

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectations

PV1	<ul style="list-style-type: none"> Describe and represent relationships in growing and shrinking patterns (where the terms are whole numbers), and investigate repeating patterns involving rotations
PV2	<ul style="list-style-type: none"> Use variables in simple algebraic expressions and equations to describe relationships

Year	PV1	PV2
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

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Year	Knowledge & Understanding	Problem Solving (Thinking)	Application
Spring 2009	MC6 MC14	MC15 OR9	MC5 MC24 MC25
Spring 2010	MC14 MC30	MC15	MC2 MC20 MC25 OR26
Spring 2011	MC1 MC14	MC31 OR29	MC6 MC22 MC25

PATTERNING & ALGEBRA: Patterns and Relationships

Grade 4	Grade 5	Grade 6
Overall Expectation		
<p>- describe, extend, and create a variety of numeric and geometric patterns, make predictions related to the patterns, and investigate repeating patterns involving reflections</p>	<p>- determine, through investigation using a table of values, relationships in growing and shrinking patterns, and investigate repeating patterns involving translations</p>	<p>- describe and represent relationships in growing and shrinking patterns (where the terms are whole numbers), and investigate repeating patterns involving rotations</p>
Specific Expectations		
<p>- create a number pattern involving addition, subtraction, or multiplication, given a pattern rule expressed in words</p>	<p>– 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</p>	<p>– 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</p>
<p>- extend, describe, and create repeating, growing, and shrinking number patterns</p>	<p>- create, identify, and extend numeric and geometric patterns, using a variety of tools</p>	<p>– identify geometric patterns, through investigation using concrete materials or drawings, and represent them numerically</p>
<p>- 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</p>	<p>- build a model to represent a number pattern presented in a table of values that shows the term number and the term</p>	<p>- 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</p>
		<p>– 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</p>
<p>- make predictions related to repeating geometric and numeric patterns</p>	<p>– make predictions related to growing and shrinking geometric and numeric patterns</p>	<p>- describe pattern rules (in words) that generate patterns by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term then distinguish such pattern rules from pattern rules, given in words, that describe the general term by referring to the term number</p>
<p>- extend and create repeating patterns that result from reflections, through investigation using a variety of tools</p>	<p>– extend and create repeating patterns that result from translations, through investigation using a variety of tools</p>	<p>– extend and create repeating patterns that result from rotations, through investigation using a variety of tools</p>

PATTERNING & ALGEBRA: Expressions and Equality

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

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Expectation #1

Spring 2006

- 7** Examine the input-output table shown below.

Input	Output
2	5
3	8
4	11
6	17

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.*

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Expectation #1

Spring 2006

- 15** A rectangular wall is being built. The table shows the dimensions of the wall after each day.

Wall Dimensions

Day	Height	Length
1	1 m	2 m
2	2 m	3 m
3	3 m	4 m
4	4 m	5 m

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

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Expectation #1

Spring 2006

16 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 *

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Expectation #1

Spring 2006

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 *

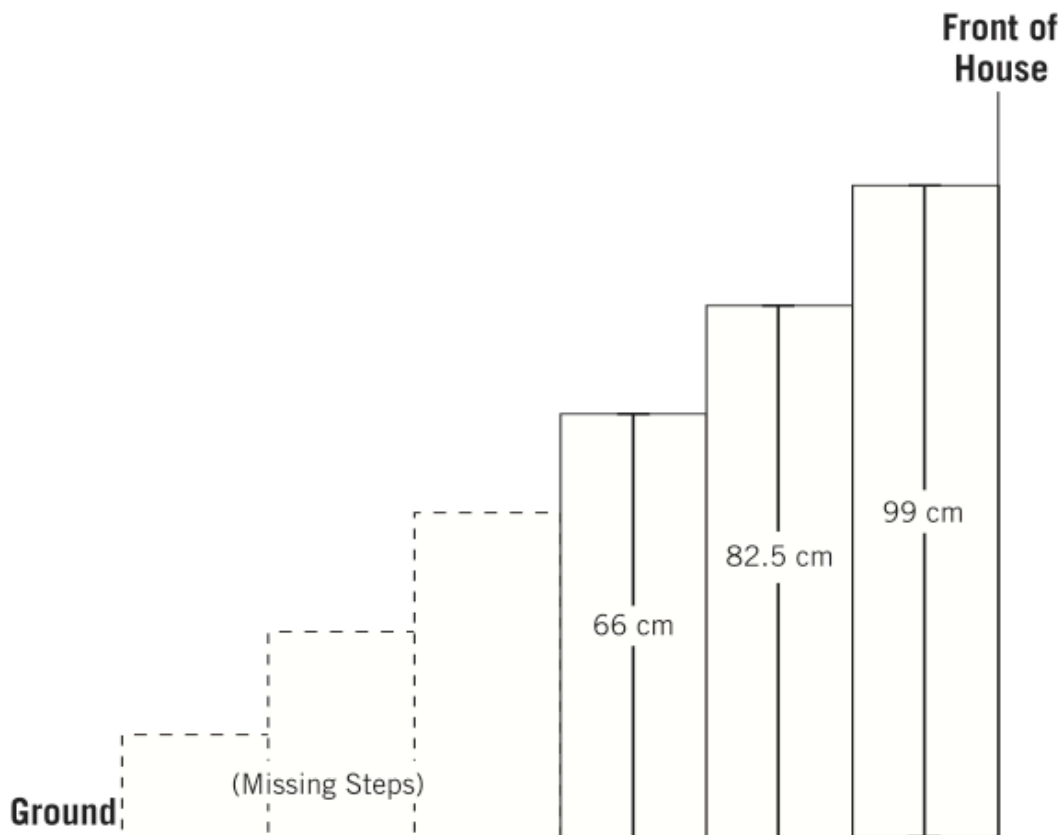
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Expectation #1

Spring 2006

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.



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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.

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Overall Expectation #1

Spring 2007

1 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

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Overall Expectation #1

Spring 2007

- 22 The four tables below each follow different input-output rules.

Table 1

Input	Output
3	6
7	14
11	22

Table 2

Input	Output
1	0
5	12
9	24

Table 3

Input	Output
4	9
8	27
12	43

Table 4

Input	Output
2	3
6	11
10	19

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

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Overall Expectation #1

Spring 2007

23 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

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Expectation #1

Spring 2008

- 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.

Pattern Table

Term Number	Term Value
1	11
2	17
3	23
4	29
5	35

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

- a 6
- b 8
- c 41
- d 47

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Expectation #1

Spring 2008

15 Look at the repeating pattern below.

R R B B G G Y Y R R B B G G Y Y

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,

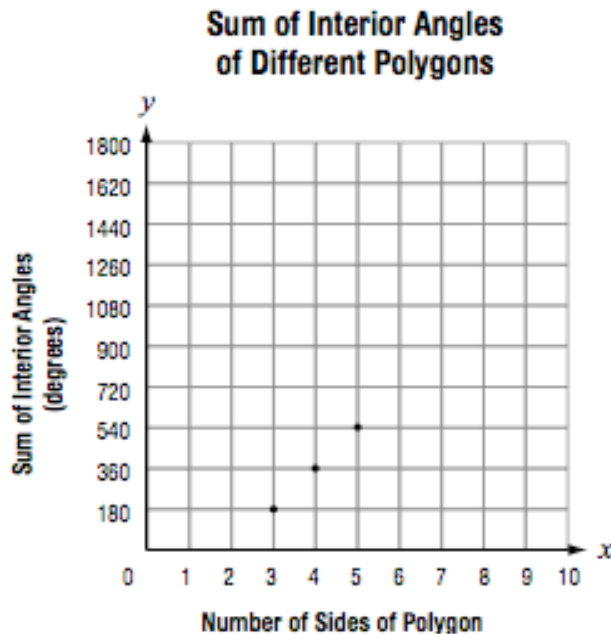
- a add 16 to get to the next term.
- b subtract 16 to get to the next term.
- c multiply by 2, and add 1 to get to the next term.
- d multiply by 2, and subtract 1 to get to the next term.

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Expectation #1

Spring 2008

- 28 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?

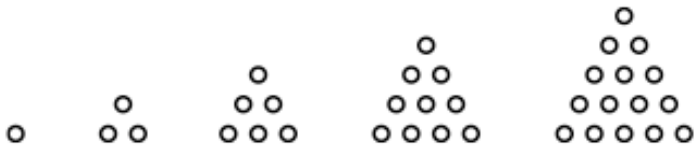
Justify your answer.

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Expectation #1

Spring 2009

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.

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Expectation #1

Spring 2009

24 A repeating pattern is shown below.



What is the 16th figure in the pattern?

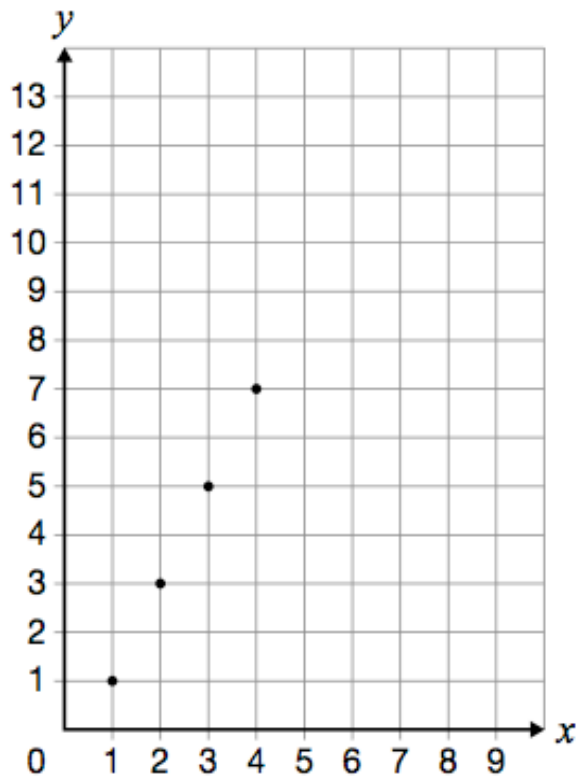


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Expectation #1

Spring 2009

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?

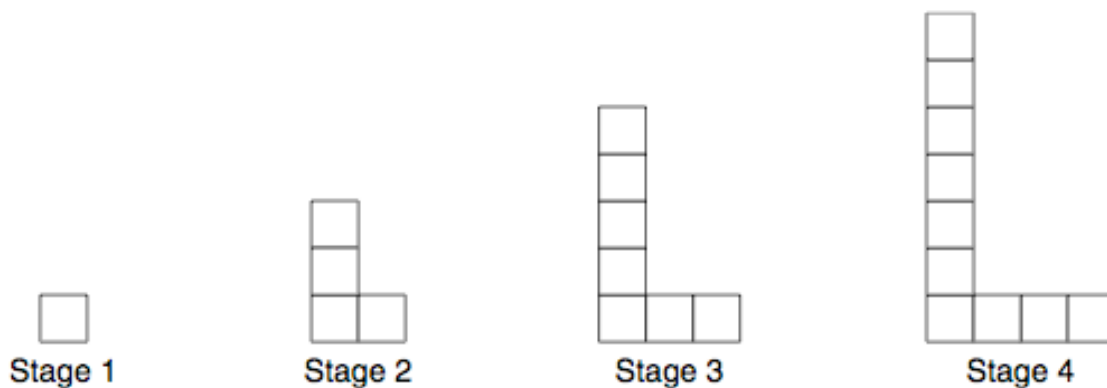
- a (6, 11)
- b (6, 12)
- c (7, 11)
- d (7, 12)

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Expectation #1

Spring 2009

9 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.

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Expectation #1

Spring 2010

- 2** Emily makes a table of values using the following rule:

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

Term number	Term
1	2

Which ordered pair belongs in her table of values?

- a (4, 8)
- b (4, 9)
- c (4, 11)
- d (4, 14)

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Expectation #1

Spring 2010

- 15** The table below shows the widths and heights of 5 towers made of blocks.

Tower Building

Tower	Width (number of blocks)	Height (number of blocks)
1	3	2
2	5	5
3	7	8
4	9	11
5	11	14

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?

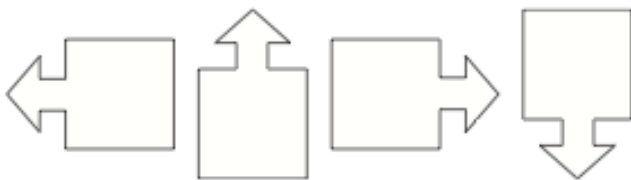
- a Tower 7
- b Tower 8
- c Tower 9
- d Tower 10

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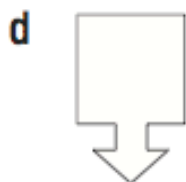
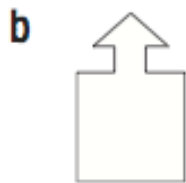
Expectation #1

Spring 2010

20 The 4 arrows below repeat in this order to make a pattern.



Which arrow is the 74th term?



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Expectation #1

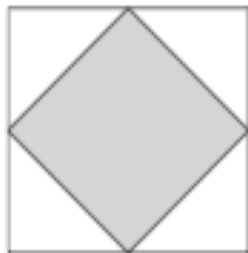
Spring 2010

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



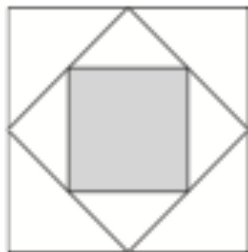
Area = 144 cm^2

1st square



Area = 72 cm^2

2nd square



Area = 36 cm^2

3rd square

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

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Expectation #1

Spring 2010

30 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

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Expectation #1

Spring 2010

26 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.

Anne's Jar

Day	Number of pennies placed in the jar
1	1
2	2
3	4
4	8
5	
6	

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

Justify your answer.

Anne will place 1024 pennies in her jar on Day ____.

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Expectation #1

Spring 2011

1 Consider the pattern below.

7, 14, 28, 56, _____, 224

What is the missing term in this pattern?

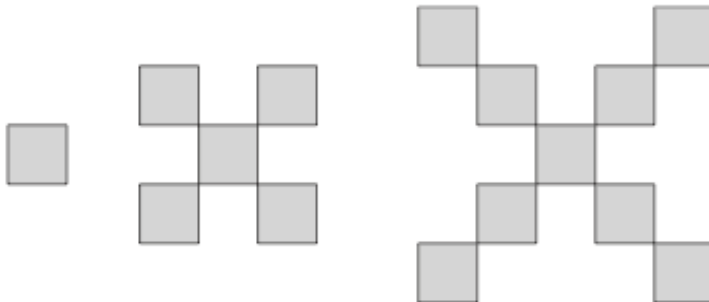
- a 84
- b 102
- c 112
- d 168

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Expectation #1

Spring 2011

- 6** 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?

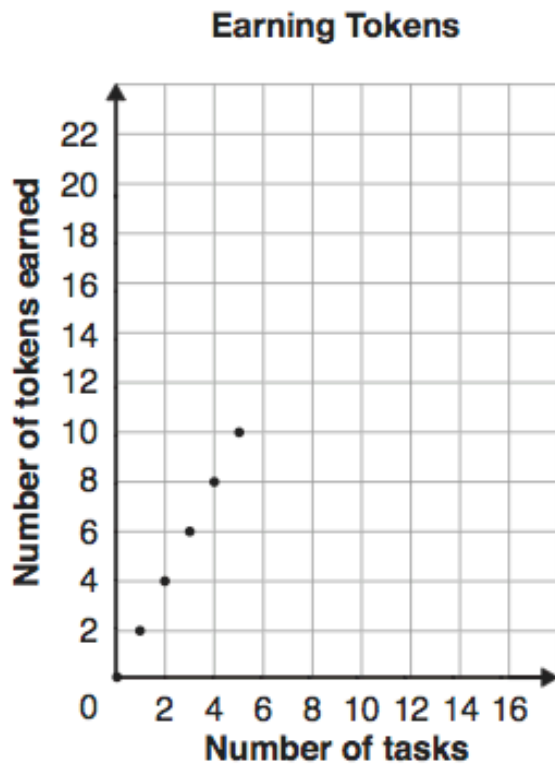
- a 17, 24, 31
- b 13, 17, 24
- c 13, 17, 21
- d 12, 16, 20

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Expectation #1

Spring 2011

- 25** 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

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Expectation #1

Spring 2011

29 Karen and Riley create the shrinking patterns shown below.

Karen's Pattern

Term number	Term
1	1024
2	512
3	256

Riley's Pattern

Term number	Term
1	111
2	99
3	87

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.

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectation #2

Spring 2006

34 What value, when placed in the box, would make the following equation true?

$$6 \times \square - 4 = 56 + 6$$

- a 10
- b 11 *
- c 31
- d 62

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectation #2

Spring 2007

2 Two equations are written below.

$$4 \times \Delta = 8$$

$$4 \times \Delta + \square = 18$$

What value does the \square 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.

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectation #2

Spring 2007

31 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

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectation #2

Spring 2007

- 27** 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 _____.

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectation #2

Spring 2008

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

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectation #2

Spring 2009

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

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectation #2

Spring 2010

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 $y = 72; z = 9$

GRADE SIX EQAO QUESTIONS: Patterning and Algebra

Overall Expectation #2

Spring 2011

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 $m = 8, n = 7$