

decreasing patterns



Children are wearing patterns, singing patterns, and dancing patterns. They are even clapping, tapping, and snapping patterns.

- What patterns do you see in the picture?
- Think about making a dancing pattern. What might it be?
- Think about making a sound pattern. How would it sound?

1

# Exploring Increasing Patterns

Here is a **growing pattern**.



Figure 1



Figure 2



Figure 3



Figure 4

What stays the same and what changes in each figure?

What will Figure 5 look like?

## Explore



You will need Pattern Blocks.

- Show what Figure 4 looks like.
- Now make Figure 5 and Figure 6.



Figure 1

## Show and Share

Show your patterns to another pair of classmates. Take turns describing the patterns.



Figure 2

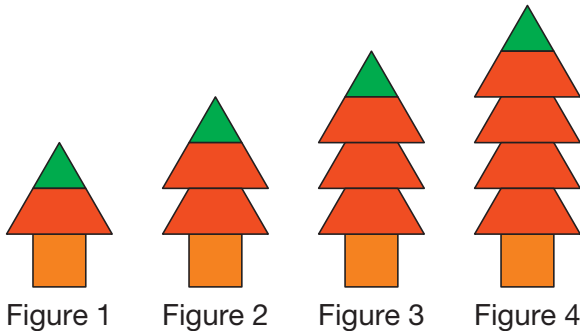


Figure 3

## Connect

Growing patterns are **increasing patterns**.

- This pattern grows by the same number of blocks each time.



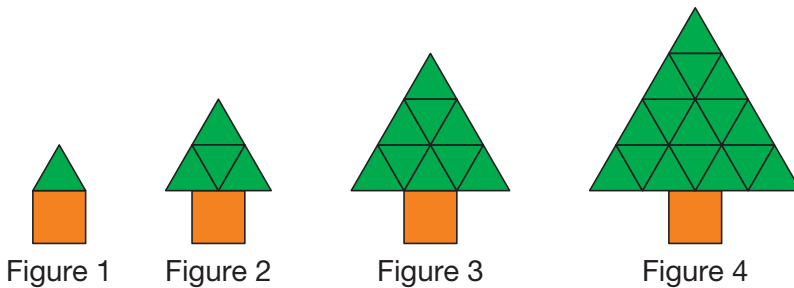
A **pattern rule** tells me how to make a pattern.






The pattern rule is: start with .

Put in 1 more  each time.

- This pattern grows by a different number of blocks each time.



The pattern rule is:

- Start with .
- Add 3 s to make a larger triangle.
- Then, add 2 more s than the time before.  
Keep the triangular tree shape each time.

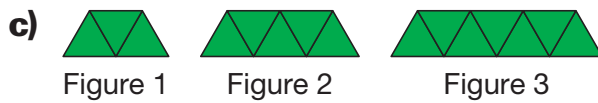
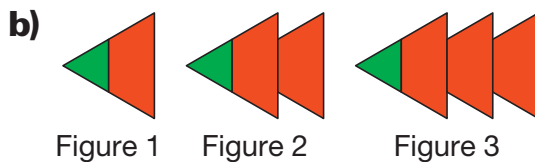
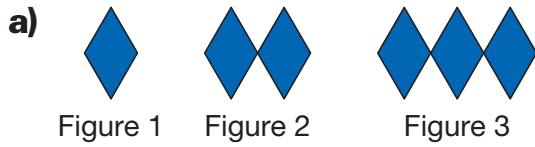
What will Figure 5 look like?

Add  blocks to make the tree larger.

# Practice

## 1. Use Pattern Blocks.

Make the next 3 figures in each increasing pattern.



## 2. Write the pattern rule for each pattern in question 1.



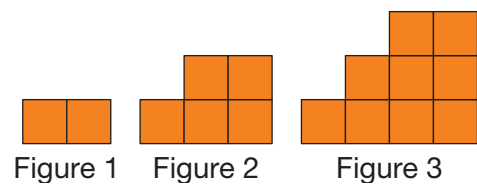
## 3. Use Pattern Blocks.

Copy the pattern.

Make the next 3 figures.

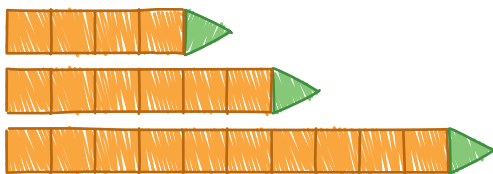
Draw the pattern on grid paper.

Write the pattern rule.



## 4. Sammi drew this increasing pattern.

His pattern grows by the same number each time.



Is a figure missing? If so, draw it.

## Reflect

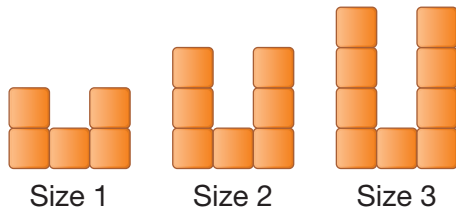
Choose an increasing pattern from this lesson.

Tell how it grows.

# 2

## Creating Increasing Patterns

A sign store makes letters that come in different sizes.  
Here are the first 3 sizes of the letter U.



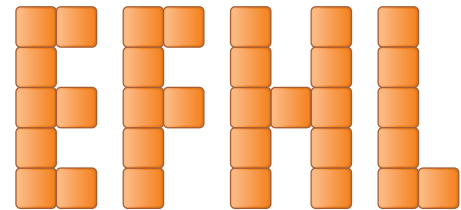
What does the next letter in the pattern look like?  
What is the pattern rule?

### Explore



You will need square tiles and grid paper.

- Choose 1 of these letters.
- Use square tiles to make the letter.
- Create an increasing pattern to show the letter in 3 more sizes.
- Draw the pattern on grid paper.
- Repeat this activity with a different letter.



### Show and Share

Share the letters you made with another pair of classmates.  
Take turns describing each other's pattern rule.





## Connect

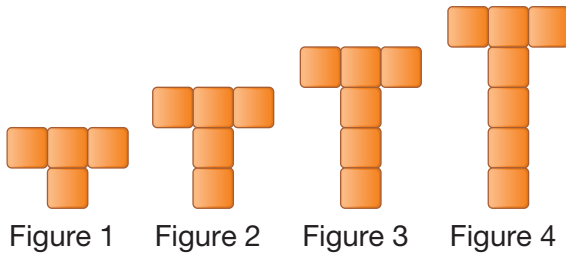
To make an increasing pattern you:

- create a starting point
- decide what to change each time

Liam and Maya are making the letter T for the sign store.

► Liam chose this pattern rule:

- Start with . Add 1  each time. His pattern grows in 1 direction.

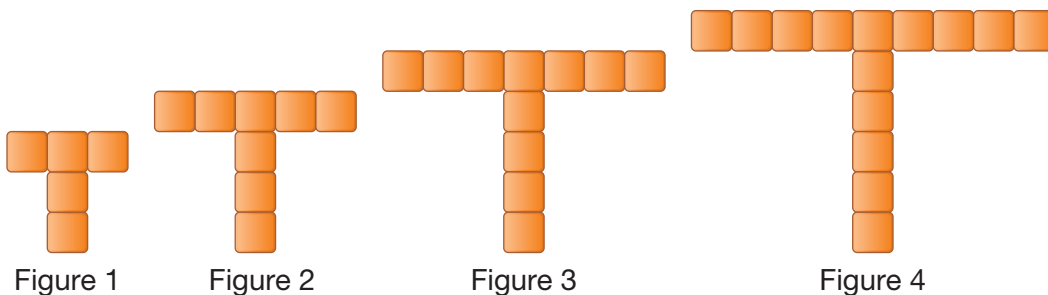


An increasing pattern can grow in different ways.



► Maya chose this pattern rule:

- Start with . Add 3 s each time, one at each end of the T-shape. Her pattern grows in more than 1 direction.



## Math Link

### Social Studies

Inuit use patterns on kamiks (boots) to show gender. Females' kamiks have horizontal bands. Males' kamiks have vertical bands.



## Practice

1. Use square tiles.  
Make a pattern that uses this rule:  
Start with 4 squares. Add 2 squares each time.  
Draw the pattern on grid paper.  
Describe your pattern using numbers and words.

2. Write an increasing pattern rule.  
Trade pattern rules with a classmate.  
Make your classmate's pattern.  
Check each other's work.



3. Draw the first 4 figures of an increasing pattern.  
Write about your pattern.

4. Figure 3 is missing.  
Sketch what it should be.  
Explain how you know.



Figure 1

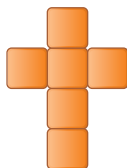


Figure 2

Figure 3

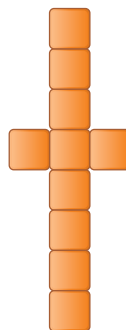


Figure 4

5. a) Use 2 or more actions to make an increasing pattern.  
b) Record the pattern rule.  
c) Clap, snap, or stomp the pattern.



## Reflect

Explain the steps you take to make an increasing pattern.

# 3

## Comparing Increasing Patterns

### Explore



You will need square tiles and grid paper.

- Use the starting point shown here.
- Make an increasing pattern that grows by 1 ■ each time.
- Make an increasing pattern that grows by 2 ■s each time.
- Draw your patterns on grid paper.

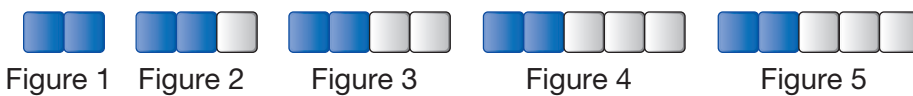


### Show and Share

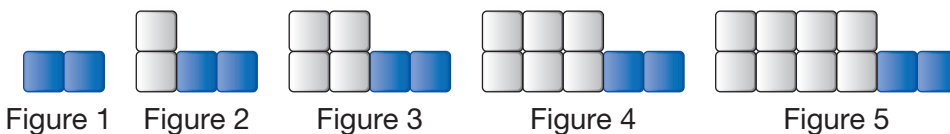
Share your patterns with another pair of classmates.  
How are the patterns the same? How are they different?

### Connect

- Carly made this pattern.



Sam made this pattern.



The patterns use the same starting point but they increase in different ways.

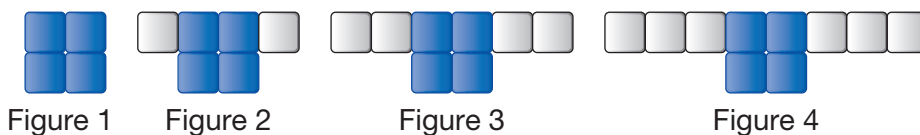
Carly's pattern rule is:

- Start with ■■. Add 1 □ at the end each time.

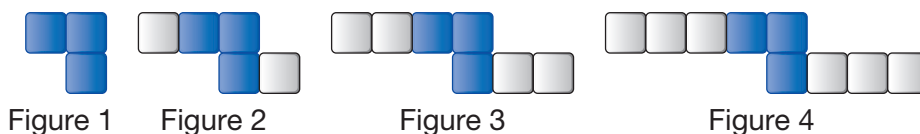
Sam's pattern rule is:

- Start with ■■. Add □ at the front each time.

► Eli made this pattern.



Pona made this pattern.



Their patterns use different starting points but they increase the same way.

Eli's pattern rule is:

- Start with . Add a at each end each time.

Pona's pattern rule is:

- Start with . Add a at each end each time.

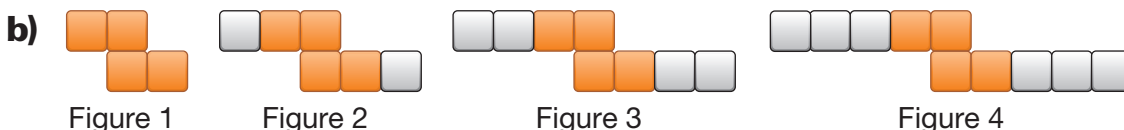
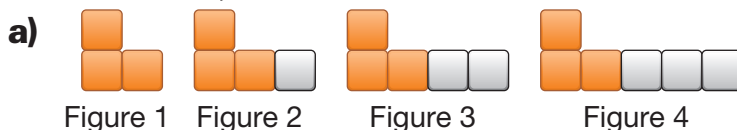
## Practice

1. a) Write the pattern rule.

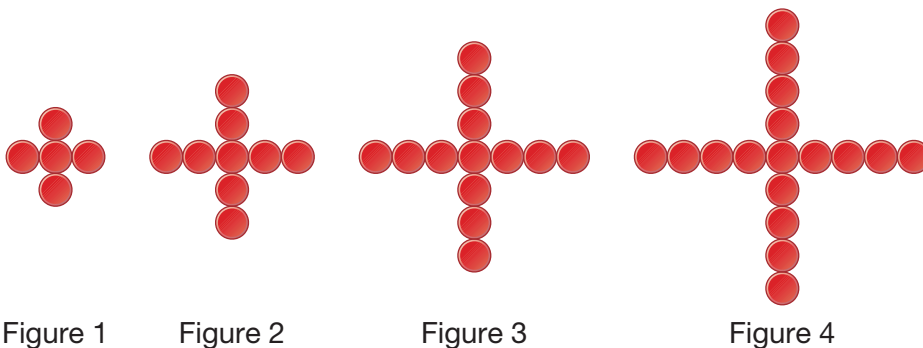


b) Draw a pattern that has the same starting point but increases a different way.

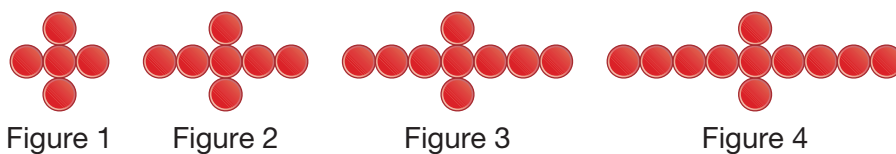
2. Which 2 patterns have different starting points but increase the same way? Write the pattern rule for each.



3. Make an increasing pattern. Show the first 4 figures. Compare your pattern with that of a classmate. Write about the patterns using numbers and words. How are the patterns the same? How are they different?
4. Jess made this pattern.





Molly made this pattern.



How are the patterns the same? How are they different?  
Write the pattern rule for each pattern.



5. Use square tiles.
  - a) Start with 3 s. Add 1  each time to make a pattern.
  - b) Repeat part a, but make a different pattern.
  - c) Compare your patterns with those of a classmate. How are they the same? How are they different?



## Reflect

How can you compare increasing patterns?

4

# Increasing Number Patterns

How would you count the eyes in this group of children?  
How would you count the number of fingers on the raised hands?



## Explore



You will need a hundred chart from 1 to 100 and 2 colours of markers or crayons.

- How can you use the hundred chart to count by 2s? By 5s?
- Colour to record your work. What patterns do you see?

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

## Show and Share

Compare your patterns with those of another pair of classmates.

Which numbers are shaded twice? Why do you think that happens?

The numbers in the coloured squares form an increasing pattern.

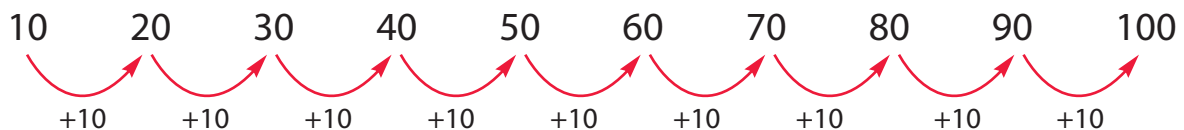
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

The numbers in the yellow squares end in 0. The numbers in the blue squares end in 5,



► The pattern rule for the yellow squares is:

- Start at 10. Add 10 each time.

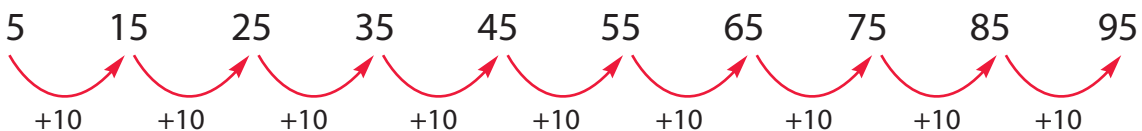


The pattern makes 1 vertical line.

The tens digit increases by 1. The ones digit is always 0.

► The pattern rule for the blue squares is:

- Start at 5. Add 10 each time.



The pattern makes 1 vertical line.

The tens digit increases by 1. The ones digit is always 5.

## Practice

1. Describe this pattern using numbers and words.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

2. Réjean started a number pattern. Which numbers would you shade to extend the pattern?  
What is the pattern rule?



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



3. Use a hundred chart from 1 to 100.
- Start at 30. Add 10 each time. Shade the numbers in this pattern blue.
  - Find a different number pattern on the same hundred chart. Shade the numbers in this pattern red.
  - Compare the patterns.
4. Copy each pattern. Write the pattern rule. Fill in the missing numbers.
- 15, 20, 25, \_\_\_\_, \_\_\_\_, \_\_\_\_
  - 40, 50, 60, \_\_\_\_, \_\_\_\_, \_\_\_\_
5. Jess is counting her coins. She says, "25, 30, 35, 40, 45, 50. I have 50 cents!" Describe the pattern using numbers. What coins do you think she has? Explain.

## Reflect

Choose a number pattern from this lesson. Describe the strategy you use to find the pattern rule. Use words and numbers to explain.



5

# Strategies Toolkit

## Explore



Joe is building this tower using Pattern Blocks. Each level has 1 red block and 2 orange blocks. He has lots of red blocks, but only 10 orange blocks. How many levels of the tower can he build?



Work together to solve this problem. Use any materials you think will help.

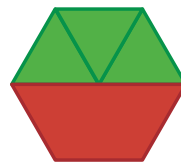
## Show and Share

Tell about the strategy you used to solve this problem.

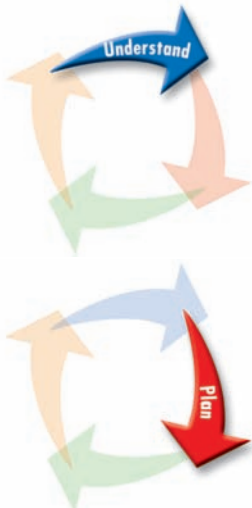
## Connect

### Strategies

Jaleel is stacking Pattern Blocks. Each level has these blocks. She has 23 green blocks and 15 red blocks. How many levels can she make? Will she have any blocks left over?



- Make a chart.
- Use a model.
- Draw a picture.
- Solve a simpler problem.
- Work backward.
- Guess and test.
- Make an organized list.
- Use a pattern.

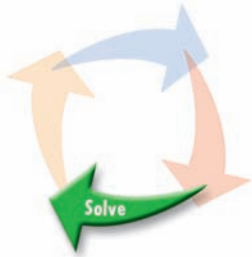


What do you know?

- There are 23 green blocks and 15 red blocks.
- There are 3 green blocks and 1 red block in each level.

Think of a strategy to help you solve the problem.

- You can **use a pattern**.



Use a hundred chart from 1 to 100 to record the pattern.  
Shade the numbers of green blocks used at each level.

How many levels can you build before you run out of green blocks?

Are there enough red blocks to build that many levels?

Check your work.

How could you solve this problem another way?



## Practice

Choose one of the

## Strategies

- Hakim builds a tower with yellow blocks and orange blocks. There are 5 levels in the tower. Each level has 2 yellow blocks and 3 orange blocks. How many orange blocks and yellow blocks are in his tower?
- Sari made a chart that shows the total number of blocks in each level of her tower. What is the total number of blocks in Level 6? How do you know?

Level	Total Number of Blocks
1	18
2	22
3	26

## Reflect

How can you use a pattern to help you solve a problem?  
Use words, numbers, or pictures to explain.

# What's the Pattern Rule?



You will need square tiles, Build Pattern cards, and Starting Point cards.

The object of the game is to guess your partner's pattern rule.

- Shuffle both sets of cards and place them face down.
- Select a Starting Point card. Place it face up in front of you.
- Select a Build Pattern card. Keep it a secret.
- Use the starting point and the build pattern rule. Make the first 5 figures of an increasing pattern.
- Take turns describing each other's pattern rules. If you describe your partner's pattern rule correctly, you score 1 point. If not, your partner scores a point.
- Draw new cards and play again.
- The player with the higher score after 3 rounds wins.



# 6

## Exploring Decreasing Patterns

Jay has eggs for breakfast every day.



Monday



Tuesday



Wednesday



How many eggs will there be after breakfast on Thursday?

How do you know?

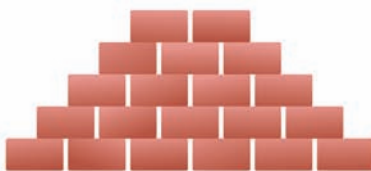
### Explore



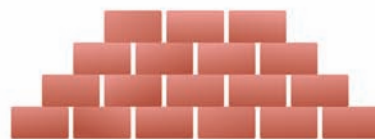
You will need Snap Cubes.



Monday



Tuesday



Wednesday

Workers take bricks from the pile every day.

- Show what the pile of bricks will look like on Thursday.
- Show what they will look like on Friday and Saturday.

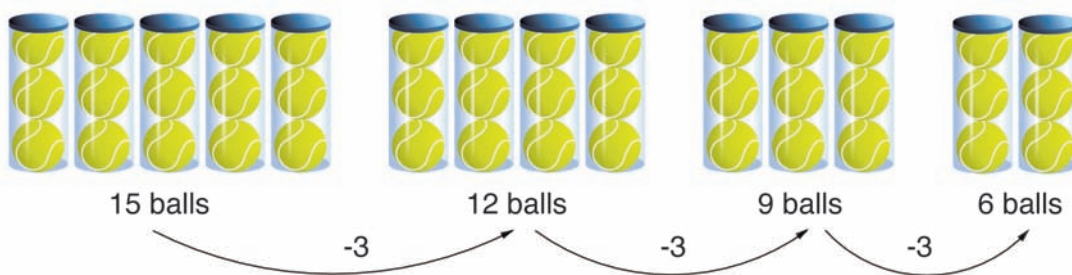
### Show and Share

Show your piles of Snap Cubes to another pair of classmates. Take turns describing the pattern rule.

## Connect

Shrinking patterns are **decreasing patterns**.

- Maxwell's tennis class starts with 15 balls. They lose the same number of balls each class.



The numbers of balls are 15, 12, 9, 6, ...

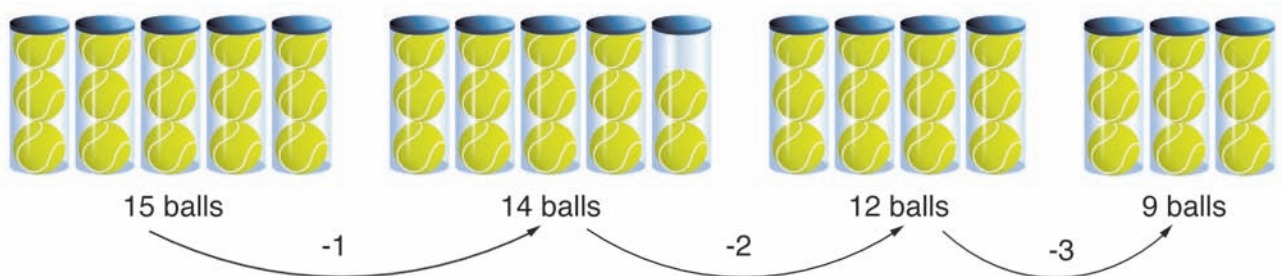
The pattern rule is:

- Start with 15 balls. Remove 3 balls each time.

Increasing patterns grow.  
Decreasing patterns shrink.



- Chloe's tennis class starts with 15 balls. They lose a different number of balls each class.



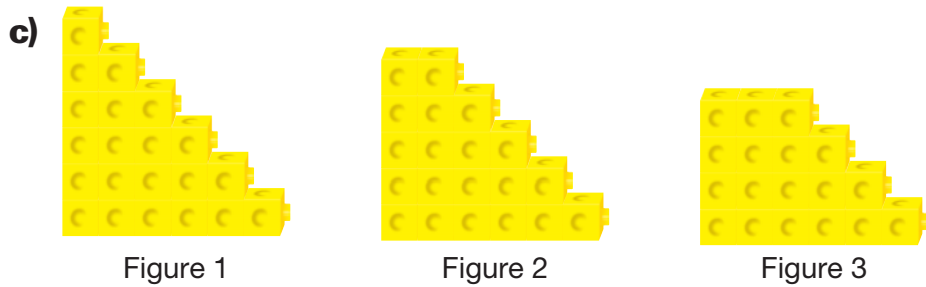
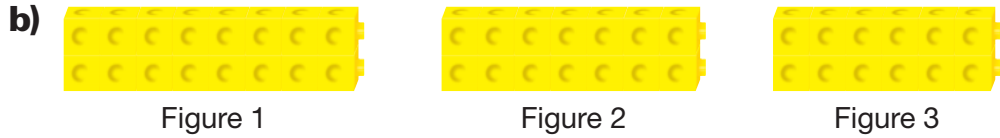
The numbers of balls are 15, 14, 12, 9, ...

The pattern rule is:

- Start with 15 balls. Remove 1 ball.
- Then, remove 1 more ball than the time before.

# Practice

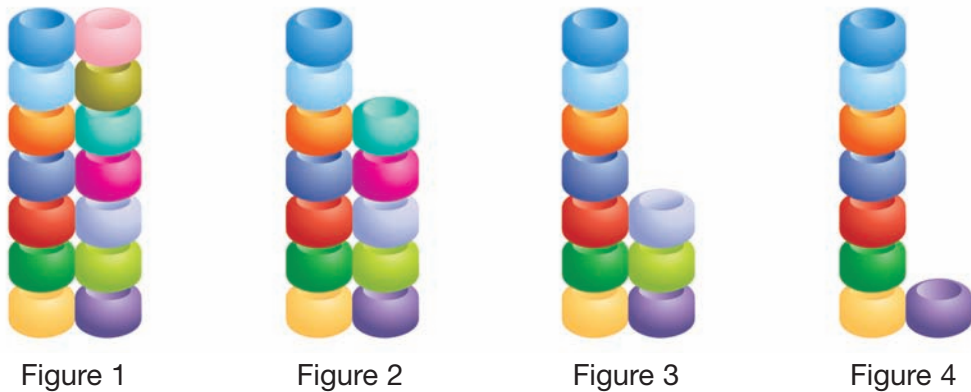
1. Use Snap Cubes.  
Make the next 3 figures in each decreasing pattern.



2. Look at the patterns in question 1.  
Write the pattern rule for each.



3. Janie made a decreasing pattern out of beads.  
She continues the pattern.  
How many more figures can she make?  
Explain how you know.



4. Zin photographed birds while he was camping. He arranged the photographs to make a decreasing pattern.

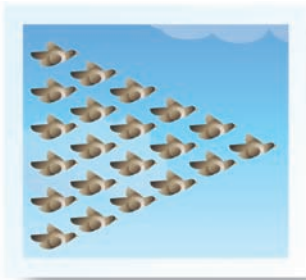


Figure 1



Figure 2

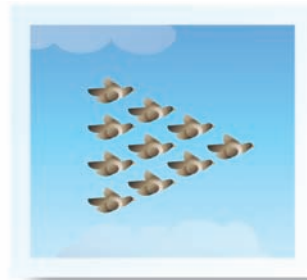


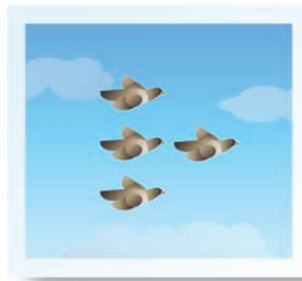
Figure 3

Which picture below extends the pattern?  
Tell how you know.

a)



b)



5. A grocery clerk has 28 cereal boxes. She continues this pattern.



The clerk uses all the boxes.  
How many boxes will be in the top row?  
How do you know? Sketch the display.

### Reflect

Choose a decreasing pattern from this lesson.  
Tell how it shrinks.

### At Home



Be a pattern detective!  
Look for patterns on clothing, buildings, furniture, or wallpaper.  
What patterns can you find?

# Creating and Comparing Decreasing Patterns

Professor Shrinker built a shrinking machine. She put a necklace through the machine 3 times.



Figure 1



Figure 2

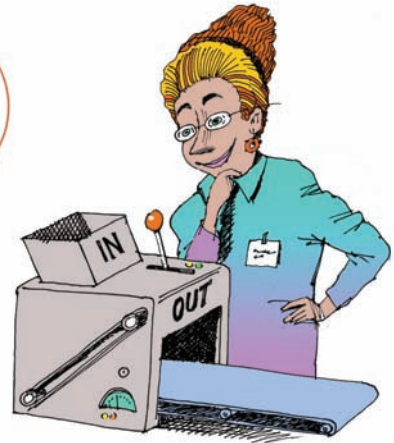


Figure 3



Figure 4

What does the next necklace look like?  
What is the pattern?

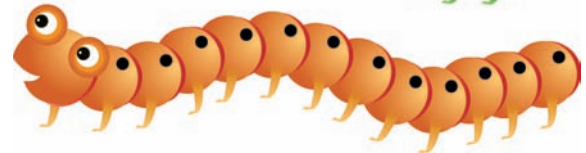


## Explore



You will need counters.

- Make a caterpillar with 10 to 15 counters.
- Create a decreasing pattern to show the caterpillar in 4 different sizes.
- Draw the pattern.  
Record the pattern rule.
- Repeat the activity with a different pattern rule.



## Show and Share

Compare your caterpillar with that of another pair of classmates. Take turns describing each other's pattern rule.



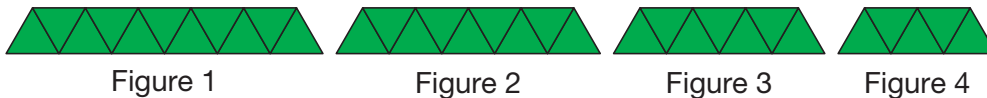
## Connect

To make a decreasing pattern you:

- create a starting point
- decide what to remove each time

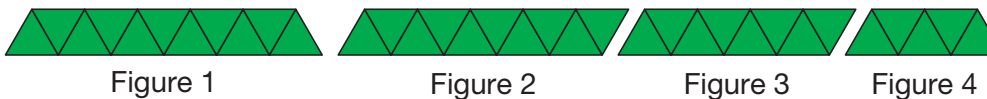
➤ Ellis chose this pattern rule:

- Start with 11 ▲s in a line. Remove 2 ▲s each time.



➤ Julie chose this pattern rule:

- Start with 11 ▲s in a line. Remove 1 ▲.
- Then, remove 1 more ▲ than the time before.



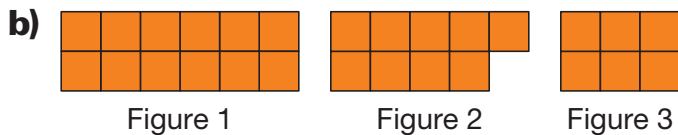
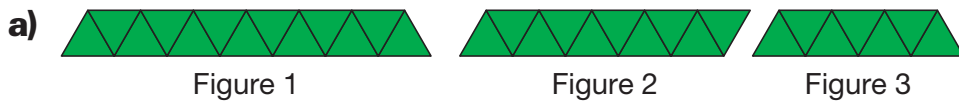
Their patterns have the same starting point but they decrease in different ways.

## Practice

1. Stewie's pattern train started with 20 blocks. He removed 2 blocks at each step of his pattern. Make a pattern that follows the same pattern rule. Describe your pattern using numbers and words.



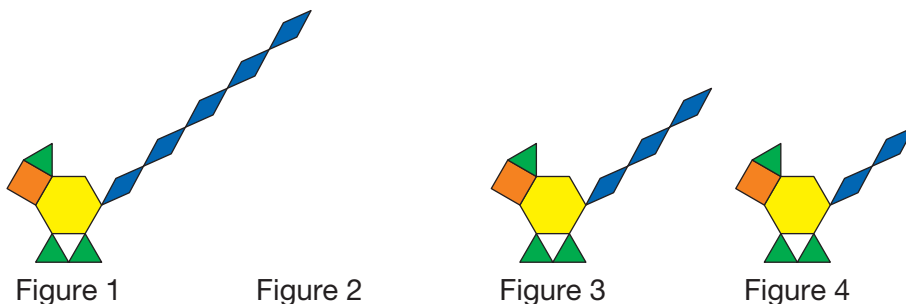
2. How are these patterns the same? How are they different?  
Tell the pattern rule for each.



3. Use 2 or more actions to make a decreasing pattern.  
Describe the pattern rule.  
Clap, snap, or stomp your pattern.



4. Professor Shrinker put a creature in her shrinking machine.  
Draw or make the missing creature.  
Tell the pattern rule.



5. Make a decreasing pattern. Show the first 4 figures.  
Compare your pattern with that of a classmate.  
Record how the patterns are the same and  
how they are different.

## Reflect

Explain the steps you take to make a decreasing pattern.

# Decreasing Number Patterns

Carly has 20¢. Each day she buys a sticker for 2¢.

Will she ever have 9¢?

How do you know?



## Explore



You will need a hundred chart from 100 to 1 and markers or crayons.

Suppose you have 95¢.

Prizes cost 5¢ each.

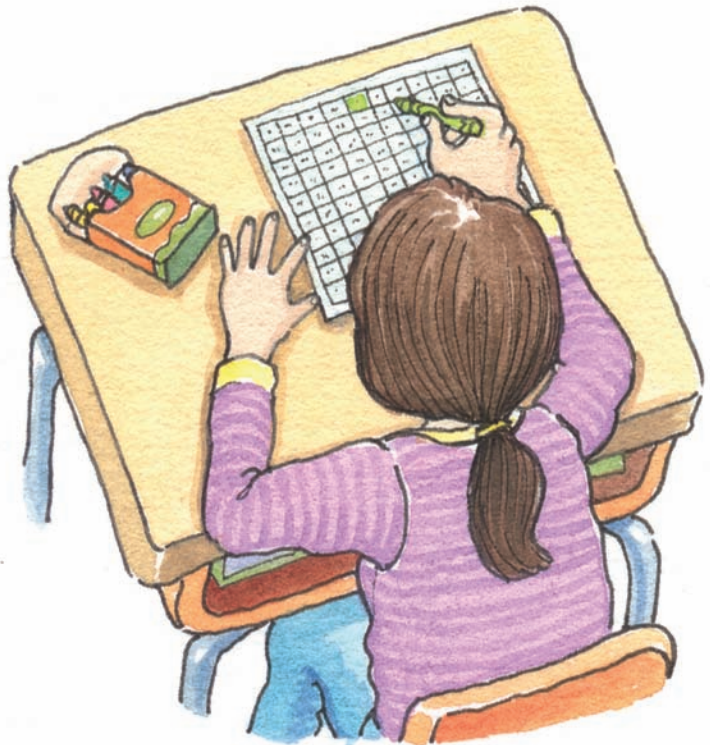
How many prizes can you buy?

- Record your work on the hundred chart.
- What pattern do you see?

## Show and Share

Compare your number pattern with that of another pair of classmates.

Decide on the pattern rule.



# Connect

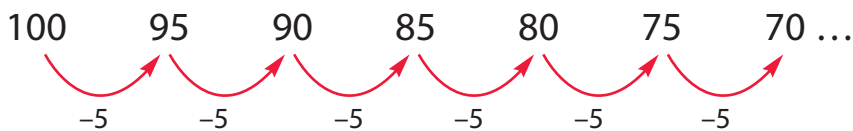
100	99	98	97	96	95	94	93	92	91
90	89	88	87	86	85	84	83	82	81
80	79	78	77	76	75	74	73	72	71
70	69	68	67	66	65	64	63	62	61
60	59	58	57	56	55	54	53	52	51
50	49	48	47	46	45	44	43	42	41
40	39	38	37	36	35	34	33	32	31
30	29	28	27	26	25	24	23	22	21
20	19	18	17	16	15	14	13	12	11
10	9	8	7	6	5	4	3	2	1

The numbers in the coloured squares form patterns.



The pattern rule for the orange squares is:

- Start at 100. Count back by 5s each time.

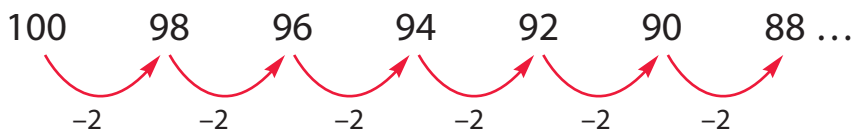


The ones digit follows this pattern: 0, 5, 0, 5, 0, 5, ...

The tens digit follows this pattern: 9, 9, 8, 8, 7, 7, ...

The pattern rule for the green squares is:

- Start at 100. Count back by 2s each time.



The ones digit follows this pattern: 8, 6, 4, 2, 0, 8, 6, 4, 2, 0, ...

The tens digit follows this pattern: 9, 9, 9, 9, 9, 8, 8, 8, 8, 8, 7, 7, 7, 7, 7, ...

Both patterns form vertical lines.

Some numbers appear in both patterns.

# Practice

- Write the first 4 numbers in each pattern.
  - Start at 75. Count back 5 each time.
  - Start at 100. Count back 3 each time.
  - Start at 65. Count back 10 each time.
  - Start at 50. Count back 2 each time.
- May-Lin coloured these patterns on a hundred chart from 100 to 1.

100	99	98	97	96	95	94	93	92	91
90	89	88	87	86	85	84	83	82	81
80	79	78	77	76	75	74	73	72	71
70	69	68	67	66	65	64	63	62	61
60	59	58	57	56	55	54	53	52	51
50	49	48	47	46	45	44	43	42	41
40	39	38	37	36	35	34	33	32	31
30	29	28	27	26	25	24	23	22	21
20	19	18	17	16	15	14	13	12	11
10	9	8	7	6	5	4	3	2	1



Describe the patterns.

How are they the same? How are they different?

- Copy each pattern.

Write the pattern rule.

Fill in the missing numbers.

**a)** 78, 76, 74, 72, \_\_\_\_, \_\_\_\_, \_\_\_\_

**b)** 35, 30, 25, 20, \_\_\_\_, \_\_\_\_, \_\_\_\_

**c)** 100, 90, 80, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_

**d)** 83, 80, 77, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_

- Elise wrote this number pattern: 98, 96, 94, 92, 88, 86

Is she missing any numbers?

How do you know?

- Suppose you write this pattern: 74, 72, 70, 68, ...

Will you write 47?

How do you know?



6. Use this hundred chart.

100	99	98	97	96	95	94	93	92	91
90	89	88	87	86	85	84	83	82	81
80	79	78	77	76	75	74	73	72	71
70	69	68	67	66	65	64	63	62	61
60	59	58	57	56	55	54	53	52	51
50	49	48	47	46	45	44	43	42	41
40	39	38	37	36	35	34	33	32	31
30	29	28	27	26	25	24	23	22	21
20	19	18	17	16	15	14	13	12	11
10	9	8	7	6	5	4	3	2	1

- The coloured squares form a decreasing pattern.  
Tell the pattern rule.
- Will the number 18 be in this pattern?  
How do you know?
- Extend the pattern to find out.



- Shade a decreasing number pattern on a hundred chart from 100 to 1.  
Tell the pattern rule.  
Compare your pattern with that of a classmate.  
How are the patterns the same?  
How are they different?

- Salvio had 18 apples.  
Each day he ate 2 apples.  
How many apples did Salvio have after 5 days?



### Reflect

How is a decreasing pattern the same as an increasing pattern?  
How is it different?  
Give examples to explain your thinking.

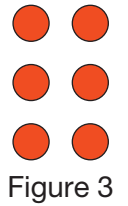
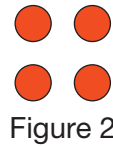
LESSON

**1** Draw the next 3 figures in each increasing pattern.

**a)**



**b)**



**2.** Write the pattern rule for each pattern in question 1.

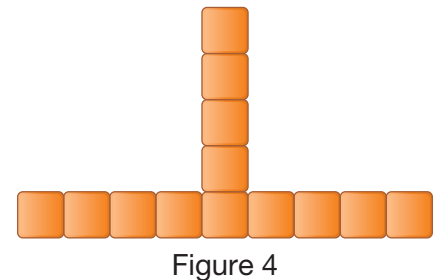
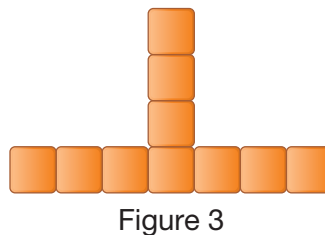
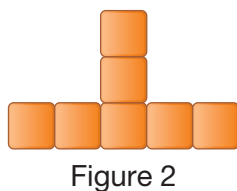
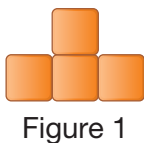
**2** **3.** Use this picture as the starting point.

Write a pattern rule.  
Draw the next 4 figures in the pattern.

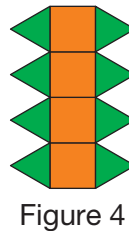
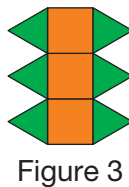


**3** **4.** Write the pattern rule for each pattern.  
How are the patterns the same? How are they different?

**a)**



**b)**



LESSON

4

5. Jez wrote this pattern: 15, 20, 25, 30, 35
- Write the pattern rule.
  - Write the next 3 numbers in the pattern.
  - Choose a different start number.  
Write a different pattern that grows the same way.

6

6. Use grid paper.  
Draw the next 3 figures in this pattern.  
Write the pattern rule.

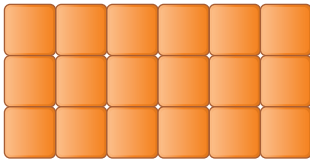


Figure 1

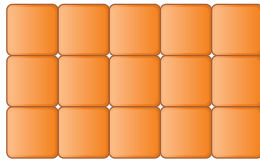


Figure 2

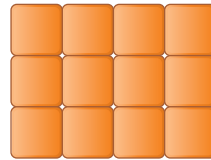


Figure 3

7

7. Choose a starting point. Make a decreasing pattern.  
Draw 4 figures of your pattern.  
Compare your pattern with that of a classmate.  
How are the patterns the same?  
How are they different?

8

8. Look at these number patterns.
- 22, 20, 18, 16, 14
  - 60, 55, 50, 45
- Write the pattern rule for each number pattern.
  - How are the patterns the same?  
How are they different?
  - Write the next 3 numbers in each pattern.
  - Write a number pattern that decreases in a different way.

UNIT

1

Learning Goals

- identify, extend, create, and compare increasing patterns
- identify, extend, create, and compare decreasing patterns
- describe patterns and pattern rules
- use patterns to solve problems



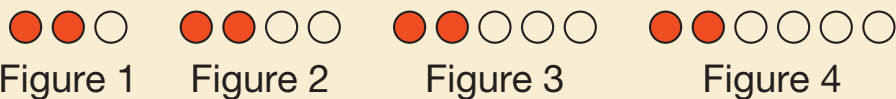
# Unit Problem

# It's a Pattern Party!



The class is making patterns for the pattern party. They are making increasing and decreasing patterns.

## Part 1



Each ● means clap your hands.

Each ○ means stamp your feet.

- Write the pattern rule.
- Draw the next 3 figures.
- Clap and stamp the pattern.

## Part 2

- Make a sound or action pattern for the party. It can be an increasing or a decreasing pattern.
- Draw your pattern.
- Write about your pattern.
- Try your pattern.

## Check List

Your work should show

- a picture of the clap and stamp pattern you extended
- a picture of the sound or action pattern you created
- an increasing or decreasing pattern you created for decoration
- correct math language used to describe your patterns

### Part 3

The pattern party needs decorations!

- Draw an increasing or decreasing pattern.
- Write about your pattern.
- Tell how to extend your pattern.
- Display your pattern in the classroom.



### Reflect on Your Learning

Think about the different increasing and decreasing patterns you made in this unit.

Write 2 things you learned about these kinds of patterns.