

## Quadratic sequences

The squared numbers

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

$1^2$ ,  $2^2$ ,  $3^2$ ,  $4^2$ ,  $5^2$ ,  $6^2$ ,  $7^2$ ,  $8^2$ ,  $9^2$ ,  $10^2$

= 1, 4, 9, 16, 25, 36, 49, 64, 81, 100

↘ ↘ ↘ ↘ ↘ ↘ ↘ ↘ ↘ ↘  
+3 +5 +7 +9 11 13 15 17 19

↘ ↘ ↘ ↘ ↘ ↘ ↘ ↘ ↘  
+2 +2 +2 2 2 2 2 2

first diff  
- not constant -  
second diff  
is constant

Maths eyes email

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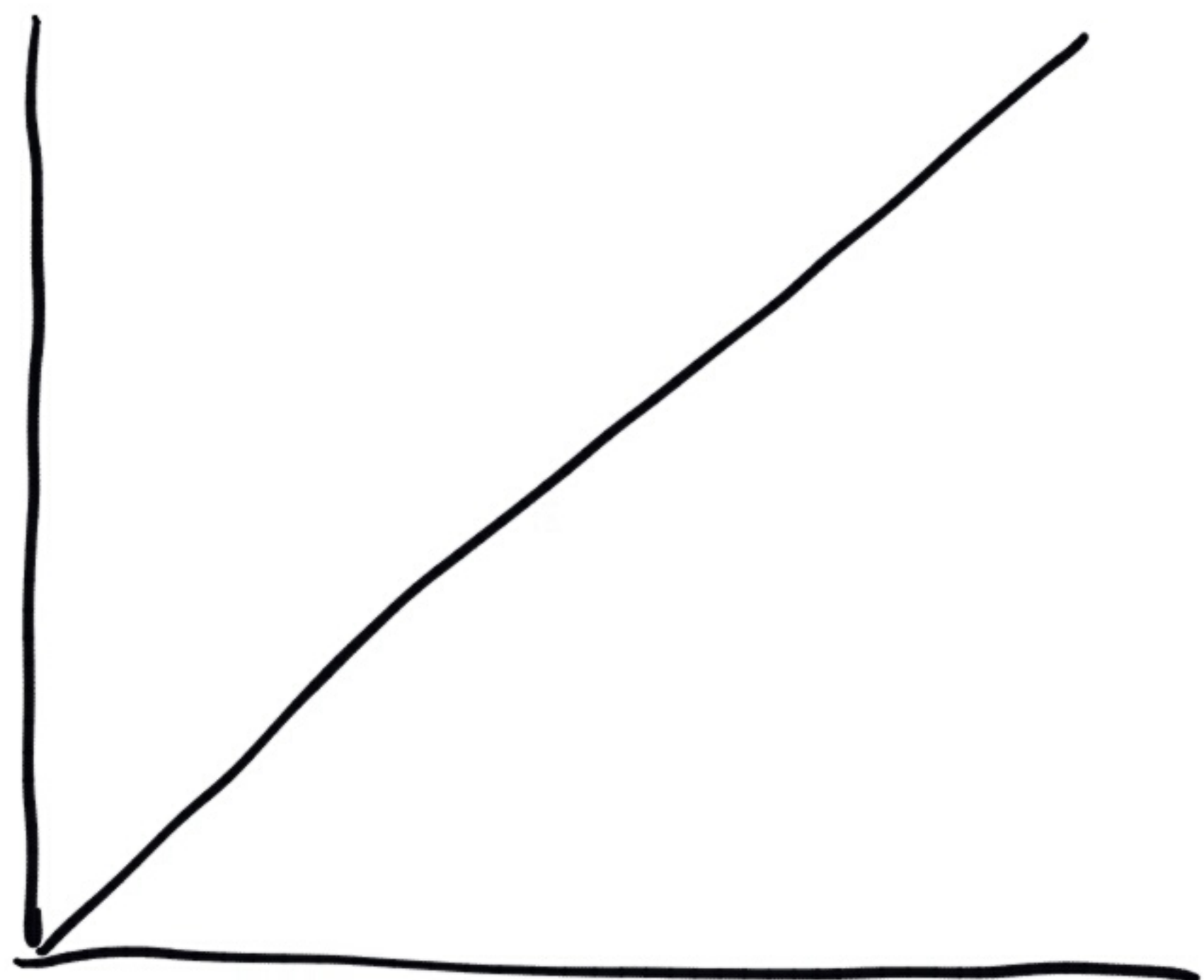
# Linear Sequences

$n^{\text{th}}$  term or  $T_n$  or term to term rule

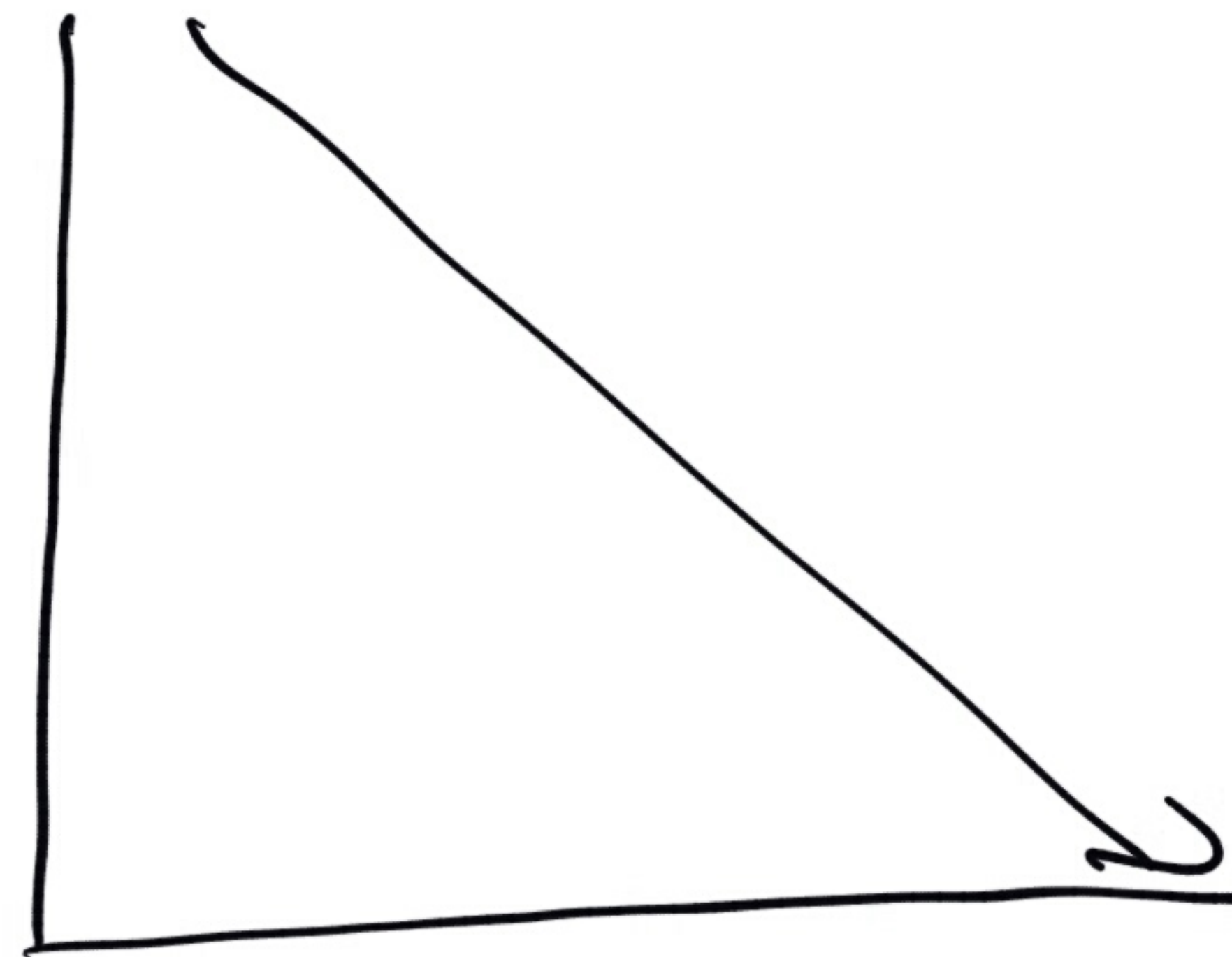
was in the form

$$T_n = an + b$$

$a$  was the first difference



If  $a$  was positive



If  $a$  was negative  
 $-an$

# Quadratic Patterns

The  $n^{\text{th}}$  term or  $T_n$  or the term to term rule of a quadratic pattern will ALWAYS be in the form

$$T_n = an^2 + bn + c, \text{ where } a, b \text{ and } c \in \mathbf{Z}$$

Q1) Work out the first four terms of the quadratic pattern

$$T_n = n^2 + 4$$

first term  $n=1$   $\xRightarrow{\substack{\text{sub in} \\ 1 \text{ for } n}}$

$$T_1 = (1)^2 + 4$$
$$1 + 4$$

$$T_1 = 5$$

Second term  $n=2$   $\xRightarrow{\substack{\text{sub in} \\ 2 \text{ for } n}}$

$$T_2 = (2)^2 + 4$$
$$4 + 4$$

$$T_2 = 8$$

Third term  $n=3$

$$T_3 = (3)^2 + 4$$
$$9 + 4$$

$$T_3 = 13$$

Fourth term  $n=4$

$$T_4 = (4)^2 + 4$$
$$16 + 4$$

$$T_4 = 20$$

Pattern

5, 8, 13, 20

$\curvearrowright$   $\curvearrowright$   $\curvearrowright$

3 5 7

$\curvearrowright$   $\curvearrowright$   
+2 2

1st diff  
not constant

second  
diff  
constant  
 $\therefore$  quadratic

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Q1 (ii)  $\rightarrow$  (iv)

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Q1 find first 4 terms

ii)  $T_n = n^2 - 2$

iii)  $T_n = 2n^2 - 1$

iv)  $T_n = 3n^2 - 4$

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Q 2) i)  $3, 4, 6, 9, 13, 18, 24$   
          1 2 3 4 5 6  
          1 1 +1

ii)  $3, 6, 11, 18, 27, 38, 51$   
      3 5 7 9 11 13  
      2 2 2

iii)  $2, 7, 14, 23, 34, 47, 62$   
      5 7 9 11 13 15

Q3) 6, 8, 12, 18, 26, 36

$\begin{array}{cccccc} & \nearrow & \nearrow & \nearrow & \nearrow & \nearrow \\ & 2 & 4 & 6 & 8 & 10 \\ & \nearrow & \nearrow & \nearrow & & \\ & 2 & 2 & 2 & & \end{array}$

first diff

second diff constant  
= Quadratic ✓

ii 6, 8, 10, 12, 14, 16

$\begin{array}{cccccc} & \nearrow & \nearrow & \nearrow & \nearrow & \\ & 2 & 2 & 2 & 2 & \end{array}$

first diff constant  
- linear ✗

iii 3, 4, 7, 12, 19, 28

$\begin{array}{cccccc} & \nearrow & \nearrow & \nearrow & \nearrow & \nearrow \\ & 1 & 3 & 5 & 7 & 9 \\ & \nearrow & \nearrow & \nearrow & \nearrow & \\ & 2 & +2 & 2 & 2 & \end{array}$

first diff

second diff constant  
Quadratic. ✓

iv 0, 3, 8, 15, 24

$\begin{array}{cccccc} & \nearrow & \nearrow & \nearrow & \nearrow & \\ & 3 & 5 & 7 & 9 & \\ & \nearrow & \nearrow & \nearrow & & \\ & 2 & 2 & 2 & & \end{array}$

Quadratic ✓



Q4)  $T_n = n^2 + 2n - 4$       10<sup>th</sup> term

$$T_{10} = (10)^2 + 2(10) - 4$$
$$100 + 20 - 4$$
$$T_{10} = 116$$

$n$	1	2	3	4	5
$3n^2 = 3(1)^2$		$3(2)^2$	$3(3)^2$	$3(4)^2$	$3(5)^2$
$= 3$	3	12	27	48	75
	9	15	21	27	
		6	6	6	

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$n$	1	2	3	4	5
$4n^2$					
$=$					
First diff					
Second diff					

$5n^2$				