Consolidation of Grade 6 EQAO Questions

Patterning and Algebra

Compiled by Devika William-Yu (SE2 Math Coach)
GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectations

<table>
<thead>
<tr>
<th>PV1</th>
<th>PV2</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Describe and represent relationships in growing and shrinking patterns (where the terms are whole numbers), and investigate repeating patterns involving rotations</td>
<td>• Use variables in simple algebraic expressions and equations to describe relationships</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>PV1</th>
<th>PV2</th>
</tr>
</thead>
</table>
| Spring 2006 | MC7  
MC15  
MC16  
MC31  
MC35  
OR28 | MC34 |
| Spring 2007 | MC1  
MC22  
MC23 | MC2  
MC17  
MC31  
OR27 |
| Spring 2008 | MC6  
MC14  
MC15  
MC24  
OR28 | MC5  
MC25 |
| Spring 2009 | MC6  
MC14  
MC24  
MC25  
OR9 | MC5  
MC15 |
| Spring 2010 | MC2  
MC15  
MC20  
MC25  
MC30  
OR26 | MC14 |
| Spring 2011 | MC1  
MC6  
MC25  
OR29 | MC14  
MC22  
MC31 |
# GRADE SIX EQAO QUESTIONS: Patterning and Algebra

<table>
<thead>
<tr>
<th>Year</th>
<th>Knowledge &amp; Understanding</th>
<th>Problem Solving (Thinking)</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2009</td>
<td>MC6, MC14</td>
<td>MC15, OR9</td>
<td>MC5, MC24, MC25</td>
</tr>
<tr>
<td>Spring 2010</td>
<td>MC14, MC30</td>
<td>MC15</td>
<td>MC2, MC20, MC25, OR26</td>
</tr>
<tr>
<td>Spring 2011</td>
<td>MC1, MC14</td>
<td>MC31, OR29</td>
<td>MC6, MC22, MC25</td>
</tr>
</tbody>
</table>
## PATTERning & Algebra: Patterns and Relationships

<table>
<thead>
<tr>
<th>Grade 4</th>
<th>Grade 5</th>
<th>Grade 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall Expectation</strong></td>
<td><strong>Specific Expectations</strong></td>
<td><strong>Specific Expectations</strong></td>
</tr>
<tr>
<td>- describe, extend, and create a variety of numeric and geometric patterns, make predictions related to the patterns, and investigate repeating patterns involving reflections.</td>
<td>- determine, through investigation using a table of values, relationships in growing and shrinking patterns, and investigate repeating patterns involving translations.</td>
<td>- describe and represent relationships in growing and shrinking patterns (where the terms are whole numbers), and investigate repeating patterns involving rotations.</td>
</tr>
<tr>
<td>- create a number pattern involving addition, subtraction, or multiplication, given a pattern rule expressed in words.</td>
<td>- make a table of values for a pattern that is generated by adding or subtracting a number to get the next term, or by multiplying or dividing by a constant to get the next term, given either the sequence or the pattern rule in words.</td>
<td>- make tables of values for growing patterns, given pattern rules in words then list the ordered pairs and plot the points in the first quadrant, using a variety of tools.</td>
</tr>
<tr>
<td>- extend, describe, and create repeating, growing, and shrinking number patterns.</td>
<td>- create, identify, and extend numeric and geometric patterns, using a variety of tools.</td>
<td>- identify geometric patterns, through investigation using concrete materials or drawings, and represent them numerically.</td>
</tr>
<tr>
<td>- connect each term in a growing or shrinking pattern with its term number, and record the patterns in a table of values that shows the term number and the term.</td>
<td>- build a model to represent a number pattern presented in a table of values that shows the term number and the term.</td>
<td>- determine a term, given its term number, by extending growing and shrinking patterns that are generated by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term.</td>
</tr>
<tr>
<td>- make predictions related to repeating geometric and numeric patterns.</td>
<td>- make predictions related to growing and shrinking geometric and numeric patterns.</td>
<td>- determine the term number of a given term in a growing pattern that is represented by a pattern rule in words, a table of values, or a graph.</td>
</tr>
<tr>
<td>- extend and create repeating patterns that result from reflections, through investigation using a variety of tools.</td>
<td>- extend and create repeating patterns that result from translations, through investigation using a variety of tools.</td>
<td>- extend and create repeating patterns that result from rotations, through investigation using a variety of tools.</td>
</tr>
</tbody>
</table>
**PATTERNING & ALGEBRA: Expressions and Equality**

<table>
<thead>
<tr>
<th>Grade 4</th>
<th>Grade 5</th>
<th>Grade 6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall Expectations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- demonstrate an understanding of equality between pairs of expressions, using addition, subtraction, and multiplication</td>
<td>- demonstrate, through investigation, an understanding of the use of variables in equations</td>
<td>- use variables in simple algebraic expressions and equations to describe relationships</td>
</tr>
<tr>
<td><strong>Specific Expectations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- determine, through investigation, the inverse relationship between multiplication and division</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- identify, through investigation and use the commutative property of multiplication to facilitate computation with whole numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- identify, through investigation, and use the distributive property of multiplication over addition to facilitate computation with whole numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- determine the missing number in equations involving multiplication of one- and two-digit numbers, using a variety of tools and strategies</td>
<td>- determine the missing number in equations involving addition, subtraction, multiplication, or division and one- or two digit numbers, using a variety of tools and strategies</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- demonstrate an understanding of different ways in which variables are used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- demonstrate, through investigation, an understanding of variables as changing quantities, given equations with letters or other symbols that describe relationships involving simple rates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- identify, through investigation, the quantities in an equation that vary and those that remain constant</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- solve problems that use two or three symbols or letters as variables to represent different unknown quantities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- determine the solution to a simple equation with one variable, through investigation using a variety of tools and strategies</td>
</tr>
</tbody>
</table>
Examine the input-output table shown below.

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>17</td>
</tr>
</tbody>
</table>

Which of these rules describes the data?

a. Multiply by 2 and add 1.
b. Multiply by 4 and subtract 3.
c. Multiply by 2 and add 5.
d. Multiply by 3 and subtract 1.*
A rectangular wall is being built. The table shows the dimensions of the wall after each day.

<table>
<thead>
<tr>
<th>Day</th>
<th>Height</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 m</td>
<td>2 m</td>
</tr>
<tr>
<td>2</td>
<td>2 m</td>
<td>3 m</td>
</tr>
<tr>
<td>3</td>
<td>3 m</td>
<td>4 m</td>
</tr>
<tr>
<td>4</td>
<td>4 m</td>
<td>5 m</td>
</tr>
</tbody>
</table>

If the pattern continues, what will the perimeter of the wall be at the end of Day 10?

a  42 m *
b  38 m
c  21 m
d  19 m
The following pattern increases by following this rule: multiply the previous term by 3 and add 1.

5, 16, 49, 148, . . .

What is the next term in the sequence?

a  159
b  218
c  444
d  445 *
31 In a hockey arena, the first row has 276 seats, the second row has 288 seats and the third row has 300 seats. Each row after this continues to increase by the same number. If the arena has a total of 6 rows, how many seats are in the arena?
   a  1836 *
   b  1176
   c  972
   d  312

35 The same number is added to each term in a pattern to get the value of the next term. Below are the fourth, fifth and sixth terms in the pattern.
   … 95, 98, 101, …

What are the first, second and third terms in the pattern?
   a  83, 85, 87
   b  83, 86, 89
   c  86, 88, 92
   d  86, 89, 92 *
28 A carpenter is replacing some missing steps at the front of Dena’s house. The bottom three steps are missing. He wants to use the same heights for the new steps as the old steps. The carpenter measures the height from the ground to the top of each remaining step.

- The fourth step is 66 cm from the ground.
- The fifth step is 82.5 cm from the ground.
- The sixth step is 99 cm from the ground.
The carpenter plans to make each step increase by the same amount.
What are the heights of the first, second and third steps?

Show or explain your work.
A pattern is shown below. Each term increases by the same amount.

4, 41, 78, 115, 152, ...

What is the 9th term in the pattern?

A 226
B 263
C 300
D 337
The four tables below each follow different input-output rules.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>22</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>43</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Input</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>19</td>
<td></td>
</tr>
</tbody>
</table>

Which one of the tables follows the input-output rule “triple each input and subtract three to get the output”?

   - F  Table 1
   - G  Table 2
   - H  Table 3
   - J  Table 4
Shanna collects coins each day. She collects 3 coins on Day 1, and the number of coins that she collects each day is double the number of coins she collected the day before. On what day will Shanna collect exactly 96 coins?

A  Day 5
B  Day 6
C  Day 7
D  Day 8
6. What is the missing term in the decreasing pattern below?
532, 515, __, 481, 464

   a. 497
   b. 498
   c. 499
   d. 500

14. A pattern that increases when the same amount is added to each term is represented in the table below.

<table>
<thead>
<tr>
<th>Term Number</th>
<th>Term Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>4</td>
<td>29</td>
</tr>
<tr>
<td>5</td>
<td>35</td>
</tr>
</tbody>
</table>

Which of the following is the term number when the term value is 53?

   a. 6
   b. 8
   c. 41
   d. 47
15. Look at the repeating pattern below.

RRBBGGYY
RRBBGGYY

If the pattern continues, what will the 82nd letter be?

a. R  
b. B  
c. G  
d. Y

24. Which rule describes this numerical pattern?

17, 33, 65, 129, ...

To each term,

a. add 16 to get to the next term.

b. subtract 16 to get to the next term.

c. multiply by 2, and add 1 to get to the next term.

d. multiply by 2, and subtract 1 to get to the next term.
The graph below shows the relationship between the number of sides of a polygon and the sum of the interior angles of that polygon.

On the grid above, extend the pattern for polygons with 6 sides, 7 sides and 8 sides.

Sam states that the rule to determine the sum of the interior angles of a polygon is “subtract 2 from the number of sides and multiply this difference by 180.” Is Sam’s rule correct?

Justify your answer.
6. Consider the five terms in the following pattern.

If the pattern continues in the same way, how many circles will be in the seventh term?

- a 21
- b 25
- c 28
- d 36

14. Which rule describes the following pattern?

1, 2, 4, 8

- a Start with 1 and add 1 to find the next term.
- b Start with 1 and add 2 to find the next term.
- c Start with 1 and divide by 2 to find the next term.
- d Start with 1 and multiply by 2 to find the next term.
24 A repeating pattern is shown below.

What is the 16th figure in the pattern?

a

b

c

d
25. Anya shows a pattern on the grid below.

If the pattern continues in the same way, which coordinates represent a point in this pattern?

a. (6, 11)
b. (6, 12)
c. (7, 11)
d. (7, 12)
Ms. Lewis has 50 blocks. She uses 22 of these blocks to make the pattern shown below.

How many stages will Ms. Lewis be able to complete with the 50 blocks?

Justify your answer.
Emily makes a table of values using the following rule:

Start with 2 and add 3 to get the next term.

<table>
<thead>
<tr>
<th>Term number</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Which ordered pair belongs in her table of values?

- a (4, 8)
- b (4, 9)
- c (4, 11)
- d (4, 14)
The table below shows the widths and heights of 5 towers made of blocks.

<table>
<thead>
<tr>
<th>Tower</th>
<th>Width (number of blocks)</th>
<th>Height (number of blocks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

If the towers continue to be built using the same pattern, for which tower will the difference between the width and the height be 7 blocks?

- a  Tower 7
- b  Tower 8
- c  Tower 9
- d  Tower 10
The 4 arrows below repeat in this order to make a pattern.

Which arrow is the 74th term?

a

b

c

d
25 Sara draws shaded squares on separate pieces of paper. The areas of the first three shaded squares are shown below.

\begin{align*}
\text{1st square} & \quad \text{Area} = 144 \text{ cm}^2 \\
\text{2nd square} & \quad \text{Area} = 72 \text{ cm}^2 \\
\text{3rd square} & \quad \text{Area} = 36 \text{ cm}^2
\end{align*}

If this pattern continues, what will the area of the 6th shaded square be?

- a. 2.25 cm\(^2\)
- b. 4.5 cm\(^2\)
- c. 9 cm\(^2\)
- d. 18 cm\(^2\)
Consider the following pattern rule.

Triple each term to get the next term.

Which pattern matches this rule?

- a) 0, 3, 6, 9, 12
- b) 0, 3, 9, 27, 81
- c) 1, 3, 9, 27, 81
- d) 1, 4, 7, 10, 13
The table below shows the number of pennies Anne places in a jar each day. The pattern continues. Complete the table for Days 5 and 6.

<table>
<thead>
<tr>
<th>Anne's Jar</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day</strong></td>
<td><strong>Number of pennies placed in the jar</strong></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

On what day will Anne place 1024 pennies in her jar?

Justify your answer.

Anne will place 1024 pennies in her jar on Day ____.
1. Consider the pattern below.
   7, 14, 28, 56, ____ , 224
   What is the missing term in this pattern?
   a 84
   b 102
   c 112
   d 168
Manny uses tiles to build the geometric pattern shown below.

Stage 1    Stage 2    Stage 3

Which of the following represents the number of squares in Stages 4, 5 and 6 of Manny’s pattern?

a  17, 24, 31
b  13, 17, 24
c  13, 17, 21
d  12, 16, 20
The graph below shows a relationship between the number of tasks Cole completes and the number of tokens he earns.

According to the pattern shown on the graph, how many tasks must Cole complete to earn 16 tokens?

- a 6
- b 8
- c 16
- d 32
Karen and Riley create the shrinking patterns shown below.

<table>
<thead>
<tr>
<th>Term number</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1024</td>
</tr>
<tr>
<td>2</td>
<td>512</td>
</tr>
<tr>
<td>3</td>
<td>256</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term number</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>111</td>
</tr>
<tr>
<td>2</td>
<td>99</td>
</tr>
<tr>
<td>3</td>
<td>87</td>
</tr>
</tbody>
</table>

What are their pattern rules?

Karen’s rule:

________________________.

Riley’s rule:

________________________.

Which pattern will be the first to reach a term smaller than 10?

Justify your answer.
34 What value, when placed in the box, would make the following equation true?

\[ 6 \times \Box - 4 = 56 + 6 \]

a 10
b 11 *
c 31
d 62
2. Two equations are written below.

\[ 4 \times \Delta = 8 \]

\[ 4 \times \Delta + \Box = 18 \]

What value does the \( \Box \) represent?

- F 2
- G 4
- H 10
- J 22

17. Francine gets paid $7.00 for each hour she works. The formula to calculate her pay is shown below.

\[ P = 7 \times H \]

Which of the following statements is true?

- A  \( P \) is the only variable.
- B  \( H \) is the only constant.
- C  \( P \) and \( H \) are variables.
- D  \( P \) and \( H \) are constants.
Two equations are shown below.

\[ n + 3 = 9 \]

\[ n + 3 + k = 23 \]

If the equations are true, what is the value of \( k \)?

A 6
B 9
C 14
D 20
When Jennifer and Tom visit another country, they find two types of coins are used there, one with a Q on it and one with an E on it. Jennifer has 13 Q coins and Tom has 5 Q coins and 7 E coins. If Jennifer’s coins have a total value of $0.65 and Tom’s coins have a total value of $3.75, what is the value of each type of coin?

Show your work.

The value of the Q coin is \[ \_\_\_\_\_\_\_\_\_\_. \]

The value of the E coin is \[ \_\_\_\_\_\_\_\_\_. \]
5. Consider the three equations below.

\[ m + 9 = 12 \]
\[ m + n + 3 = 14 \]
\[ m + n + p = 15 \]

What is the value of \( p \)?

a. 3
b. 4
c. 5
d. 8

25. The total number of books Mitzi reads over the summer can be found using the expression \( 2 \times n + 3 \), where \( n \) represents the number of weeks. After how many weeks will she have read 11 books?

a. 3
b. 4
c. 7
d. 8
5. If \( a + c = 24 \), what is the value of \( e \) in the equation \( a + c + e = 27? \)

- a. 3
- b. 9
- c. 15
- d. 51

15. If \( 6 \times a = 54 \) and \( b - a = 14 \), what is \( a \times b? \)

- a. 32
- b. 45
- c. 126
- d. 207
14. Look at the equation below.

\[ y \div z = 9 \]

Which values of \( y \) and \( z \) do not make the equation true?

- a) \( y = 27; \ z = 3 \)
- b) \( y = 54; \ z = 6 \)
- c) \( y = 63; \ z = 7 \)
- d) \( y = 72; \ z = 9 \)
14 Consider the equation below.

\[ 5 \times n + 12 = 32 \]

What is the value of \( n \) in this equation?

a 3  
b 4  
c 15 
d 17

22 If \( 6 \times a = 12 \) and \( 6 \times a - b = 8 \), what is the value of \( b \)?

a 2  
b 4  
c 6  
d 8

31 Consider the equation below.

\[ 3 \times m + 2 \times n = 36 \]

Which values of \( m \) and \( n \) would not make the equation true?

a \( m = 2, n = 15 \)  
b \( m = 4, n = 12 \)  
c \( m = 6, n = 9 \)  
d \( m = 8, n = 7 \)