Student Guide

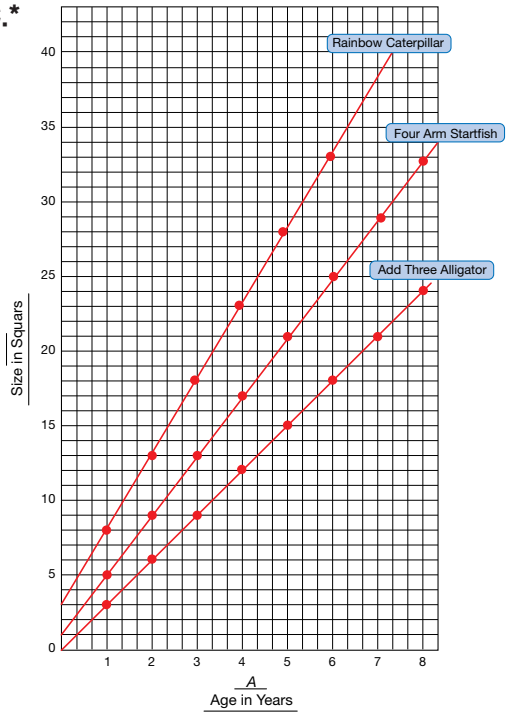
Growth Patterns on Planet Gzorp
Questions 1–24 (SG pp. 433–437)

1. A.*

Add Three Alligator

A Age in Years	*S* Size in Squares	
1	3	
2	6	
3	9	
4	12	Q#1A
5	15	
6	18	
7	21	
8	24	
10	30	
20	60	Q#3
25	75	

B–C.*



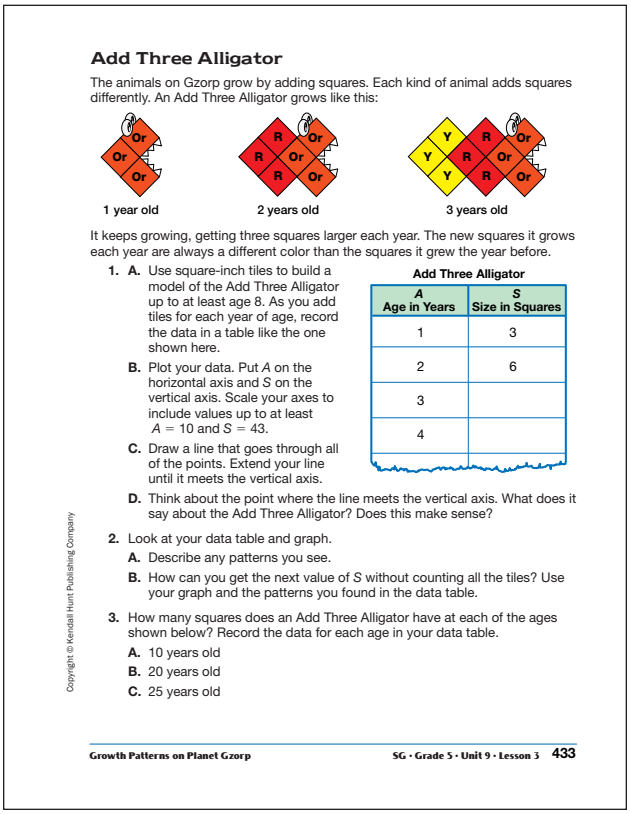
D.* The line meets the vertical axis at (0, 0). This would mean the alligator had 0 squares when it was born. Students may say that this doesn't make sense or say that when it is born it only has teeth as shown in the picture in the *Student Guide.*

2. Descriptions of patterns will vary. Possible responses include:

A.* The size of the alligator grows by 3 squares every year. The age multiplied by 3 will equal the size in squares.

B. You can add 3 to the last years size. You can multiply the age by 3.

3. See the last three rows of the data table above.



Add Three Alligator

The animals on Gzorp grow by adding squares. Each kind of animal adds squares differently. An Add Three Alligator grows like this:

It keeps growing, getting three squares larger each year. The new squares it grows each year are always a different color than the squares it grew the year before.

1. A. Use square-inch tiles to build a model of the Add Three Alligator up to at least age 8. As you add tiles for each year of age, record the data in a table like the one shown here.

Add Three Alligator

A Age in Years	*S* Size in Squares
1	3
2	6
3	
4	

B. Plot your data. Put *A* on the horizontal axis and *S* on the vertical axis. Scale your axes to include values up to at least $A = 10$ and $S = 43$.

C. Draw a line that goes through all of the points. Extend your line until it meets the vertical axis.

D. Think about the point where the line meets the vertical axis. What does it say about the Add Three Alligator? Does this make sense?

2. Look at your data table and graph.

A. Describe any patterns you see.

B. How can you get the next value of *S* without counting all the tiles? Use your graph and the patterns you found in the data table.

3. How many squares does an Add Three Alligator have at each of the ages shown below? Record the data for each age in your data table.

A. 10 years old

B. 20 years old

C. 25 years old

***Student Guide* - Page 433**

***Answers and/or discussion are included in the lesson.**

4. Think of a rule that gives the size in squares, *S*, for an Add Three Alligator of any age, *A*. Write the rule both in words and as a number sentence using *A* and *S*. This kind of number sentence is called a **formula.**

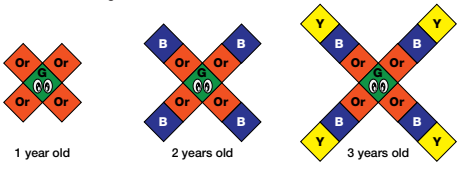
5. Use your formula to calculate the number of squares a 25-year-old Add Three Alligator will have. Did you get the same answer you got for Question 3C? If not, explain why not.

6. How old is an Add Three Alligator that has 66 squares? Show or tell how you solved this problem.

7. If an Add Three Alligator has 100 squares, about how old is it? Show or tell how you solved the problem.

Four Arm Starfish

A Four Arm Starfish grows like this:



8. **A.** Use square-inch tiles to build a model of the Four Arm Starfish up to at least age 8. As you add tiles for each year of age, record the data in a table.

   B. Plot your data using the same set of axes you used for the Add Three Alligator.

   C. Draw a line that goes through all of the points. Extend your line until it meets the vertical axis.

   D. Think about the point where the line meets the vertical axis. What does it say about the Four Arm Starfish? Does this make sense?

Four Arm Starfish

A Age in Years	*S* Size in Squares
1	5
2	
3	
4	

***Student Guide* - Page 434**

9. Look at your data table and graph.
   A. Describe any patterns you see.
   B. How can you get the next value of *S* without counting all the tiles?

10. How many squares does a Four Arm Starfish have at each of the ages below? Record the data for each age in your data table.
   A. 10 years old
   B. 20 years old
   C. 25 years old

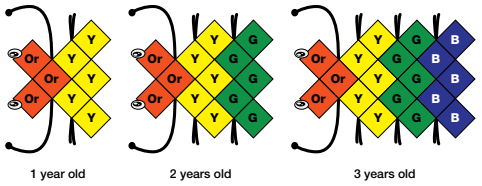
11. Write a formula that gives the size in squares, *S*, for a Four Arm Starfish of any age, *A*.

12. Use your formula to calculate the number of squares a 25-year-old Four Arm Starfish will have. Did you get the same answer you got for Question 10C? If not, explain why not.

13. How old is a Four Arm Starfish that has 201 squares? Show or tell how you know.

Rainbow Caterpillar

Caterpillars on Gzorp are called Rainbow Caterpillars. They do not turn into butterflies like caterpillars on Earth. Instead, they just keep growing. A Rainbow Caterpillar grows like this:



***Student Guide* - Page 435**

4.* The alligator's age multiplied by 3 will equal the alligator's size in squares. $S = 3 \times A$

5. $A = 25$, so $3 \times 25 = 75$ squares.

6. Responses will vary. Two possible responses:

An Add Three Alligator that has 66 squares is 22 years old, because 22 times 3 is 66.

66 is between 60 and 75, so starting from an age of 20 years. When the alligator is 21 years old, it has 63 squares, when it is 22 years old it has 66 squares.

7. About 33 years old; Possible response: 100 is really close to 99, and 33 times 3 is 99, so an Add Three Alligator that has 100 squares is a little older than 33 years old.

8. A.

Four Arm Starfish

A Age in Years	*S* Size in Squares	
1	5	
2	9	
3	13	
4	17	
5	21	Q#8A
6	25	
7	29	
8	33	
10	41	
20	81	Q#10
25	101	

B.* See the graph for ***Questions 1B–C***.

C.* See the graph for ***Questions 1B–C***.

D.* The line meets the vertical axis at (0 years, 1 square). It means that the starfish had 1 square when it was born. That makes sense.

9. Descriptions of patterns will vary. Possible responses include:

A.* The size goes up by 4 squares every year. The size is an odd number every year.

B.* You can add 4 to the last year's size. On the graph, you always go over 1 and up four each year.

10. See the last 3 rows in the data table in ***Question 8***.

11.* $S = A \times 4 + 1$

12. 101 squares; $A = 25$, so $25 \times 4 + 1 = 101$.

13. 50 years old; Possible response: Because my formula adds 1 to age after multiplying by 4, I subtracted 1 from 201 to get 200. And 50 x 4 is 200 so the starfish is 50 years old.

*Answers and/or discussion are included in the lesson.

14. A.

Rainbow Caterpillar

A Age in Years	*S* Size in Squares	
1	8	Q#14A
2	13	
3	18	
4	23	
5	28	
6	33	
7	38	
8	43	
10	53	Q#16
20	103	
25	128	

B.* See the graph for ***Questions 1B–C***.

C.* See the graph for ***Questions 1B–C***.

D. The line meets the vertical axis at (0 years, 3 squares). That means that the Rainbow Caterpillar has three squares when it is born. This makes sense.

15. Descriptions of patterns will vary. Possible responses include:

A.* The age gets bigger by 1 each year and the size gets bigger by 5 squares each year. All the sizes end in 8 or 3.

B. To get the size, keeping adding 5 squares to the year before. You can multiply the age by 5 and add 3 to get the size.

16. See the last three rows of the data table in Question 14.

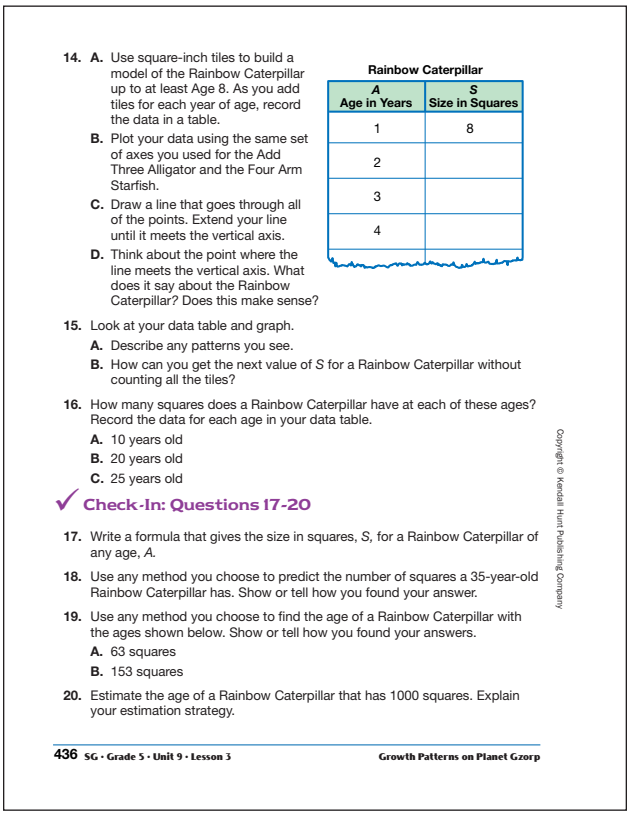
17. $S = 5 \times A + 3$

18. 178 years; Strategies will vary. Possible responses include:

I used my formula: $5 \times 35 + 3 = 178$

I used the pattern in the chart. I started at 25 years old. The caterpillar has 128 squares. I added 5 more squares every year for ten years until I got to 35 years. Then it has 178 squares.

19 A. 12 years; Possible response: I looked on the table and 63 squares goes between 53 and 103 squares. So, the caterpillar is between 10 and 20 years old. I know it grows 5 squares each year. So I added in rows until I found 63 in the S column.



14. A. Use square-inch tiles to build a model of the Rainbow Caterpillar up to at least Age 8. As you add tiles for each year of age, record the data in a table.

B. Plot your data using the same set of axes you used for the Add Three Alligator and the Four Arm Starfish.

C. Draw a line that goes through all of the points. Extend your line until it meets the vertical axis.

D. Think about the point where the line meets the vertical axis. What does it say about the Rainbow Caterpillar? Does this make sense?

Rainbow Caterpillar

A Age in Years	*S* Size in Squares
1	8
2	
3	
4	

15. Look at your data table and graph.

A. Describe any patterns you see.

B. How can you get the next value of *S* for a Rainbow Caterpillar without counting all the tiles?

16. How many squares does a Rainbow Caterpillar have at each of these ages? Record the data for each age in your data table.

A. 10 years old

B. 20 years old

C. 25 years old

✓ **Check-In: Questions 17-20**

17. Write a formula that gives the size in squares, *S*, for a Rainbow Caterpillar of any age, *A*.

18. Use any method you choose to predict the number of squares a 35-year-old Rainbow Caterpillar has. Show or tell how you found your answer.

19. Use any method you choose to find the age of a Rainbow Caterpillar with the ages shown below. Show or tell how you found your answers.

A. 63 squares

B. 153 squares

20. Estimate the age of a Rainbow Caterpillar that has 1000 squares. Explain your estimation strategy.

436 SG • Grade 5 • Unit 9 • Lesson 3 Growth Patterns on Planet Gzorp

***Student Guide* - Page 436**

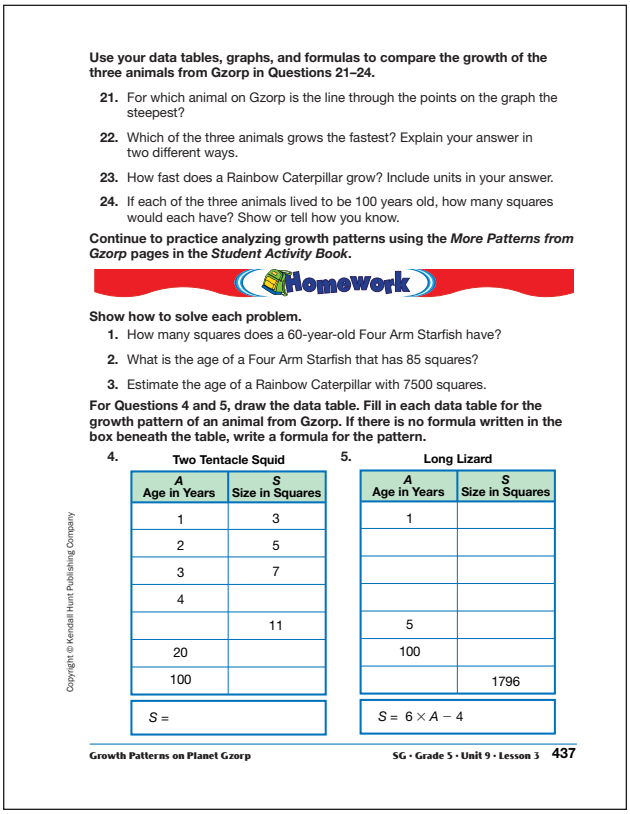
Rainbow Caterpillar

A Age in Years	*S* Size in Squares	
1	8	
2	13	
3	18	
4	23	
5	28	
6	33	
7	38	
8	43	
10	53	A | S : 11 | 58 ; 12 | 63
20	103	
25	128	

B. 30 years; Possible response: I used the rule backwards. I subtracted 3 squares for the squares it had when it was born. $153 - 3 = 150$. Then I divided by 5 for the number of squares it grows each year. The answer is 30 years.

20. About 200 years old; $1000 \div 5 = 200$ years.

***Answers and/or discussion are included in the lesson.**



Use your data tables, graphs, and formulas to compare the growth of the three animals from Gzorp in Questions 21–24.

21. For which animal on Gzorp is the line through the points on the graph the steepest?
22. Which of the three animals grows the fastest? Explain your answer in two different ways.
23. How fast does a Rainbow Caterpillar grow? Include units in your answer.
24. If each of the three animals lived to be 100 years old, how many squares would each have? Show or tell how you know.

Continue to practice analyzing growth patterns using the *More Patterns from Gzorp* pages in the *Student Activity Book*.

Homework

Show how to solve each problem.

1. How many squares does a 60-year-old Four Arm Starfish have?
2. What is the age of a Four Arm Starfish that has 85 squares?
3. Estimate the age of a Rainbow Caterpillar with 7500 squares.

For Questions 4 and 5, draw the data table. Fill in each data table for the growth pattern of an animal from Gzorp. If there is no formula written in the box beneath the table, write a formula for the pattern.

4. Two Tentacle Squid

A Age in Years	S Size in Squares
1	3
2	5
3	7
4	
	11
20	
100	

S =

5. Long Lizard

A Age in Years	S Size in Squares
1	
5	
100	
	1796

S = 6 × A − 4

Growth Patterns on Planet Gzorp SG • Grade 5 • Unit 9 • Lesson 3 437

***Student Guide* - Page 437**

21.* The line for the Rainbow Caterpillar is the steepest.

22.* The Rainbow Caterpillar grows the fastest. In the data table, you add 5 squares for each year. For the alligator, you only add 3 each year and for the starfish, you add 4 each year. The caterpillar graph is steepest because every time you move over on the horizontal for 1 more year of age, you move up five spaces for adding 5 more tiles.

23.* The caterpillar grows 5 squares each year.

24.* Alligator: 300 years old; $3 \times 100 = 300$
Starfish: 401 years old; $4 \times 100 + 1 = 401$
Caterpillar: 503 years old; $5 \times 100 + 3 = 503$

Homework (SG p. 437)
Questions 1–5

1. 241 squares; Possible response: I used my formula. 60 multiplied by 4 is 240, and plus 1 is 241.

2. 21 years old; Two possible responses:

   I used my formula backwards. First I subtracted 1 from 85 to get 84, then I divided by 4 to get 21.

   I looked at my data table. Since a 20 year old starfish has 81 squares, and I know that size in squares grows by 4 every year, a 21 year old starfish would have 85 squares.

3. 1500 years old; Possible responses:

   My formula says that a Rainbow Caterpillar's size is equal to its age multipled by 5 and add 3. So $7500 \div 5 = 1500$ is a good estimate.

4. Two Tentacle Squid

A Age in Years	S Size in Squares
1	3
2	5
3	7
4	9
5	11
10	21
20	41
100	201

$S = A \times 2 + 1$

5. Long Lizard

A Age in Years	S Size in Squares
1	2
2	8
3	14
4	20
5	26
100	596
300	1796

$S = 6 \times A - 4$

*Answers and/or discussion are included in the lesson.