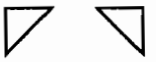
Patchwork

T1

A sheet of square dot paper is provided for use with this item.

Kate makes patchwork cushions.
She uses right triangles  and squares. 

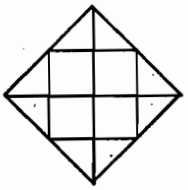
She uses triangles along the edges of each cushion. The rest is made from squares.

The backs of the cushions are made of plain material, not patchwork.

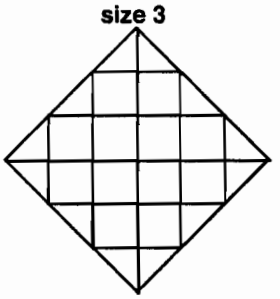
Here are the first five sizes of patchwork cushions.

size 1

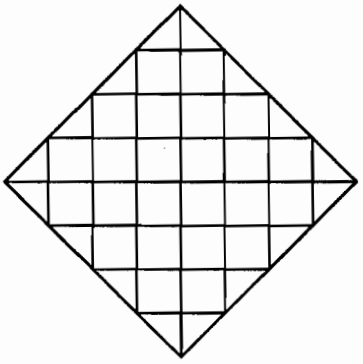
size 2



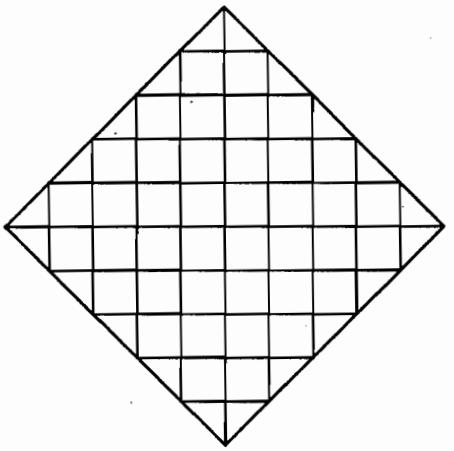
size 3



size 4



size 5



Kate makes cushions in many other different sizes.

She begins to figure out how many triangles and squares she needs for each size.

For size 1, she needs 4 triangles and 0 squares.

For size 2, she needs 8 triangles and 4 squares.

T1

1. Complete this table to show how many triangles and squares she needs for each of these five sizes.

Size (n)	Number of triangles (t)	Number of squares (s)
1	4	0 × 4
2	8	4 + 8
3	12	12 + 12
4	16	24 + 16
5	20	40

$(2n)(n-1)=5$

2. Find a rule, or a formula, that will help Kate figure out the number of triangles she needs for cushions of different sizes. Explain how you figured it out.

A formula that works is $t = 4n$ (t=# of triangles; n=size) this works because if you were to divide the cushion into fourths along the corners, you would see that one side of the cusion contains the # of triangles that there are in the # of the cushion size.

3. Use the number patterns in the table to find a rule, or a formula, that will help Kate figure out the number of squares she needs for cushions of different sizes. Explain why your rule works.

A formula that works is $5 = (2n)(n-1)$ (5=# of squares; n=size) this works because each cusion contains 4 bits: put two bits together we get 2 rectangles, ▭ $(n-1)$ n by $(n-1)$

4. Kate has a cushion made with 180 squares.
How many triangles are in this cushion? 40
Show how you found the number of triangles.

$\frac{180}{2} - \frac{(2n)(n-1)}{2}$ # of t = 180

$90 = (n)(n-1)$ size = 10

10 9 # of s = 40

Patchwork

T2

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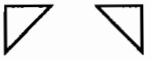
She uses right triangles  and squares. 

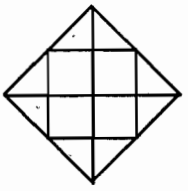
She uses triangles along the edges of each cushion. The rest is made from squares.

The backs of the cushions are made of plain material, not patchwork.

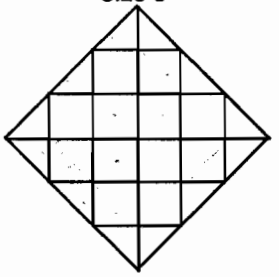
Here are the first five sizes of patchwork cushions.

size 1

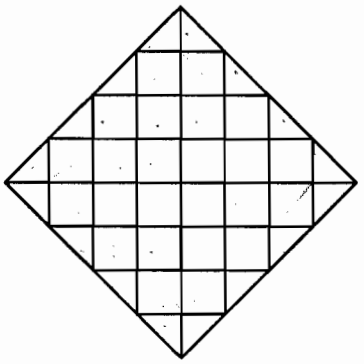
size 2



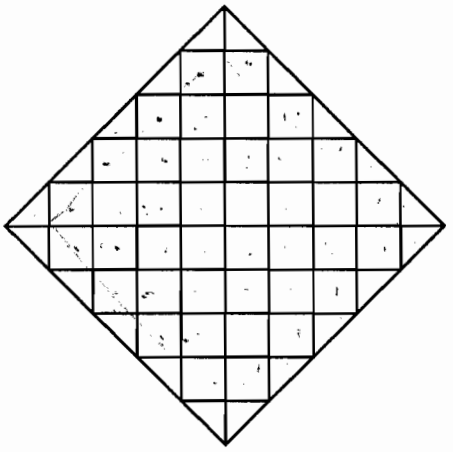
size 3



size 4



size 5



Kate makes cushions in many other different sizes.

She begins to figure out how many triangles and squares she needs for each size.

For size 1, she needs 4 triangles and 0 squares.

For size 2, she needs 8 triangles and 4 squares.

T2

1. Complete this table to show how many triangles and squares she needs for each of these five sizes?

Size *(n)*	Number of triangles *(t)*	Number of squares *(s)*
1	4	0
2	8	4
3	12	12
4	16	24
5	20	40

2. Find a rule, or a formula, that will help Kate figure out the number of triangles that she needs for cushions of different sizes. Explain how you figured it out.

$4n = t$: every time you add in size, if you multiply 4 by the size it gets you the number of triangles.

3. Use the number patterns in the table to find a rule, or a formula, that will help Kate figure out the number of squares she needs for cushions of different sizes. Explain why your rule works.

$n = 2 \quad 4 = n^2$

$n = 3 \quad 12 = n^2 + 3 = n^2 + n = n(n+1)_{n-2}$

$n = 4 \quad 4 = n^2 + 8 = n^2 + 2n = n(n+2)_{n-2}$

$n = 5 \quad 40 = n^2 + 15 = n^2 + 3n = n(n+3)_{n-2}$

$S = n(n + n - 2) = S = n(2n-2)$

$S = 2n(n-1)$

4. Kate has a cushion made with 180 squares.
How many triangles are in this cushion?
Show how you found the number of triangles.

$180 = 2n(n-1)$

Patchwork

T3

A sheet of square dot paper is provided for use with this item.

Kate makes patchwork cushions.
She uses right triangles   and squares. 

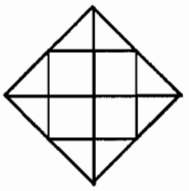
She uses triangles along the edges of each cushion. The rest is made from squares.

The backs of the cushions are made of plain material, not patchwork.

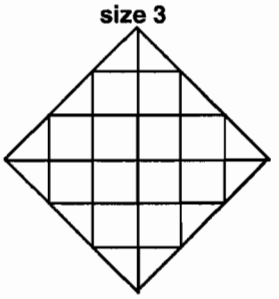
Here are the first five sizes of patchwork cushions.

size 1

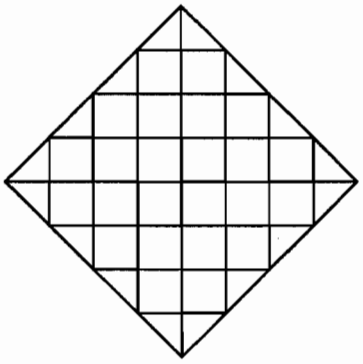
size 2



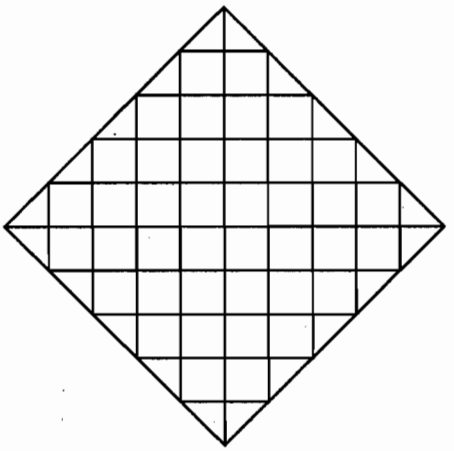
size 3



size 4



size 5



Kate makes cushions in many other different sizes.

She begins to figure out how many triangles and squares she needs for each size.

For size 1, she needs 4 triangles and 0 squares.

For size 2, she needs 8 triangles and 4 squares.

T3

1. Complete this table to show how many triangles and squares she needs for each of these five sizes.

Size (*n*)	Number of triangles (*t*)	Number of squares (*s*)
1	4	0
2	8	4
3	12	12
4	16	24
5	20	40

2. Find a rule, or a formula, that will help Kate figure out the number of triangles she needs for cushions of different sizes. Explain how you figured it out.

For every new size you increase the triangles by 4 because $4 \times 1 = 4$ and $4 \times 2 = 8$ and so on. $4n = t$ You're adding four because that's the way she divided it up. (4, 8, 12, 16, 20, 24) The next size of triangles.
(+4 +4 +4 +4 +4)

3. Use the number patterns in the table to find a rule, or a formula, that will help Kate figure out the number of squares she needs for cushions of different sizes. Explain why your rule works.

For every new size you add the sum of the triangle and square of the last size. that she did.

$4 + 0 = 4$ (#TRIS, #Sqs., new #Sqs.)

#TRIS $\rightarrow 8 + 4 = 12$ (#Sqs, new # of sqs.)

4. Kate has a cushion made with 180 squares. How many triangles are in this cushion? Show how you found the number of triangles.

new # Sqs

$20 + 40 = 60$
$+4$
$24 + 60 = 84$
$+4$
$28 + 84 = 112$
$+4$
$32 + 112 = 144$
$+4$
$36 + 144 = 180$
$+4$
$40 + 180$

40

TRIANGLES = 40
Squares = 180

Patchwork

T4

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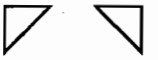
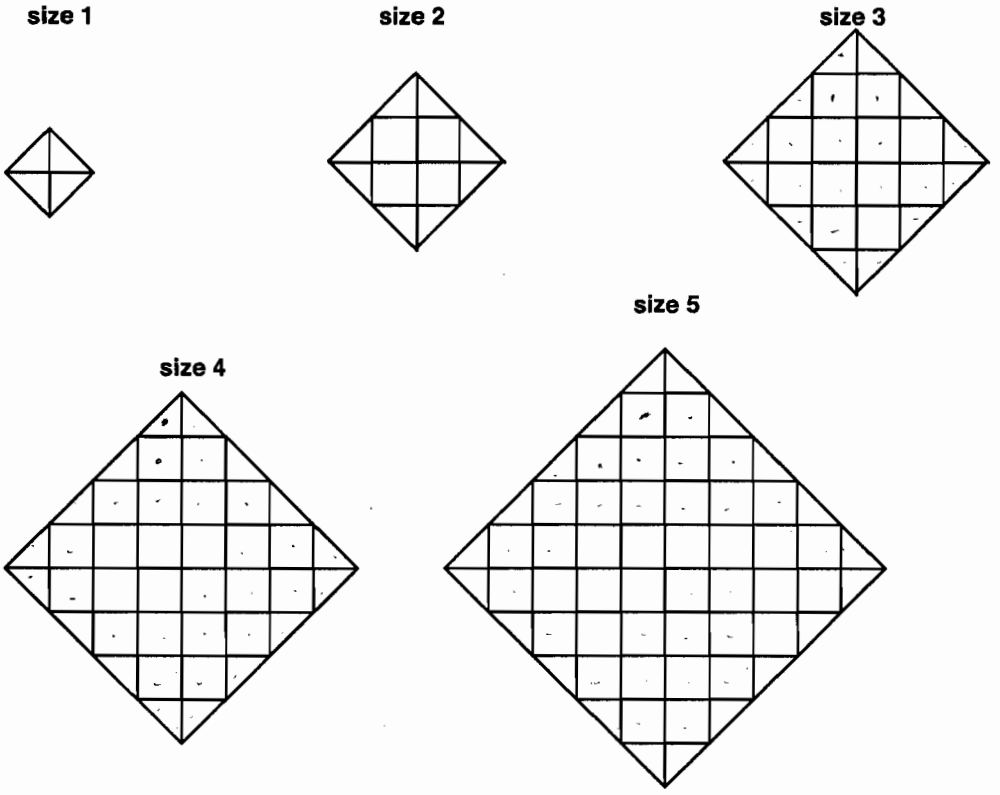
She uses right triangles  and squares. 

She uses triangles along the edges of each cushion. The rest is made from squares.

The backs of the cushions are made of plain material, not patchwork.

Here are the first five sizes of patchwork cushions.



Kate makes cushions in many other different sizes.

She begins to figure out how many triangles and squares she needs for each size.

For size 1, she needs 4 triangles and 0 squares.

For size 2, she needs 8 triangles and 4 squares.

T4

1. Complete this table to show how many triangles and squares she needs for each of these five sizes?

Size *(n)*	Number of triangles *(t)*	Number of squares *(s)*
1	4	0
2	8	4
3	12	8
4	16	12
5	20	16

2. Find a rule, or a formula, that will help Kate figure out the number of triangles that she needs for cushions of different sizes. Explain how you figured it out.

Add 4 triangles to the size kate previously made to find the next amount of triangles, so the rule must be $t = 4n$

3. Use the number patterns in the table to find a rule, or a formula, that will help Kate figure out the number of squares she needs for cushions of different sizes. Explain why your rule works.

Add # of triangles to the # of squares of the previous amount to get next # of triangles. # of squares increases by multiples of 4

4. Kate has a cushion made with 180 squares.
How many triangles are in this cushion?
Show how you found the number of triangles.

90 triangles

Patchwork

T5

A sheet of square dot paper is provided for use with this item.

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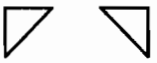
She uses right triangles  and squares. 

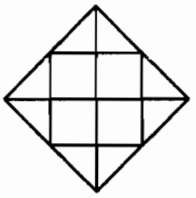
She uses triangles along the edges of each cushion. The rest is made from squares.

The backs of the cushions are made of plain material, not patchwork.

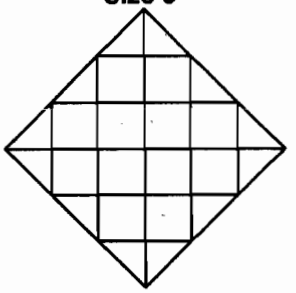
Here are the first five sizes of patchwork cushions.

size 1

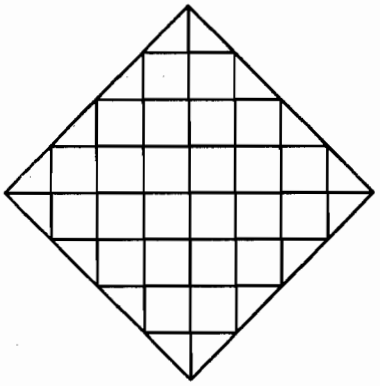
size 2



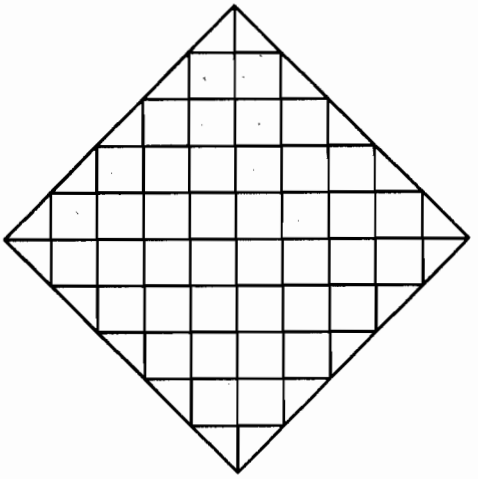
size 3



size 4



size 5



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She begins to figure out how many triangles and squares she needs for each size.

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1. Complete this table to show how many triangles and squares she needs for each of these five sizes?

Size *(n)*	Number of triangles *(t)*	Number of squares *(s)*
1	4	0
2	8	4
3	12	12
4	16	24
5	20	40

2. Find a rule, or a formula, that will help Kate figure out the number of triangles that she needs for cushions of different sizes. Explain how you figured it out.

$y = 4x$
y- the # of triangles increases by 4 every time

3. Use the number patterns in the table to find a rule, or a formula, that will help Kate figure out the number of squares she needs for cushions of different sizes. Explain why your rule works.

$y = 2x^2 + -2x$
it's quadratic ($y = ax^2 + bx + 0$)
$y = 2x^2 - 2x$
$y = 2x(x-1)$

4. Kate has a cushion made with 180 squares. How many triangles are in this cushion? Show how you found the number of triangles.

$180 = 2x(x-1$
$= 2 \times 20(19)$
$180 = 2.10(10-1)$ $x = 10$
$= 180$ triangles $4x = 40$