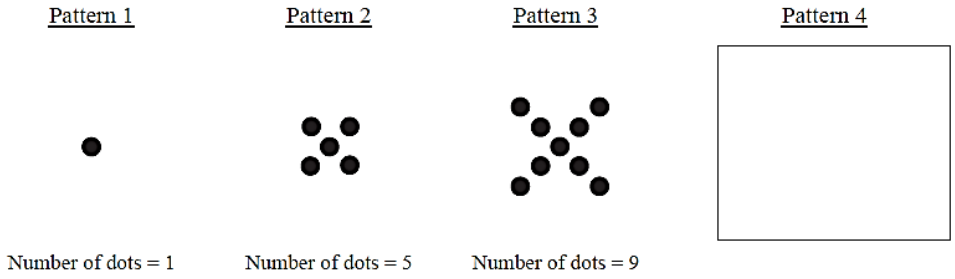
5 MUST KNOW QUESTIONS TO *CONQUER*

NUMBER PATTERNS

1	The first four terms of a sequence are 2, 5, 10 and 17. (a) Write down the next two terms. (b) Find an expression, in terms of n, for the nth term of the sequence. (c) Explain, with working, why 525 is not a term in the sequence.	[1] [2] [2]
2	A sequence of patterns formed by dots is as shown.  (a) Draw the 4^{th} pattern of the sequence in the above box. (b) State the total number of dots required, in terms of n, to form the n^{th} pattern? (c) Pattern P requires 333 dots. What is the value of 'P'?	[1] [2] [2]
3	Given the following sequence, $\frac{1}{6}+\frac{1}{3}=\frac{1}{2}$ $\frac{1}{12}+\frac{1}{4}=\frac{1}{3}$ $\frac{1}{20}+\frac{1}{5}=\frac{1}{4}$ $\frac{1}{30}+\frac{1}{6}=\frac{1}{5}$ ... $\frac{1}{\boldsymbol{p}}+\frac{1}{12}=\frac{1}{11}$ Find (a) the 5th line of sequence, (b) the value of p, (c) the value of $\frac{1}{98}-\frac{1}{99}$, showing your workings clearly.	[2] [1] [3]

4 The following diagram shows the first three figures of a sequence of triangles.

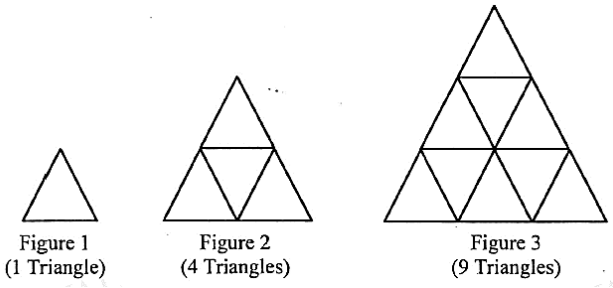


Figure 1 (1 Triangle) Figure 2 (4 Triangles) Figure 3 (9 Triangles)

Figure	Number of triangles	Total
1	1	1
2	$1+3$	4
3	$1+3+5$	9
4		
5		x
⋮	⋮	⋮
n	$1+3+5+\ldots+y$	z

(a) Complete the table above to find the value of x. [4]

(b) Write an expression for y and z, in terms of n, giving your answers in their simplest form. [2]

(c) Is it possible for a figure to consist of 3365 triangles?
Explain your answer clearly. [2]

5 The birth weight of a newborn baby girl is 2 800 g.
During the first year, her weight increases by 480 g every month.

(a) Write down her weight when she is [1]

(i) 1 month old, [1]

(ii) 2 months old. [1]

(b) Find an expression for her weight when she is n months old. [2]

(c) If the girl weighs 8.0 kg when she is m months old, find the value of m. [2]

(d) Explain why the expression in **(b)** is not used to find the weight of the girl when she is 10 years old.

Answer Key

1	Solutions: (a) $T_1 = 1^2 + 1 = 2$ $T_2 = 2^2 + 1 = 5$ $T_3 = 3^2 + 1 = 10$ $T_4 = 4^2 + 1 = 17$ (c) $n^2 + 1 = 525$ $n^2 = 524$ $n = 22.89$ 525 cannot be a term in the sequence as the *n* is not an integer Ans: (b) $T_n = n^2 + 1$	
2	Solutions: (b) $T_1 = 1 = 4(1) - 3$ $T_2 = 5 = 4(2) - 3$ $T_3 = 9 = 4(3) - 3$ $T_4 = 13 = 4(4) - 3$ $T_n = 4n - 3$ $T_p = 4p - 3 = 333$ (c) $4p = 336$ $p = 84$ Ans: (a)  (b) $T_n = 4n - 3$ (c) $p = 84$	
3	Solutions: (a) $\frac{1}{42} + \frac{1}{7} = \frac{1}{6}$ (c) $\frac{1}{99\times98} + \frac{1}{99} = \frac{1}{98}$ $\frac{1}{98} - \frac{1}{99} = \frac{1}{99\times98}$ $= \frac{1}{9702}$ (a) Ans: (a) $\frac{1}{6}$ (b) $p = 132$ (c) $\frac{1}{9702}$	

4 Ans: (a)

Figure	Number of △	Total
1	1	1
2	$1+3$	4
3	$1+3+5$	9
4	$1+3+5+7$	16
5	$1+3+5+7+9$	**25**
⋮	⋮	⋮
n	$1+3+5+\ldots+y$	z

$x = 25$

(b) $y = 2n - 1$
$z = n^2$

(c) No, $\sqrt{3365} = 58.0086$, which is not a whole number.
OR 3365 *does not give a whole number as answer.*

5 Solutions:

(a) (i) $2800 + 480 = 3280g$
(ii) $3280 + 480 = 3760g$
(c) $2800 + 480(m) = 8000$
$m = 10.3$ (3 s.f)
The expression should only be used to find his weight for the first year.
It is unrealistic to say

Ans: (a)(i) $3280g$ (ii) $3780g$ (b) $2800 + 480n$ (c) 10.3