LINEAR AND NON-LINEAR SEQUENCES

BUILDING BLOCKS

NAME _____ CLASS _____ DATE _____

KEY IDEA

Find the jump between each pair of terms. Are the jumps the same?

3, 5, 7, 9 (+2, +2, +2) — same jump

1, 2, 4, 8 (+1, +2, +4) — jumps change

1 Fill in the jumps. Then circle SAME or DIFFERENT.

a) 6, 13, 20, 27 — SAME / DIFFERENT

b) 1, 4, 9, 16 — SAME / DIFFERENT

2 Which pattern adds the same number of squares each time?

A 

B 

Circle: PATTERN A PATTERN B

3 Sort the sequences. Write each letter in the correct column.

A 10, 20, 30, 40

B 2, 3, 5, 9

C 50, 45, 40, 35

D 3, 4, 6, 9

E 2, 8, 14, 20

F 5, 6, 8, 11

SAME JUMP EACH TIME	JUMPS CHANGE

4 Write the first five terms of each sequence.

a) Start at 5 and add 6 each time. 5, ____, ____, ____, ____

b) Start at 30 and subtract 4 each time. 30, ____, ____, ____, ____

LINEAR AND NON-LINEAR SEQUENCES

SUPPORT

NAME _____ CLASS _____ DATE _____

KEY IDEA

LINEAR: the difference between terms is always the same.

+7 +7 +7

1, 8, 15, 22 LINEAR

NON-LINEAR: the difference between terms changes.

+2 +4 +8

2, 4, 8, 16 NON-LINEAR

1 Fill in the differences. Then circle LINEAR or NON-LINEAR.

a) □ □ □

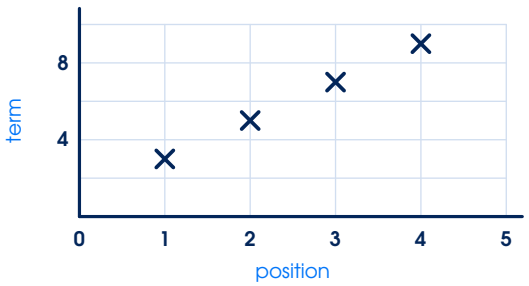
9, 13, 17, 21 LINEAR NON-LINEAR

b) □ □ □

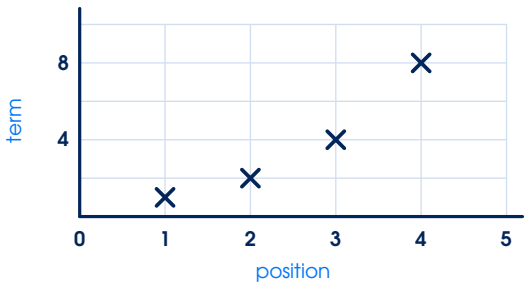
1, 6, 36, 216 LINEAR NON-LINEAR

2 Each graph shows the first four terms of a sequence.

A



B



a) Which graph shows a linear sequence? GRAPH A GRAPH B

b) How can you tell from the graph? .....

3 Jo says, "2, 4, 8, 16 is linear because 4 – 2 = 2, so you add 2 each time." Explain Jo's mistake.

.....

4 The sequence 26, 21, 16, 11, ... is linear.

Common difference: □ Next term: □

LINEAR AND NON-LINEAR SEQUENCES

CORE

NAME _____ CLASS _____ DATE _____

KEY IDEA

A linear sequence has a common difference: the same amount is added or subtracted each time. A non-linear sequence does not. Check every difference, not just the first one.

FLUENCY

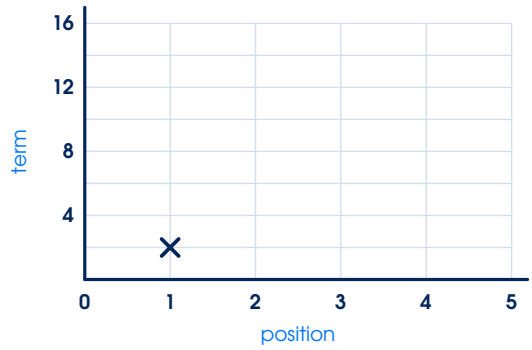
1 Complete the table.

SEQUENCE	LINEAR OR NON-LINEAR?	COMMON DIFFERENCE (IF LINEAR)
8, 15, 22, 29		
40, 31, 22, 13		
5, 20, 80, 320		
2, 2.3, 2.6, 2.9		

2 Here are two sequences.

A: 2, 4.5, 7, 9.5, 12

B: 1, 2, 4, 7, 11



a) Plot both sequences. Use × for A and ● for B.
Example: the 1st term of A is 2, so it is plotted at (1, 2).

b) Which sequence is linear? How does the graph show this?

.....

c) Why should you not join the points?

.....

REASONING

3 In each sequence, the 4th term is 20. Fill in the other terms.

a) A linear sequence: ☐, ☐, ☐, **20**, ☐

b) A non-linear sequence: ☐, ☐, ☐, **20**, ☐

4 Can a linear sequence be descending? Explain with an example.

.....

LINEAR AND NON-LINEAR SEQUENCES

GREATER DEPTH

NAME _____ CLASS _____ DATE _____

REASONING

1 Is each statement always, sometimes or never true? Circle your answer.

If it is sometimes true, give an example of when it is true and when it is not.

a) A linear sequence goes up. ALWAYS SOMETIMES NEVER

b) In a non-linear sequence, the differences get bigger. ALWAYS SOMETIMES NEVER

c) If the first two differences are equal, it is linear. ALWAYS SOMETIMES NEVER

d) The sum of two linear sequences is linear. ALWAYS SOMETIMES NEVER

PROBLEM SOLVING

2 Look at the differences. Then write the next two terms.



Describe the pattern in the differences. _____

3 Put three of these cards in order to make a linear sequence. Find all the ways.

5	13	14	21	29

a) Linear sequences: _____

b) Which card can never be used? Why? _____

★ CHALLENGE FOR ALL

4 Complete the table: A is linear and B is non-linear.

TERM	1ST	2ND	3RD	4TH	5TH	6TH	7TH	8TH
A	1	5	9	13				
B	1	2	4	8				

a) From which term onwards is B bigger than A? ____

b) Which sequence passes 100 first, and in which term? ____ ____

LINEAR AND NON-LINEAR SEQUENCES – ANSWERS

ANSWERS

BUILDING BLOCKS

1 a) +7, +7, +7; SAME · b) +3, +5, +7; DIFFERENT

2 Pattern A

3 Same jump: A, C, E · Jumps change: B, D, F (B: +1, +2, +4 · D: +1, +2, +3 · E: +6 each time)

4 a) 5, 11, 17, 23, 29 · b) 30, 26, 22, 18, 14

SUPPORT

1 a) +4; LINEAR · b) +5, +30, +180; NON-LINEAR

2 a) Graph A · b) its points lie in a straight line

3 Jo only checked the first difference. The differences are +2, +4, +8, so it is not linear

4 common difference –5 · next term 6

CORE

1 8, 15, 22, 29: linear, 7 · 40, 31, 22, 13: linear, –9 · 5, 20, 80, 320: non-linear (no common difference) · 2, 2.3, 2.6, 2.9: linear, 0.3

2 a) A at (1, 2), (2, 4.5), (3, 7), (4, 9.5), (5, 12); B at (1, 1), (2, 2), (3, 4), (4, 7), (5, 11) · b) A is linear: its points lie on a straight line (it goes up 2.5 each time) · c) terms only exist at whole-number positions

3 e.g. a) 5, 10, 15, 20, 25 · b) 2.5, 5, 10, 20, 40

4 Yes, e.g. 20, 17, 14, 11 (common difference –3)

GREATER DEPTH

1 a) Sometimes · b) Sometimes · c) Sometimes (e.g. 1, 2, 3, 5) · d) Always

2 differences 3, 5, 7, 9 (they go up by 2 each time); next terms 37, 50

3 a) 5, 13, 21 and 13, 21, 29 (add 8), or the same in reverse (subtract 8) · b) 14: no two other cards make a linear sequence with it (e.g. 13, 14 would need 15; 14, 21 would need 28)

4 A: 17, 21, 25, 29 · B: 16, 32, 64, 128 · a) the 6th term · b) B, in the 8th term (128)