Unit 3: Patterns and Relations

Name: _____

Quiz (Lessons 1–4)

Date: _____

1. Write the gap as a positive or negative number. Is the sequence increasing or decreasing? (2 marks)

   a) 306, 295, 284, 273 _____ increasing / decreasing

   b) −35, −30, −25, −20, −15 _____ increasing / decreasing

2. Use the pattern rule to write the first five terms of the sequence. (6 marks)

   a) Start at 105 and add 8 each time. _____

   b) Start at 105 and add −8 each time. _____

3. State the starting number and gap for each sequence. Write a rule for the linear sequence. (8 marks)

   a) 430, 445, 460, 475 Starting number: _____ Gap: _____

   Rule: _____

   b) 510, 500, 490, 480 Starting number: _____ Gap: _____

   Rule: _____

4. Substitute the given values of the variables and evaluate the expression. (3 + 5 marks)

   a) $6n + 9$, $n = 5$ **Bonus►** $30A - 40B - Y$, $Y = -25$, $B = 10$, $A = 7$

5. Make a table for the sequence. Find the gaps between the term values. Is the relation linear? (15 marks)

   a) Start at 5 and add 4 each time.

Input (*A*)	Output (*B*)
1	
2	
3	
4	

   linear / non-linear

   b) Multiply the term number by 25 to get each term.

Input (*n*)	Output (*y*)
1	
2	
3	
4	

   linear / non-linear

   c) 4, 12, 36, 108

Input (*A*)	Output (*y*)
1	
2	
3	
4	

   linear / non-linear

6. Complete the table. Write the number you must add to or subtract from "Gap × *n*" to get the term value (*v*). Fill in the blanks to describe in words how to get the term value from the term number and write a formula for the sequence. (16 marks)

a)

Term Number (*n*)	Gap × *n*	Term Value (*v*)
1		15
2		25
3		35

Add _____

Multiply by _____ and then add _____.

Formula: ___*v* = _____

b)

Term Number (*n*)	Gap × *n*	Term Value (*v*)
1		2
2		11
3		20

Subtract _____

Multiply by _____ and then subtract _____.

Formula: _____

/50 + 5 marks

Unit 3: Patterns and Relations

Quiz (Lessons 1–4)

1. a) −11
   decreasing
   b) +5
   increasing
2. a) 105, 113, 121, 129, 137
   b) 105, 97, 89, 81, 73
3. a) 430, +15
   Start at 430 and add 15 each time.
   b) 510, −10
   Start at 510 and subtract 10 each time.
4. a) 39

   Bonus

   −165
5. a) 5, 9, 13, 17;
   gaps: +4, +4, +4;
   linear
   b) 25, 50, 75, 100;
   gaps: +25, +25, +25;
   linear
   c) 4, 12, 36, 108;
   gaps: +8, +24, +72;
   non-linear
6. a) gaps: +10, +10;
   Gap × *n*: 10, 20, 30;
   Add 5;
   Multiply by 10 and then add 5.
   $v = 10n + 5$
   b) gaps: +9, +9;
   Gap × *n* = 9, 18, 27;
   Subtract 7;
   Multiply by 9 and then subtract 7.
   $v = 9n - 7$

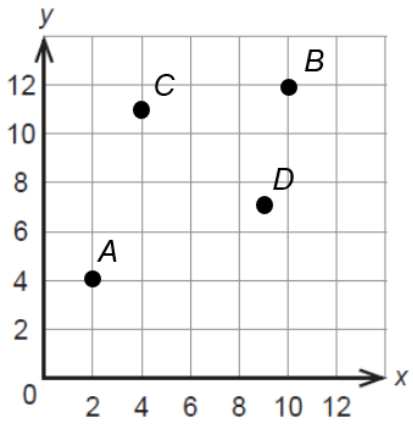
Unit 3: Patterns and Relations

Quiz (Lessons 5–8)

Name: _____

Date: _____

1. a) Find the coordinates of the points. (4 marks)



A (,) *B* (,)

C (,) *D* (,)

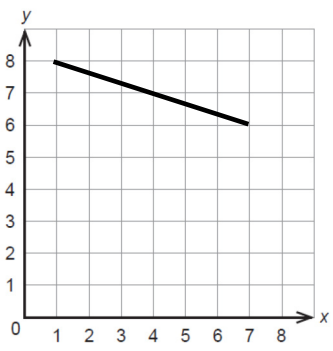
b) Plot and label the points. (4 marks)

E (4, 8) *F* (8, 14)

G (11, 5) *H* (0, 0)

2. Does the graph show a linear relation? Explain why or why not. (6 marks)

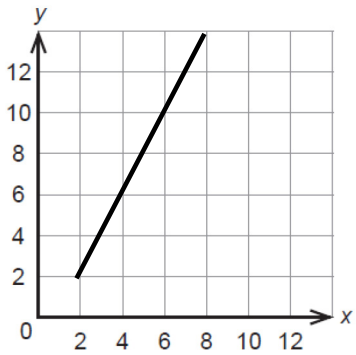
a)



_____

_____

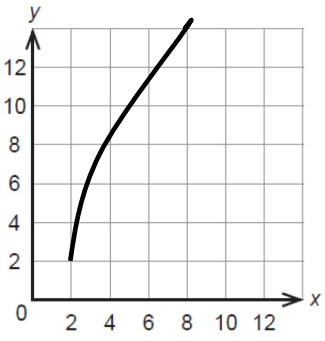
b)



_____

_____

c)



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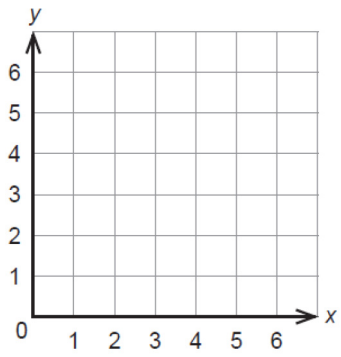
3. A linear relation is given by the formula $y = 3x - 2$. (10 marks)



a) What is the coefficient of x in the formula? ____

b) What will be the y-coordinate of the point on the graph when $x = 1$? Plot this point on the grid.

c) How will the value of y change in the graph when x increases by 1? Plot another point on the grid for $x = 2$, using this change in y.

d) Draw a line through the two points to sketch the graph of the linear relation. Use a ruler.

e) Extend the line to predict the value of x when y is 7. _____

4. a) Write the gaps between the output values in the table. Is the relation linear or non-linear? Is the relation increasing or decreasing? (12 marks)

i)

Input (*A*)	Output (*B*)
1	9
2	5
3	1

linear / non-linear

increasing / decreasing

ii)

Input (*n*)	Output (*y*)
1	2
2	8
3	9

linear / non-linear

increasing / decreasing

iii)

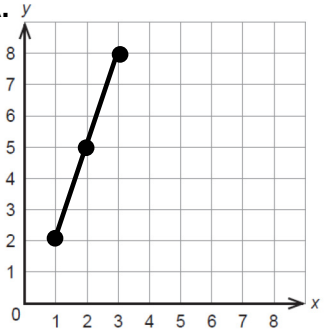
Input (*A*)	Output (*y*)
1	2
2	5
3	8

linear / non-linear

increasing / decreasing

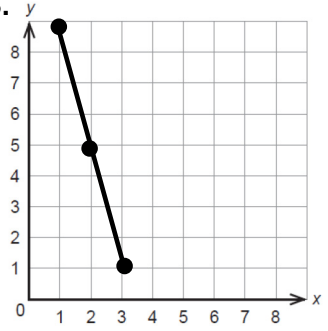
b) Match each relation from part a) to its graph. (6 marks)

A.



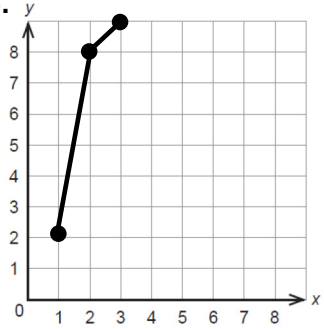
_____

B.



_____

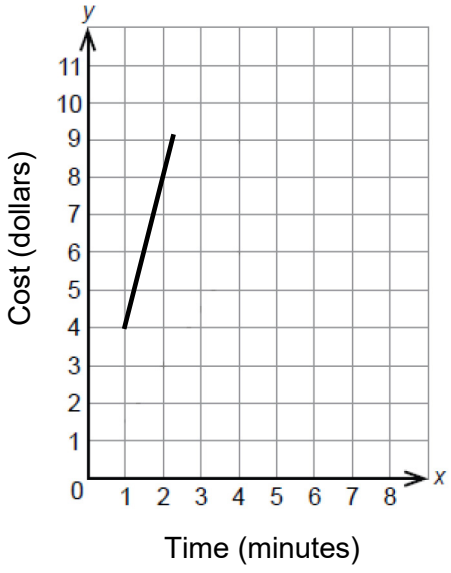
C.



_____

5. The graph shows the cost of making a telephone call to Austria.

Cost of Calling Austria



Time (minutes)

a) If you talked for 2 minutes, how much would you have to pay? (2 marks)

b) How much does the cost rise every minute? (2 marks)

c) How much does it cost to talk for 3 minutes? Extend the line to find out. (4 marks)

Bonus► How much would it cost to talk for an hour? Hint: Find a formula for the relation. (+5 marks)

/50 + 5 marks

Unit 3: Patterns and Relations

Answer Key

Quiz (Lessons 5–8)

1. a) *A* (2, 4), *B* (10, 12), *C* (4, 11), *D* (9, 7)
   b) Teacher to check.
2. a) Yes, because the graph is a straight line.
   b) Yes, because the graph is a straight line.
   c) No, because the graph is not a straight line.
3. a) +3
   b) Teacher to check grid.
   $y = 1$
   c) Teacher to check grid.
   y increases by 3; (2, 4)
   d) Teacher to check.
   e) $x = 3$
4. a) i) −4, −4; linear, decreasing
      ii) +6, +1; non-linear, increasing
      iii) +3, +3; linear, increasing
   b) A. iii; B. i; C. ii
5. a) $8
   b) $4
   c) $12

   Bonus

   Cost = 4 × time, so for an hour, or 60 minutes, the cost is 4 × 60 = $240.

Unit 3: Patterns and Relations

Name: _____

Test (Lessons 1–4, 6–8)

Date: _____

1. State the starting number and gap for each sequence. Write a rule for the linear sequence. (8 marks)

   a) 225, 250, 275, 300 Starting number: _____ Gap: _____

   Rule: _____

   b) 611, 599, 587, 575 Starting number: _____ Gap: _____

   Rule: _____

2. a) Substitute the values of the variables. What is the value of the expression? (6 marks)

   i) $15a + 22$, $a = 6$ ii) $g - 50p$, $p = 7$, $g = -100$

   b) Substitute the values of the expressions from part a). Is the equation true or false? (4 marks)

   i) $15a + 22 = 114$, $a = 6$ ii) $g - 50p = -450$, $p = 7$, $g = -100$

3. Complete the table. Find the gaps between output values. Is the relation linear or non-linear? Is the relation increasing or decreasing? (15 marks)

   a) Multiply the term number by 40 each time.

Input (A)	Output (B)
1	
2	
3	
4	

linear / non-linear

increasing / decreasing

   b) $y = 100 - 15n$

Input (n)	Output (y)
1	
2	
3	
4	

linear / non-linear

increasing / decreasing

   c) 200, 100, 50, 25

Input (n)	Output (t)
1	
2	
3	
4	

linear / non-linear

increasing / decreasing

4. Consider the sequence given by the rule: Start at 4 and add 9 each time.

   a) Write the first five terms of the sequence. _____ (2 marks)

   b) What is the gap for this linear sequence? _____ (1 mark)

   c) How can you write the starting number as the gap minus another number? 4 = 9 − ____ (1 mark)

   d) Complete the table for the sequence. (7 marks)

Term Number (*n*)	Term Value (*v*)	Repeated Addition	Multiplication
1	4	9 − ____	(___ × 1) − ___
2		(9 + 9) − ____	(___ × 2) − ___
3			
4		(9 + 9 + 9 + 9) − ____	
5			

   e) Write an expression for the given term of the sequence using multiplication. (3 marks)

   i) 10^{th} term: _____ ii) 95^{th} term: _____ iii) n^{th} term: _____

   f) Write a formula to find the term value (*v*) from the term number (*n*). *v* = _____ (1 mark)

5. Ali's boat rental store charges $30 to rent a boat for one hour and $10 for each additional hour.

   a) Complete the table. (4 marks) b) Is the relation linear? (2 marks)

Number of Hours (*n*)	Cost (*C*)
1	
2	
3	
4	

   c) Write a formula to find the cost (*C*) of renting the boat for *n* hours. (3 marks)

   d) How much would it cost to rent the boat for the given length of time? (4 marks)

   i) 8 hours _____ ii) 24 hours _____

Bonus► Mona's boat rental store charges $400 to rent a boat for 2 days. If you needed a boat for 48 hours, whose store would you rent from, Mona's or Ali's? Explain. (+5 marks)

6. a) The formula represents a linear sequence. Find the value of y when $x = 1$ for the formula. (6 marks)

   i) $y = 10 - 2x$ when $x = 1$, $y =$ ____

   ii) $y = 11 - 3x$ when $x = 1$, $y =$ ____

   iii) $y = 11 - 2x$ when $x = 1$, $y =$ ____

   b) Write the coefficient of x for each formula from part a). (3 marks)

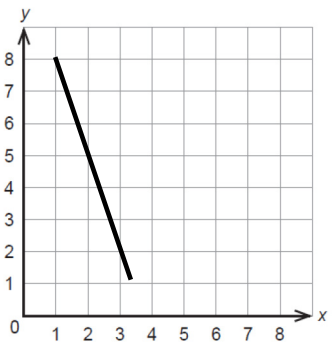
   i) coefficient of x: ____

   ii) coefficient of x: ____

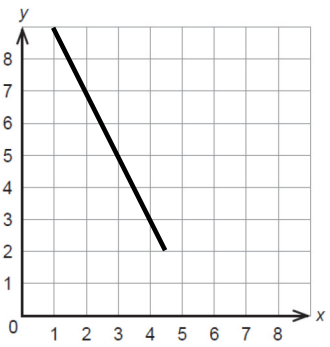
   iii) coefficient of x: ____

   c) Each graph represents a linear sequence. Find the value of y when $x = 1$ for each graph. Plot the point. (6 marks)

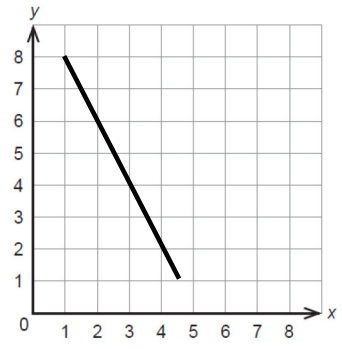
A.



B.



C.



   d) Find the change in y as x increases by 1 in each graph from part c). Show it on the graph. (6 marks)

   e) Each graph in part c) corresponds to a formula in part a). Match the formulas and graphs. Explain how you did the matching. (9 marks)

7. The graph shows Satra's distance from home as they drive back home from the library.

   a) How far is Satra from home after … (3 marks)

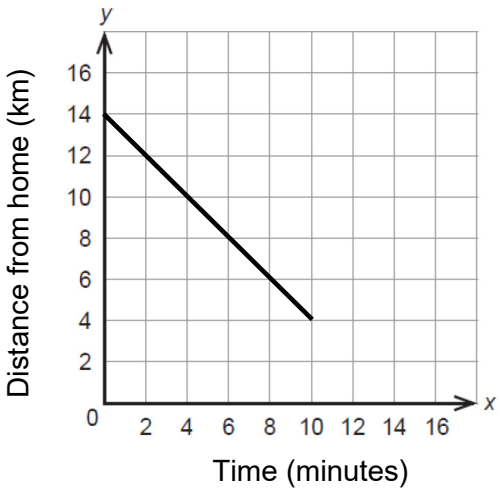
   i) 2 minutes? ii) 8 minutes? iii) 5 minutes?

   b) How far is Satra's home from the library? Explain how you know. (3 marks)

   c) How much time has passed when Satra is 11 km from home? (1 mark)

   d) How long does it take Satra to get home? Extend the line to find out. (2 marks)

Satra's Distance from Home



/100 + 5 marks

Unit 3: Patterns and Relations

Test (Lessons 1–4, 6–8)

1. a) 225, +25
   Start at 225 and add 25 each time.
   b) 611, −12
   Start at 611 and subtract 12 each time.
   OR
   Start at 611 and add −12 each time.
2. a) i) 112
   ii) −450
   b) i) 112 = 114, false;
   ii) −450 = −450, true
3. a) 40, 80, 120, 160;
   gaps: +40, +40, +40;
   linear, increasing
   b) 85, 70, 55, 40;
   gaps: −15, −15, −15;
   linear, decreasing
   c) 200, 100, 50, 25;
   gaps: −100, −50, −25;
   non-linear, decreasing
4. a) 4, 13, 22, 31, 40
   b) +9
   c) 4 = 9 − 5
   d)

v	R A	M
4	9 − 5	(9 × 1) − 5
13	(9 + 9) − 5	(9 × 2) − 5
22	(9 + 9 + 9) − 5	(9 × 3) − 5
31	(9 + 9 + 9 + 9) − 5	(9 × 4) − 5
40	(9 + 9 + 9 + 9 + 9) − 5	(9 × 5) − 5

   e) i) 9 × 10 − 5
   ii) 9 × 95 − 5
   iii) 9*n* − 5
   f) *v* = 9*n* − 5
5. a) $30, $40, $50, $60
   b) yes
   c) *C* = 10*n* + 20
   d) i) $100
   ii) $260

   Bonus

   Ali's store would charge $500, which is more than the $400 Mona's store charges, so I would rent from Mona's store.
6. a) i) 8
   ii) 8
   iii) 9
   b) i) −2
   ii) −3
   iii) −2
   c) Teacher to check.
   d) Teacher to check.
   e) A matches with ii since it shows a starting value of 8 and a gap of −3.
   B matches with iii since it shows a starting value of 9 and a gap of −2.
   C matches with i since it shows a starting value of 8 and a gap of −2.
7. a) i) 12 km
   ii) 6 km
   iii) 9 km
   b) 14 km, since that's how far Satra is when *x* = 0, before they start driving home
   c) 3 minutes
   d) 14 minutes