Worksheet 3: Number Patterns

Grade 11 Mathematics

1. Identify the type of pattern and give the next three terms:

   a) $-\frac{3}{5}; -\frac{4}{5}; -1; -\frac{6}{5} \dots$

   b) 12; 24; 48; 96… (R)

   c) 1; 8; 27; 64 …

   d) 1; 6; 14; 25 … (R)

   e) 1; 4; 9; 16 ….

   f) 11; 16; 21; 26… (R)

   g) 48; 16; $\frac{16}{3}; \frac{16}{9} \dots$

   h) 3; 5; 6; 6 … (R)

   i) 0; 3; 8; 15…

   j) 1; 10; 101; 1010… (R)

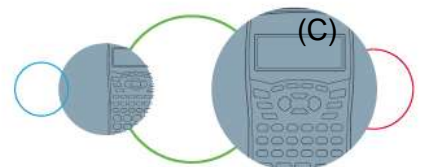2. For each of the following patterns, determine the formula T_n for the nth term:

   a) 125; 119; 113; 107…

   b) $-13\frac{1}{2}; -12\frac{3}{4}; -12; -11\frac{1}{4} \dots$ (R)

   c) 8; 17; 30; 47…

   d) 5; 8; 11; 14… (R)

   e) $12; 11\frac{1}{2}; 11; 10\frac{1}{2} \dots$

   f) 4; 7; 12; 19 … (R)

   g) 1; 5; 14; 28 …

   h) 32; 19; 6; -7… (R)

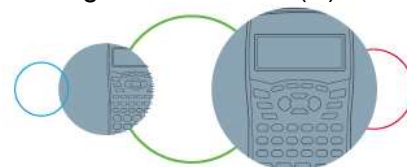   i) 2; 6; 13; 23

   j) 1; 4; 5; 4… (R)

3. For each of the patterns in question 2, determine the 11th term.

4. Given the pattern: $1; 6\frac{1}{3}; 11\frac{2}{3}; 17$ and so on, determine:
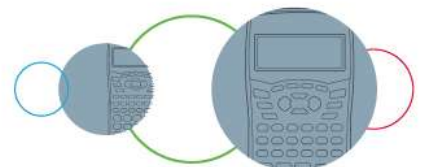
   a) the formula T_n for the nth term. (R)

   b) the 13th term. (R)

   c) The value of n for which $T_n = 33$. (R)

   d) whether 81 is part of the sequence. (C)

5. Given the pattern: -9; -3; 3; 9… Find:

   a)   the formula T_n for the nth term.   (R)

   b)   the 20th term.   (R)

   c)   the value of n for which $T_n = 75$ (R)

   d)   the sum of the first 5 terms.   (C)

6. Given the pattern: -3; 2; 11; 24… Determine:

   a)   the next three terms.   (R)

   b)   the formula T_n for the nth term.   (R)

   c)   the 14th term.   (R)

   d) T_n if n = 12   (R)

   e)   n if $T_n = 116$ (C)

7. Given the pattern: 6; 11; 18; 27… Determine:

   a)   the next three terms.   (R)

   b)   the formula T_n for the nth term   (R)

   c)   the 10th term   (R)

   d)   n if $T_n = 258$ (C)

   e)   whether 98 is part of the sequence – show all working out.   (C)

8. Given the pattern: 2; a; 21; 32; b…

   a)   Prove that a = 11 and b = 44   (P)

   b)   Determine the next three terms.   (R)

   c)   Determine the formula T_n for the nth term.   (R)

   d)   Find the 11th term.   (R)

   e)   Find n if $T_n = 176$ (C)

   f)   Determine whether 242 is part of the sequence – show all working out.   (C)

9.   Given the pattern 2; 2; a; b; 50…

   a)   Determine the values of a and b.   (P)

   b)   Determine the next three terms.   (R)

   c)   Determine the formula T_n for the nth term.   (R)

   d)   Find the 10th term.   (R)

   e)   Find n if T_n = 962.   (C)

   f)   Determine whether 1001 is part of the sequence – show all working out.   (C)

10. A ball is thrown from the top of a building, after 1 second the ball is 120m, after 2 seconds the ball is 136m high, after 3 seconds the ball is 146m and after 4 seconds the ball is 150m high.

   a)   Determine the height of the ball after the 5th, 6th and 7th second.   (C)

   b)   Give a formula that determines the height of the ball given the time, t, in seconds. (C)

   c)   Determine when the ball will hit the ground.   (P)

   d)   Determine the maximum height of the ball.   (P)

   e)   How tall was the building?   (P)

11. A submarine is submerged under the water and decides to rise to the surface. After 1 second the submarine was 7776m under the water, after 2 seconds the submarine was 7676m under the water, after 3 seconds the submarine was 7524m under the water and after 4 seconds the submarine was 7320m under the water.

   a)   Determine the depth of the submarine after the 5th, 6th and 7th seconds.   (C)

   b)   Give a formula that determines the depth of the submarine given time, t, in seconds.
                                                                            (C)

   c)   Determine after how many seconds the submarine will reach the surface of the water.
                                                                            (P)

   d)   Determine the depth of the submarine after 15 seconds.   (C)

   e)   If the submarine is 1644m from the surface, determine how many seconds have passed.   (C)

   f)   Can the pattern continue after the submarine has reached the surface? Why or why not?   (P)

12. Sally's weekly allowance follows the following pattern: R216 for the first week, R185 for the second week, Ra for the third week, Rb for the fourth week and R188 for the fifth week.

    a)   Determine how much money Sally receives for the third and fourth week.   (P)

    b)   Determine the formula for the pattern of pocket money Sally receives per week, w.

                                                                                              (C)

    c)   Determine how much pocket money Sally will receive after three months (assume each month has 4 weeks in it)   (P)

    d)   When will Sally's weekly pocket money reach R1000 or more?   (P)

13. The Fibonacci sequence is given by 0; 1; 1; 2; 3; 5; 8; 13… and so on. Is the sequence a second common differences pattern? Why or why not? Show all your working out.   (P)