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# How to Solve Pattern Questions: Patterns Your Child Must Know for PSLE Math

P6 pattern questions often appear in the last few questions in Paper 2, and they are usually worth five marks.

So, it's important to understand how to solve Pattern questions better.

Here are 3 simple steps which you can guide your child to solve any Pattern Questions.

1) Identify the Pattern

There are 3 common types of patterns which your child must know for PSLE Math.

- Common Difference: 1, 3, 5, 7, 9…
- Square Numbers: 1x1, 2x2, 3x3, 4x4, 5x5…
- Increasing Difference: 1, 3, 6, 10, 15, 21…

2) Think of the strategy

Many students only know 1 strategy to solve Pattern questions: Listing.

Listing method is too time consuming!

In this tutorial, we are going to explore some strategies which your child can use easily.

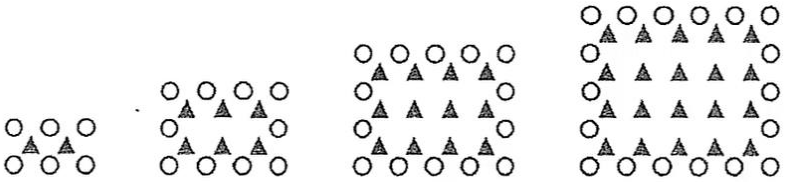
3) Apply the strategy

In this tutorial, we're solving two questions from last year's prelim papers. After this tutorial, you'll realize that pattern questions can actually be solved very easily.

**Example 1**

This question was taken from the Henry Park Primary School 2022 Prelim Paper 2.

**Question**: Jimena uses circles and triangles to form figures that follow a pattern as shown below.




**(a) The table shows the number of triangles and circles for the first 4 figures. Complete the table for Figure 5.**

| Figure Number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Number of triangles | 2 | 6 | 12 | 20 | |
| Number of circles | 6 | 10 | 14 | 18 | |
| Total number of triangles and circles | 8 | 16 | 26 | 38 | |

***Step 1: Look at the range of numbers on the table to see if there is a pattern.***

Skimming through the numbers, we see that the number of circles follows a pattern of a constant difference. A constant difference means a difference that is the same throughout.

| Figure Number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Number of triangles | 2 | 6 | 12 | 20 | |
| Number of circles | 6 | 10 | 14 | 18 | 22 |
| Total number of triangles and circles | 8 | 16 | 26 | 38 | |

The constant difference here is +4. Therefore, the number of circles in Figure 5 would be 18 + 4, which is 22.

***Step 2: Look at how the number of triangles is increasing.***

There doesn't seem to be any obvious pattern. But what if we try to relate the figure number with the number of triangles?

Let's start with Figure 4, looking for a 4 somewhere in the triangle.

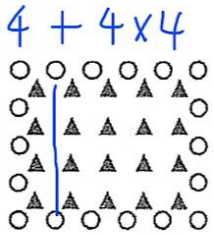
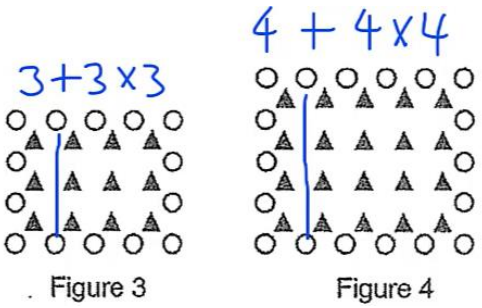



Figure 4

We separate the first column of 4 from the main group of triangles. Then, you can see that the other side has a group of triangles that forms a 4 × 4 square.

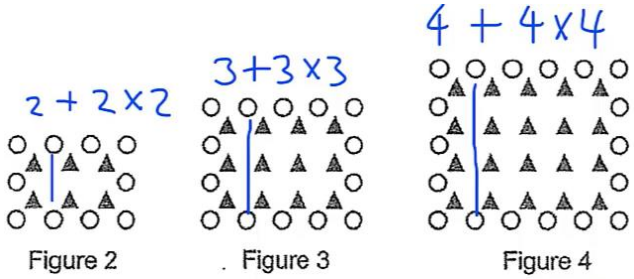
So, Figure 4 is made up of a column of 4 + a group of triangles that forms a square (4 × 4).

***Step 3: Try the same formula for all figures.***




If we partition the first column, we get 3 triangles on the left. On the right, we have 3 rows of 3 triangles. This 3 × 3 is a squared number, just like 4 × 4.

This also works in Figure 2.




There are 2 triangles on the left and 2 × 2 triangles on the right.

This formula works for Figure 1 as well, where the left is a 1 and the right is a simple 1 × 1.

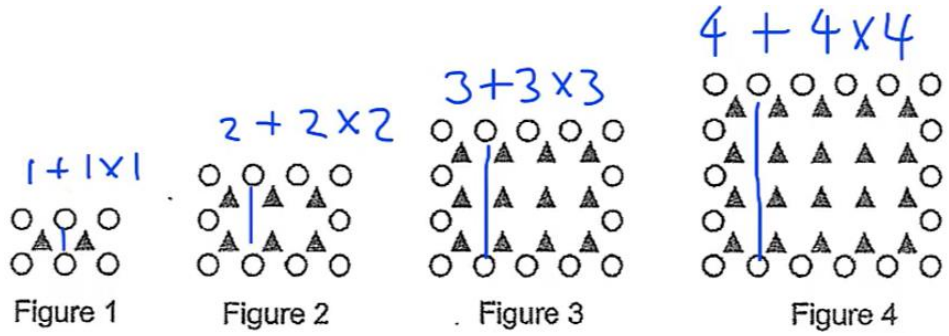



Figure 5 also has to follow the same formula. Therefore, 5 + 5 × 5 = 30. From here, we can find the total number of triangles and circles, which is 52.

| **Figure Number** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| Number of triangles | 2 | 6 | 12 | 20 | 30 |
| Number of circles | 6 | 10 | 14 | 18 | 22 |
| Total number of triangles and circles | 8 | 16 | 26 | 38 | 52 |

+4 +4 +4 +4

5+5x5

**(b) A figure in the pattern has 240 triangles. What is the Figure Number?**

The answer to this question follows the formula where the figure number (n) + the squared number of n = the number of triangles. So, n + n × n = 240.

Here, we can do a simple guess and check. When n = 15. 15 + 15 × 15 = 240. So, the figure number is 15.

N+N×N = 240
× 10+10×10 = 110
× 14+14×14 = 210
15+15×15 = 240

Ans: (b) 15 [2]

**(c) What is the total number of triangles and circles in Figure 100?**

We can find the number of triangles in Figure 100 using the formula we found in question **(a)**. So, this will be 100 + 100 × 100 = 10100.

Now, let's try to find the number of circles in Figure 100.

We know that the number of circles follows a constant difference of +4. So, we find the number of intervals from Figure 1 to Figure 100.

So, we simply subtract Figure 1 from Figure 100. We find that there are 99 intervals.

100 + 100×100 = 10100
100 − 1 = 99

From Figure 1, all the way to Figure 100, there are 99 additions of 4. That means from Figure 1, we will be adding 99 +4s.

So, 99 × 4 will tell us the total increase from Figure 1's number of circles.

100 + 100×100 = 10100
100 − 1 = 99
99 × 4 = 396

Figure 1's number of circles is going to increase by 396. So, we take 6 + 396, which gives us 402 circles.

100 + 100×100 = 10100
100 − 1 = 99
99 × 4 = 396
6 + 396 = 402

Therefore, 402 circles + 10100 triangles will give us the total number.

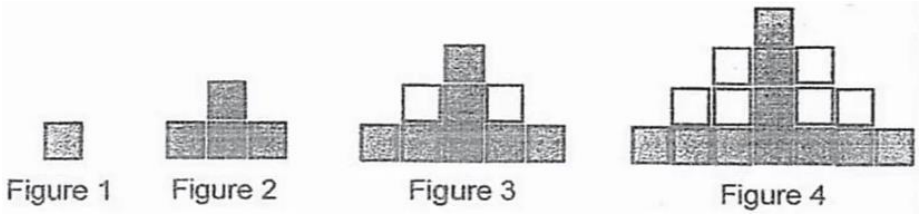
$100 + 100 \times 100 = 10100$
$100 - 1 = 99$
$99 \times 4 = 396$
$6 + 396 = 402$
$402 + 10100 = 10502$

Ans: (c) 10502 [2]

**Example 2**

This question was taken from the Catholic High School 2022 Prelim Paper 2.

**Question**: Raju used white and grey squares to form the following patterns as shown.




The table below shows the number of white and grey squares in each figure.

| Figure Number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Number of white squares | 0 | 0 | 2 | 6 | |
| Number of grey squares | 1 | 4 | 7 | 10 | |

**(a) Fill in the table for Figure 5.**

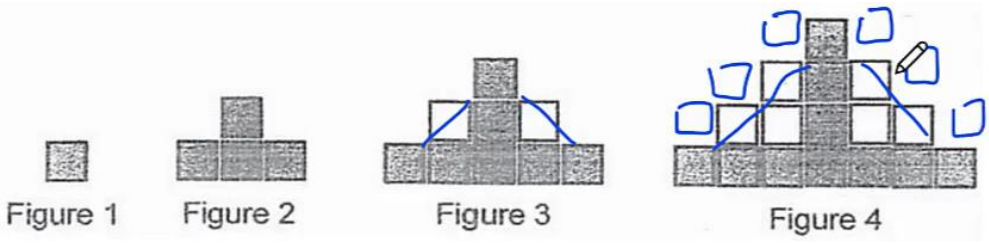
Again, we skim through for an easy pattern. We see an easy pattern of a constant +3 for the grey squares.

| Figure Number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Number of white squares | 0 | 0 | 2 | 6 | |
| Number of grey squares | 1 | 4 | 7 | 10 | 13 |

(+3 → 4, +3 → 7, +3 → 10, +3 → 13)

So, Figure 5 will have 13 grey squares because it's 10 + 3. Now we can look at how the white squares are arranged.

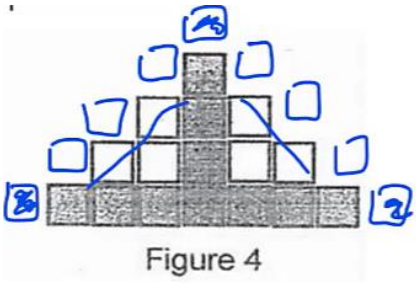
We can easily draw the number of white triangles for Fig 5 as follow.




So, the total is 6, and 6 + 6 = 12 white squares in Figure 5.

| **Figure Number** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| Number of white squares | 0 | 0 | 2 | 6 | 12 |
| Number of grey squares | 1 | 4 | 7 | 10 | 13 |

Figure 5 will also have another 3 grey squares. So, it will look as follows:




**(b) What is the total number of squares in Figure 40?**

The question only gives us 1 mark, meaning it's perhaps a simple question that may only require one equation.

So, let's look at the total number of grey squares first to see if there's a pattern:

| **Figure Number** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|
| Number of white squares | 0 | 0 | 2 | 6 | 12 |
| Number of grey squares | 1 | 4 | 7 | 10 | 13 |
| | 1 × 1 = 1 | 2 × 2 = 4 | 3 × 3 = 9 | 4 × 4 = 16 | 5 × 5 = 25 |

(a) Fill in the table for Figure 5.

These are all squared numbers. Figure 1 is 1 × 1, Figure 2 is 2 × 2, and Figure 3 is 3 × 3 total. Therefore, the total number of squares in Figure 40 has to be 40 × 40 = 1600.

(b) What is the total number of squares in Figure 40?

$40 \times 40 = 1600$

Ans: (b) 1600 [1]

**(c) How many more white squares than grey squares are used in Figure 40?**

The pattern for white is a bit strange and not as straightforward as grey.

So, we can use the constant difference to find the intervals and then find the number of grey squares in Figure 40.

Once we find the number of grey squares, we can find the number of white because we already found the total number of squares in the previous question.

The number of intervals from Figure 1 to Figure 40 is 40 - 1 = 39 intervals. We know that each interval carries a constant difference of +3.

Therefore, 39 × 3 = 117.

So, we increase the number of grey squares in Figure 1 by 117. Therefore, 1 + 117 = 118 is the number of grey squares in Figure 40.

$40 - 1 = 39$
$39 \times 3 = 117$
$1 + 117 = 118$ (Grey)

With this total, we can find the number of white squares because we know that the total number of squares is 1600. So, the total - grey squares = white squares, meaning that 1600 – 118 = 1482.

$40 - 1 = 39$
$39 \times 3 = 117$
$1 + 117 = 118$ (Grey)
$1600 - 118 = 1482$ (white)

The question is asking for the difference between the white squares and the grey squares. Therefore, we just subtract the grey, which gives us 1364.

40 − 1 = 39
39 × 3 = 117
1 + 117 = 118 (Grey)
1600 − 118 = 1482 (white)
1482 − 118 = 1364

Ans: (c) 1364 [3]

In this question, we used our knowledge of squared numbers, the number of intervals, and the constant difference.

Pattern questions like this are not that challenging if you can spot the constant difference and can immediately use the interval concept or spot the square numbers.

*I hope this tutorial was easy to understand and helpful for your child. If you have any questions or suggestions, please feel free to leave a comment below.*

*You can also watch the full video tutorial here:*
*https://www.youtube.com/watch?v=JUzKsrqMl5g&t=682s*

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Ms Nelly Ke
Math Specialist
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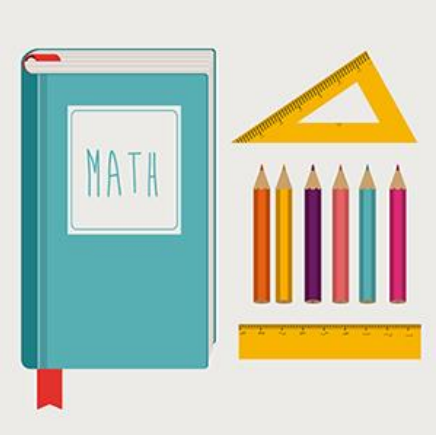


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