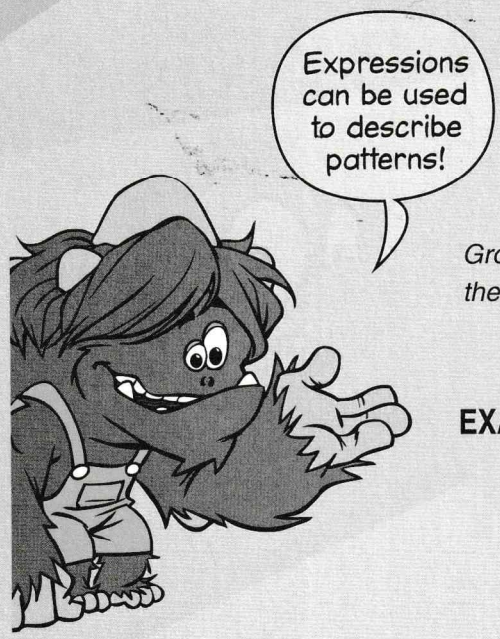
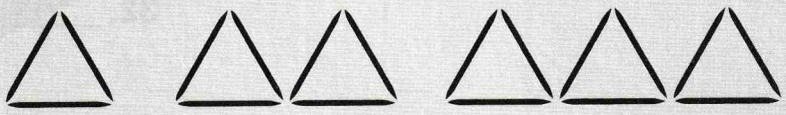


Grogg makes patterns from toothpicks. He records the numbers of shapes and toothpicks in a table.

EXAMPLE

Complete the table below with the number of toothpicks needed to make each number of triangles.



Triangles	Toothpicks
1	3
2	6
3	9
4	
5	
6	
7	
8	
n	

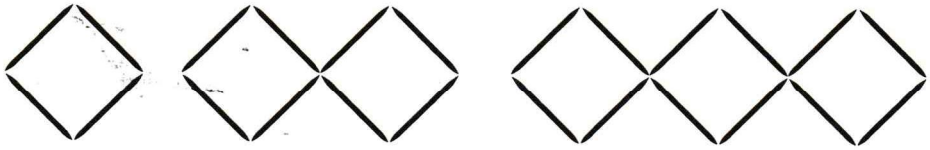
Triangles	Toothpicks
1	3
2	6
3	9
4	**12**
5	**15**
6	**18**
7	**21**
8	**24**
n	$\boldsymbol{n\times3}$

For each triangle in the diagram, Grogg needs 3 toothpicks. So, we can multiply the number of triangles by 3 to get the number of toothpicks.

$4\times3=12$.
$5\times3=15$.
$6\times3=18$.
$7\times3=21$.
$8\times3=24$.

← To make a pattern with n triangles, he needs $n\times3$ toothpicks.

PRACTICE | Use the toothpick patterns below for Problems 38-40.



38. Complete the table below with the number of toothpicks needed to make each number of squares.

Squares	Toothpicks
1	4
2	8
3	12
4	
5	
10	
100	

39. Circle the expression below that describes the number of toothpicks that Grogg needs to make a diagram of n squares.

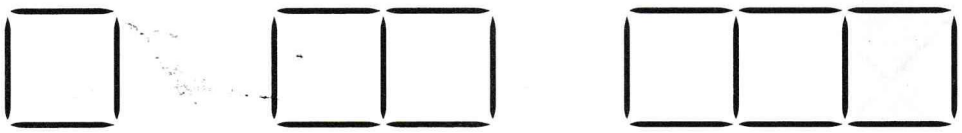
n	

$n+3$ $\quad$ $n\times3$ $\quad$ $n\times4$ $\quad$ $1+n\times2$ $\quad$ $1+n\times3$

Check your work! Evaluate the expression you chose for some values of n from the table. Your answers should match entries in the table above.

40. How many toothpicks does Grogg need to make the same pattern with 40 squares? **40.** _____

PRACTICE | Use the toothpick pattern below for Problems 41-43.



41. Complete the table below with the number of toothpicks needed to make each number of squares.

Squares	Toothpicks
1	4
2	7
3	10
4	
5	
★ 20	
★ 100	

42. Circle the expression below that describes the number of toothpicks that Grogg needs to make a diagram of n squares.

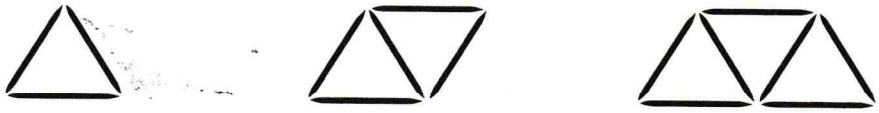
n	

$n \times 5$ $\quad$ $n \times 3$ $\quad$ $n+3$ $\quad$ $1+n \times 2$ $\quad$ $1+n \times 3$

Check your work! Evaluate the expression you chose for some values of n from the table. Your answers should match entries in the table above.

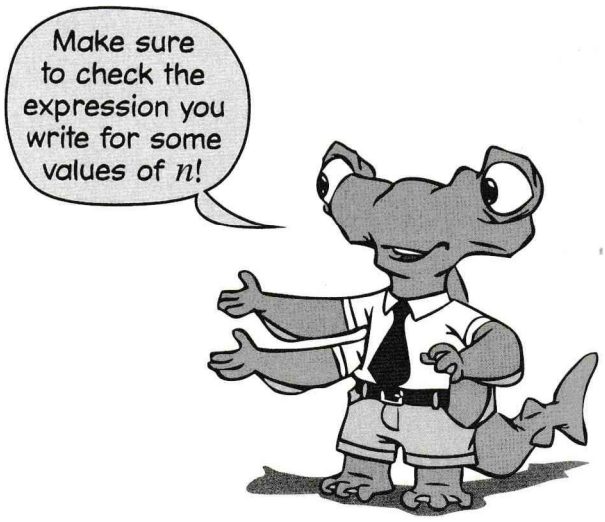
43. How many toothpicks does Grogg need to make the same pattern with 50 squares? **43.** _____

PRACTICE | Use the toothpick pattern below for Problem 44.



44. ★ Complete the table below with the number of toothpicks needed to make each number of triangles.

Triangles	Toothpicks
1	3
2	5
3	7
4	
5	
n	
100	



PRACTICE | Use the toothpick pattern below for Problem 45.

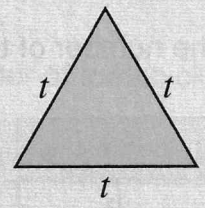
45. ★ Complete the table below with the number of toothpicks needed to make each number of pentagons.

Pentagons	Toothpicks
1	5
2	9
3	13
4	
5	
n	
100	

EXAMPLE

Write an expression for the perimeter of an equilateral triangle with sides of length t.

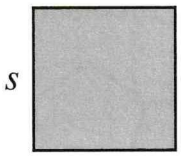
Since the triangle is equilateral, we know the length of each side is t.



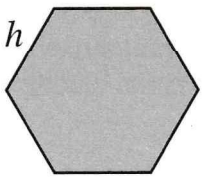
So, the perimeter of the triangle is $t+t+t$ or $3\times t$.

PRACTICE

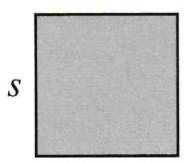
46. Write an expression for the perimeter of a square with side length s. **46.** _____



47. Write an expression for the perimeter of a regular hexagon with side length h. **47.** _____

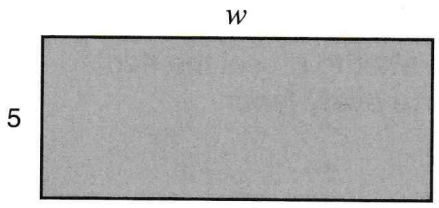


48. Write an expression for the ***area*** of a square with side length s. **48.** _____



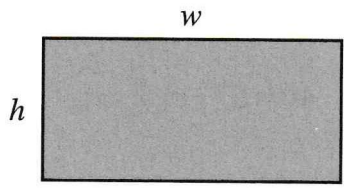
49. Write an expression for the area of a rectangle with height 5 and width w.

49. _____



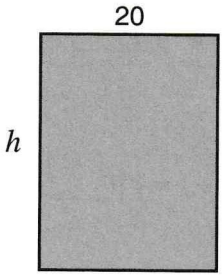
50. Write an expression for the area of a rectangle with height h and width w.

50. _____



51. Write an expression for the perimeter of a rectangle with height h and width 20.

51. _____



52. Write an expression for the perimeter of a rectangle with height h and width w.

52. _____

Calamitous Clod has encoded a riddle below!

PRACTICE

Solve each equation. Then, fill in the blanks with the correct letter to reveal the riddle. You might not use every letter.

53. $2 \times a = 18$ $a =$ _____

54. $6 + b = 12$ $b =$ _____

55. $d = 2 + 3 \times 2$ $d =$ _____

56. $e \times 9 = 45$ $e =$ _____

57. $27 = 9 \times h$ $h =$ _____

58. $40 = 57 - m$ $m =$ _____

59. $80 = 93 - o$ $o =$ _____

60. $4 \times r = 28$ $r =$ _____

61. $70 = s \times 7$ $s =$ _____

62. $7 = t - 15$ $t =$ _____

63. $2 \times 10 - w = 19$ $w =$ _____

64. $68 + z = 79$ $z =$ _____

1	3	5	7	5		8	13		17	9	22	3							
6	5	9	10	22	10		5	9	22	?									

Calamitous Clod has encoded the answer to his riddle below. Be careful! He used a different code for the letters on this page.

PRACTICE | Solve each equation. Then, fill in the blanks with the correct letter to reveal the answer to the riddle. You might not use every letter.

65. $90-a=79$ $a=$ ______

66. $5\times5-2=b$ $b=$ ______

67. $d+3=20$ $d=$ ______

68. $36-e=24$ $e=$ ______

69. $g-12=4$ $g=$ ______

70. $150-i=130$ $i=$ ______

71. $5\times j=20$ $j=$ ______

72. $11\times l=22$ $l=$ ______

73. $100=m\times20$ $m=$ ______

74. $n+50=75$ $n=$ ______

75. $2\times9+6=s$ $s=$ ______

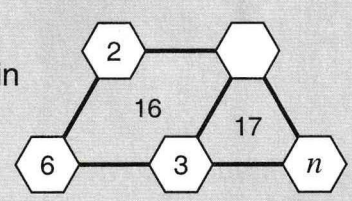
76. $t+4=22$ $t=$ ______

__ __   __   __ __ __ __ __
11 18   11   18 20 5 12 24

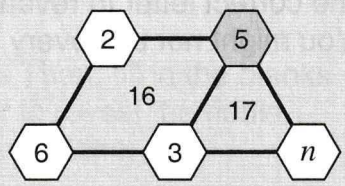
__ __ __ __ __ !
18 11 23 2 12

In the diagrams below, the number in a region is the ***sum*** *of the numbers in the hexagons that surround it.*

EXAMPLE Find the value of n in the diagram shown.

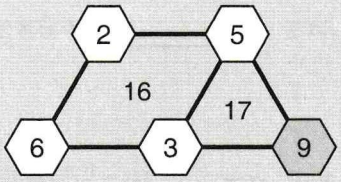


First, we use the region with a sum of 16 to write an equation: $2+6+3+\bigcirc = 16$.
We can simplify the equation by adding $2+6+3$. This gives us $11+\bigcirc = 16$.
Since $11+\boxed{5} = 16$, we place a 5 in the blank hexagon.



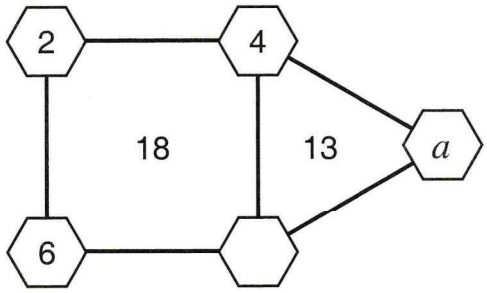
Then, we can use the region with a sum of 17 to write an equation: $3+5+n = 17$.
We simplify the left side by adding $3+5$. This gives us $8+n = 17$.
Since $8+\underline{9} = 17$, the value of n is **9**.

We replace n with 9 and check our work.



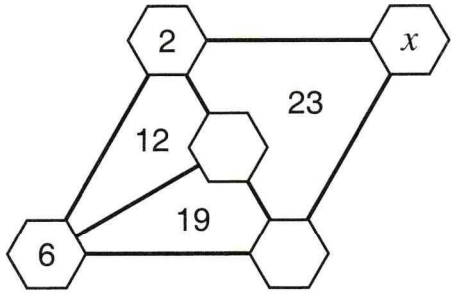
PRACTICE Find the value of the variable in each diagram below.

77.



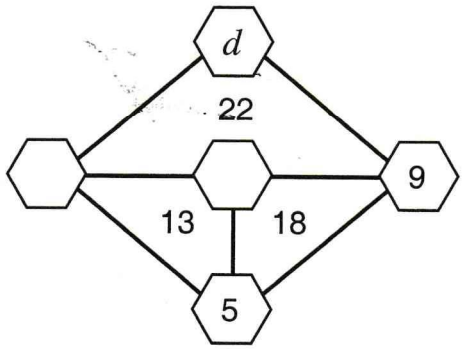
77. $a =$ _____

78.



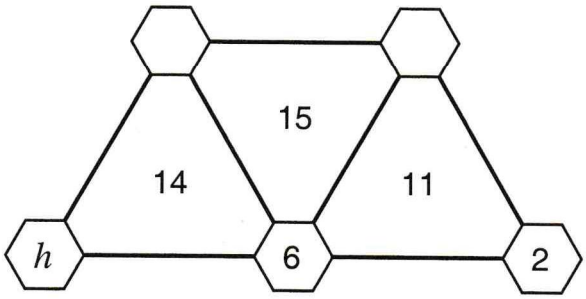
78. $x =$ _____

79.



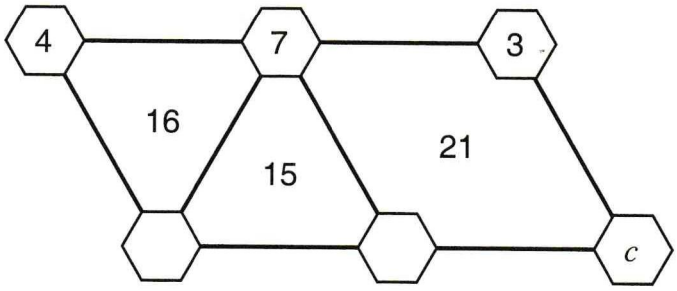
79. $d =$ _____

80.



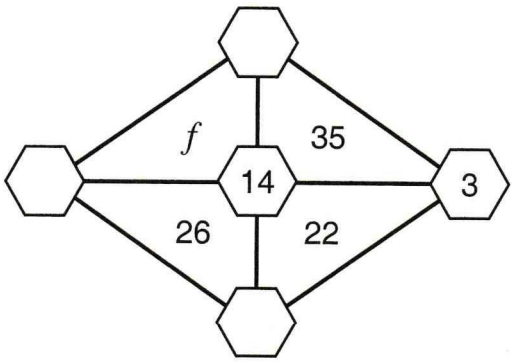
80. $h =$ _____

81.



81. $c =$ _____

82.



82. $f =$ _____