GRADE 11		FEBRUARY 2024
MATHEMATICS	INVESTIGATION	TOTAL: 50

NAME: _____

Quadratic Number patterns

SECTION A: [25]

Consider the following number pattern:

$$-1; \quad 2; \quad 9; \quad 20; \quad ...$$

Answer the following questions on the paper:

1. Determine the first and second difference of the pattern:

    $$-1; \quad 2; \quad 9; \quad 20; \quad ...$$

    First difference: ___ ___ ___

    Second difference: ___ ___ **(5)**

2. What do you notice about the second differences?

    _____

    _____

    _____

    _____

    _____

    (1)

1

If the second difference is constant, then it is a quadratic number pattern. The general formula for a quadratic number pattern is $T_n = an^2 + bn + c$

Use the formula $T_n = an^2 + bn + c$ to determine the following:
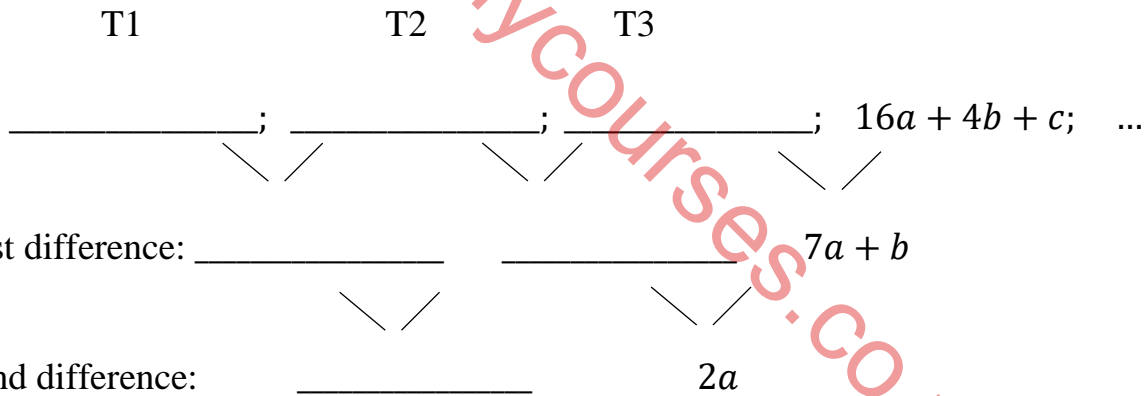
Let n = 1: $T_1 = $ _____

_____

Let n = 2: $T_2 = $ _____

_____

Let n = 3: $T_3 = $ _____

_____

Let n = 4: $T_4 = $ _____

(3)

3. Use the info from question 2 and complete the following:

       T1   T2   T3

_____; _____; _____; $16a + 4b + c$;   ...

1st difference: _____   _____ $7a + b$

2nd difference: _____ $2a$

(6)

4. Derive formulas to determine a, b and c.

First term = _____

First of the 1st differences = _____

Second difference = _____

(4)

2

From the above investigation, we see that the following formulas can be used to determine the nth-term (general term) for any quadratic number pattern:

2a	=	second difference
3a + b	=	2nd term minus 1st term
a + b + c	=	1st term

We use the formulas from bottom to top.

5. Use the above info and determine the general term of the quadratic number pattern in question 1: (*hint: solve for a , b and c first*)

$$-1; \qquad 2; \qquad 9; \qquad 20; \qquad ...$$

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

6. Determine the 50th term of the above pattern:

_____

_____

_____ **(2)**

SECTION B: [25]

1. Use all the above info and determine the general term of the quadratic number pattern on the given space:

1.1 $1; -3; -9; -17; ...$ (4)
1.2 $3; 6; 10; 15; 21; ...$ (4)
1.3 $31; 30; 27; 22; 15; ...$ (4)
1.4 $244; 193; 148; 109; ...$ (4)
1.5 $3; 5; 8; 12; ...$ (4)
1.6 $3; x; 21; 24$ (5)

[25]

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TOTAL: 50