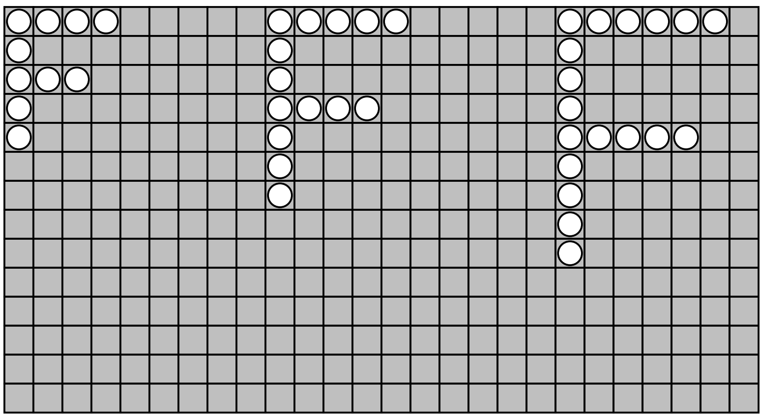
CHAPTER 1

2-D Patterns

Goal **Use models and t-charts to record, extend, and make predictions about number patterns.**

Look at design 1 of the capital letter F.
It has been made from 10 dots.

design 1 design 2 design 3



1. How many dots are needed to complete design 4?

22 dots

2. Predict the number of dots needed to complete design 5.

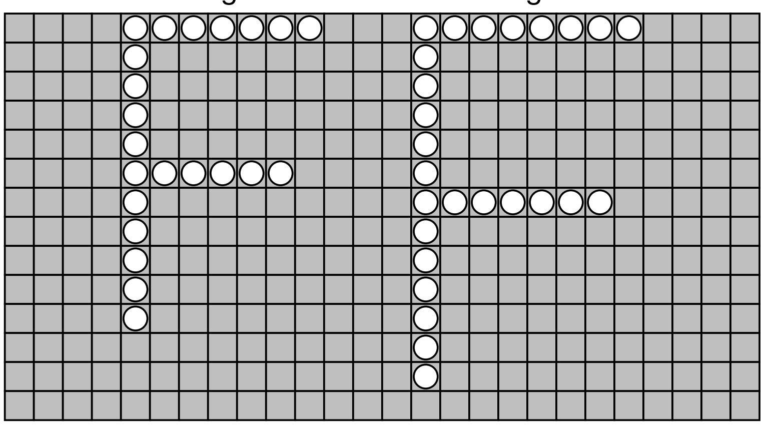
Suggested answer: 20 dots

3. Draw design 4 and design 5.

4. Complete the t-chart to show the pattern.

Letter design	Number of dots
1	10
2	14
3	18
4	22
5	26

design 4 design 5



5. If you had a total of 50 dots, what design number would the letter F be?

design 11

At-Home Help

A **2-D pattern** has a length and a width.

For example, these shapes form a 2-D pattern.

A **t-chart** has 2 columns. The data in both columns are related.

For example: As the number of songs increases by 1, the number of minutes of practice increases by 15 minutes.

Number of songs	Number of minutes of practice
1	10
2	25
3	40

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2

Patterns in Tables

Goal **Create tables to display, predict, and extend patterns.**

Apple crisp is a great recipe to make for many different sized groups. The recipe in the chart is complete for one class and partially complete for two classes.

Apple Crisp Recipe

Number of classes	Number of apples	Amount of butter (mL)	Amount of brown sugar (mL)
1	24	150	200
2	48	300	400
3	72	450	600
4	96	600	800
5	120	750	1000

At-Home Help

A **table** usually has three or more columns of data. Each column has its own heading and is related to the other columns.

For example:

Number of times I make the recipe	Number of cups of water	Number of scoops of crystals	Number of people served
1	5	3	4
2			

1. Complete the recipe for all of the classes in the chart.
2. What pattern rule did you use to complete the table?

   Each amount of food increases by the amount needed to make one class recipe.
3. If you bought 200 apples, what is the greatest number of classes that could have apple crisp? Explain your thinking using numbers.

   8 classes. Add 24 apples to each of the next recipes.

   6 classes: 120 + 24 = 144 apples

   7 classes: 144 + 24 = 168 apples

   8 classes: 168 + 24 = 192 apples

   9 classes: 192 + 24 = 216 apples (too many apples)
4. **a)** If one and one half classes wanted apple crisp, explain how you would calculate the amount of each ingredient.

   Take the amount for one recipe and add half of that amount.

   b) Calculate the amounts. Show your work.

   24 + 12 = 36 apples, 150 + 75 = 225 mL butter, and 200 + 100 = 300 mL brown sugar

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3

Solve Problems Using Patterns

Goal **Identify patterns to solve problems.**

1. What pattern could you use to add these numbers? Write a number sentence to show the pattern.

$1 + 2 + 3 + 4 + \ldots + 37 + 38 + 39 + 40$

Paired numbers as shown sum to 41.

$1 + 40 = 41, 2 + 39 = 41, 3 + 38 = 41, 4 + 37 = 41, \ldots$

2. Use a pattern to add these numbers. Show your work.

$15 + 25 + 35 + 45 + 55 + 65 + 75 + 85$

Paired numbers as shown sum to 100.
$(15 + 85) + (25 + 75) + (35 + 65) + (45 + 55)$
$= 100 + 100 + 100 + 100$
$= 400$

At-Home Help

Pairing numbers can help you find sums more easily. Try to find pairs that add up to the same number.

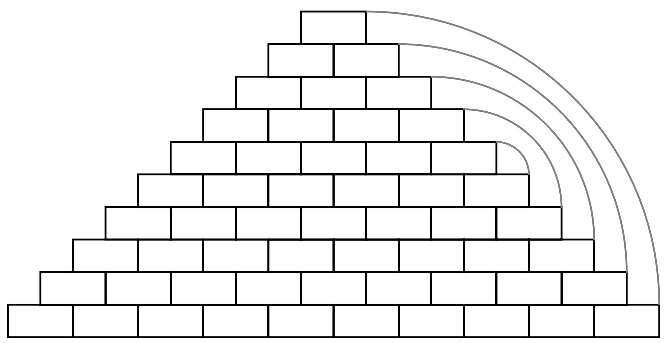
For example, to add

$1 + 3 + 5 + 7 + 9 + 11$

notice that $1 + 11$, $3 + 9$, and $5 + 7$ all add up to 12.

$$\begin{aligned} \text{sum} &= (1 + 11) + (3 + 9) + (5 + 7) \\ &= 12 + 12 + 12 \\ &= 36 \end{aligned}$$

3. Glynis is stacking boxes of candles for a store display.



a) Make a plan that uses a pattern to find the number of boxes in the stack. Use number sentences and words.

Paired rows as shown have a total of 11 boxes in each pair.

$1 + 10 = 11, 2 + 9 = 11, 3 + 8 = 11, 4 + 7 = 11, 5 + 6 = 11$

b) Use your plan to find the total number of boxes in the stack. 55 boxes

c) How many boxes would there be in a stack that has 16 boxes in the bottom row? Explain your answer using number sentences and words.

136 boxes. Pairing rows as before gives a total of 17 boxes in each pair.

$1 + 16 = 17, 2 + 15 = 17, 3 + 14 = 17, 4 + 13 = 17, 5 + 12 = 17, 6 + 11 = 17, 7 + 10 = 17, 8 + 9 = 17$

8 groups of $17 = 8 \times 17$ or 136

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4

3-D Patterns

Goal **Create a 3-D pattern and make predictions about its growth.**

You will need linking cubes.

Look at the stack of boxes in Lesson 3 Question 3.

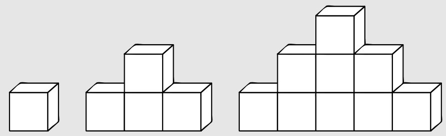
1. Make the first three stacks in the table using linking cubes. Determine how each stack is made from the one before. Then complete the table to show how many layers of boxes there will be if there are 210 boxes in total.

Number of layers	Number of new boxes	Total number of boxes
1	1	1
2	2	2 + 1 = 3
3	3	3 + 3 = 6
4	4	4 + 6 = 10
5	5	5 + 10 = 15
6	6	6 + 15 = 21
7	7	7 + 21 = 28
8	8	8 + 28 = 36
9	9	9 + 36 = 45
10	10	10 + 45 = 55
11	11	11 + 55 = 66
12	12	12 + 66 = 78
13	13	13 + 78 = 91
14	14	14 + 91 = 105
15	15	15 + 105 = 120
16	16	16 + 120 = 136
17	17	17 + 136 = 153
18	18	18 + 153 = 171
19	19	19 + 171 = 190
20	20	20 + 190 = 210

At-Home Help

A **3-D pattern** has a length, a width, and a height.

For example, these cubes form a 3-D pattern.



Organizing numbers in a table helps you see patterns.

For example:

Number of layers	Number of new boxes	Total number of boxes
1	1	1
2	3	3 + 1 = 4
3	5	5 + 4 = 9
4	7	7 + 9 = 16

total number of boxes
= number of new boxes
+ total number of boxes
in the line above

2. Explain what pattern you used to calculate your answer.

number of layers = number of new boxes

total number of boxes = number of new boxes + previous total number of boxes

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5

Number Patterns in Spreadsheets

Goal **Create and identify patterns in spreadsheets.**

Yoshi is starting a new spreadsheet for a school sale of used equipment that includes small beanbags, medium hula hoops, and large basketballs.

	A	B	C	D
1	Sports equipment sale prices			
2	Number of items	Small	Medium	Large
3	1	$1.20	$2.40	$4.40
4	2	$2.40	$4.80	$8.80
5	3	$3.60	$7.20	$13.20
6	4	$4.80	$9.60	$17.60
7	5	$6.00	$12.00	$22.00
8	6	$7.20	$14.40	$26.40
9	7	$8.40	$16.80	$30.80
10	8	$9.60	$19.20	$35.20

At-Home Help

Spreadsheets are columns of data that are related. Each number in a spreadsheet has its own cell. To extend the numbers in a column, use one or more operations.

For example:
cost of 3 red shirts in cell
B5 = B3 + B4, or B5 = B3 × A5
total cost in cell D3 = B3 + C3

	A	B	C	D
1	Shirt prices			
2	Number of shirts	Red	Green	Total cost
3	1	$10.00	$15.00	$25.00
4	2	$20.00	$30.00	$50.00
5	3	$30.00	$45.00	$75.00

1. Complete the spreadsheet.

2. Write a pattern rule for column B by looking at the numbers in that column. Then write a pattern rule for columns C and D.

   Add $1.20 to each number going down column B. Add $2.40 to each number going down column C. Add $4.40 to each number going down column D.

   OR Multiply number at top of each column by number of items.

3. Calculate the total cost. Show your work.

   a) 6 small items and total cost
   6 x $1.20 = $7.20

   b) 3 small items, 2 medium items, and 7 large items and total cost
   3 x $1.20 = $3.60, 2 x $2.40 = $4.80, 7 x $4.40 = $30.80
   $3.60 + $4.80 + $30.80 = $39.20

   c) 10 items of each size and total cost
   10 x $1.20 = $12.00, 10 x $2.40 = $24.00, 10 x $4.40 = $44.00
   $12.00 + $24.00 + $44.00 = $80.00

4. How can you get the answer in cell C5 from other cells?
   C5 = C3 x A5 OR C5 = C3 + C4

CHAPTER 1

Test Yourself

Circle the correct answer.

Use the table to answer Questions 1 and 2.

Number of teams	Number of players
1	4
2	8
3	16
4	32
5	64

1. What is the pattern in the second column of the table?

A. The numbers increase by 4. **B.** The numbers double.

C. The numbers increase by 3. **D.** The numbers increase by 2.

2. How many players would there be if there were 7 teams?

A. 256 **B.** 212 **C.** 128 **D.** 246

3. Which table shows column 1 increasing by multiplying by 3 and column 2 doubling?

A.

1	8
3	10
9	12
12	14

B.

1	4
3	8
6	16
12	32

C.

1	2
2	6
4	18
8	54

D.

1	1
3	2
9	4
27	8

4. What are the next 2 numbers in this pattern?

29, 30, 32, 35, 39, 44, _______, _______

A. 50 and 55 **B.** 49 and 55 **C.** 50 and 57 **D.** 49 and 57

CHAPTER 1

Test Yourself Page 2

5. Soccer teams go through a lot of equipment in one season.
What numbers would complete the last row of this table?

Number of teams	Number of soccer nets	Number of soccer balls
1	2	5
3	6	15
5	10	25
?	?	?

A. 7, 14, 30 **B.** 7, 14, 35 **C.** 6, 15, 30 **D.** 7, 15, 35

6. What will be the number of Xs in design 4 and design 7?

design 1

```
XXX
X X
```

design 2

```
XXXX
X  X
X  X
```

design 3

```
XXXXX
X   X
X   X
X   X
```

A. 19 and 13 **B.** 23 and 14 **C.** 14 and 23 **D.** 13 and 19

Use this spreadsheet to answer Questions 7 and 8.

	A	B	C	D
1	**Cost of Cans**			
2	**Number of Cans**	**Small**	**Medium**	**Large**
3	1	$0.50	$2.00	$3.25
4	2	$1.00	$4.00	$6.50
5	3	$1.50	$6.00	$9.75

7. What would be the total cost of 4 cans of each size?

A. $22.50 **B.** $24.00 **C.** $23.50 **D.** $23.00

8. What is the pattern rule for column C?

A. Add $0.50 to each number going down column C.

B. Add $2.00 to each number going down column C.

C. Add $3.25 to each number going down column C.

D. Add $1.00 to each number going down column C.