

Name: \_\_\_\_\_

## 2004, Mathematics - Grade 10

### Question 27: Multiple Choice

*Patterns, Relations, and Algebra*

What is the 9th term in the quadratic sequence shown below?

2, 5, 10, 17, 26, ...

- A. 97
- B. 82
- C. 71
- D. 65



## 2004, Mathematics - Grade 10

### Question 20: Open Response

*Patterns, Relations, and Algebra*

The first four terms in a pattern are shown below.

$$3x, 4x^2, 5x^3, 6x^4, \dots$$

The formula given for this pattern is

$$a_n = (2 + n)x^n$$

where  $n$  = the number (position) of the term in the pattern. The first term is  $3x$ , the second term is  $4x^2$ , and so on.  
When  $x = 10$ , the value of the first term is 30, since  $3(10) = 30$ .

- a. What is the value of the fifth term in the pattern when  $x = 2$ ? Show or explain how you obtained your answer.
- b. Using the formula, what will be the seventh term in the pattern? Show or explain how you obtained your answer.
- c. List the values, in order, of the first six terms in the pattern when  $x = -1$ .
- d. Which term in the pattern will have the numerical coefficient 24? Show or explain how you obtained your answer.



## 2003, Mathematics - Grade 10

### Question 23: Multiple Choice

*Patterns, Relations, and Algebra*

What is the first term in the exponential sequence below?

{\_\_\_\_, \_\_\_\_, \_\_\_\_, 81, 243, 729, ...}

- A. 1
- B. 3
- C. 9
- D. 27



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## 2003, Mathematics - Grade 10

### Question 20: Open Response

*Patterns, Relations, and Algebra*

Use the following sums to answer question 20.

$$\frac{1}{4} + \frac{3}{4} = 1$$

$$\frac{1}{6} + \frac{3}{6} + \frac{5}{6} = \frac{3}{2}$$

$$\frac{1}{8} + \frac{3}{8} + \frac{5}{8} + \frac{7}{8} = 2$$

$$\frac{1}{10} + \frac{3}{10} + \frac{5}{10} + \frac{7}{10} + \frac{9}{10} = \frac{5}{2}$$

- Write the next series of fractions in the pattern and find its sum. Show or explain how you got your answer.
- What is the denominator of the series of fractions in the pattern that has a sum of 4? Show or explain how you got your answer.
- What is the sum of the series of fractions in the pattern in which the first term is  $\frac{1}{36}$ ? Show or explain how you got your answer.
- If the denominator is an even number,  $n$ , what is the sum of the series in terms of  $n$ ? Show or explain how you got your answer.



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## 2003, Mathematics - Grade 10

### Question 4: Multiple Choice

*Patterns, Relations, and Algebra*



The table below shows a linear relationship between  $x$  and  $y$ .

$x$	$y$
-7	$a$
-3	10
-1	6
0	4
5	-6

What is the value of  $a$ ?

- A. -18
- B. -14
- C. 14
- D. 18

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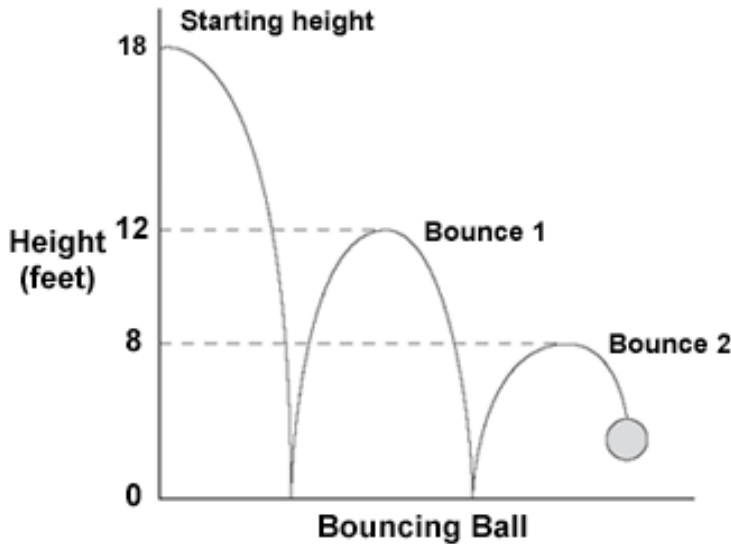
**2002, Mathematics - Grade 10**

**Question 42: Open Response**

*Patterns, Relations, and Algebra*



The diagram shown below represents the path of a ball that is dropped from a height of 18 feet. On its first bounce, the ball rebounds to a height of 12 feet; on its second bounce, it rebounds to a height of 8 feet.



- Show that the ratio of the height of Bounce 1 to the starting height is equal to the ratio of the height of Bounce 2 to the height of Bounce 1. Show your work or explain how you obtained your answer.
- Create a table like the one shown below in your Student Answer Booklet.

Bounce, $b$	Height, $h$ (in feet)
0 (Starting height)	18
1	12
2	8
3	
4	
5	

If the pattern in the table continues, complete your table to show the height of bounces 3, 4, and 5.

- Based on the pattern shown in the table, if  $h$  is the height of a certain bounce, write an expression that represents the height of the next bounce in terms of  $h$ .
- Based on the pattern shown in the table, write an equation that represents the relationship between height,  $h$ , and bounce,  $b$ .

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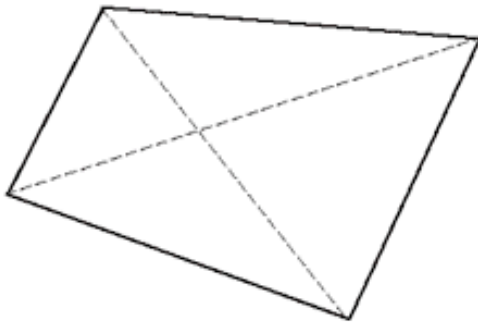
**2002, Mathematics - Grade 10**

**Question 21: Open Response**

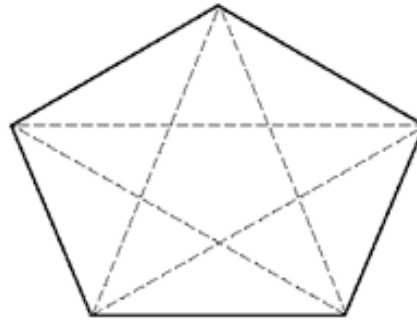
*Geometry*



Alex wanted to find a pattern to predict the total number of diagonals in a convex polygon. He used each of the figures below to determine the number of diagonals in the 4-sided convex polygon and the 5-sided convex polygon shown below.



**4-sided convex polygon**



**5-sided convex polygon**

- a. Create a table like the one shown below in your Student Answer Booklet. Complete the table to show the relationship between the number of sides, the number of diagonals drawn from each vertex, and the total number of diagonals in each of the convex polygons listed.

Number of sides	4	5	6	7	8
Number of diagonals from each vertex	1	2	3		
Total number of diagonals	2	5	9		

- b. What is the total number of diagonals that a convex polygon of 12 sides has?
- c. Write an expression which represents the number of diagonals that a convex polygon of  $n$  sides has.

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**2002, Mathematics - Grade 10**

**Question 8: Multiple Choice**

*Patterns, Relations, and Algebra*







Computers are designed around off/on switches that are used to represent numbers. In the following pattern, which represents the numbers from 0 to 10,  represents a switch that is on and  represents a switch that is off.

- |   |     |
|---|-----|
| <input checked="" type="radio"/> <input checked="" type="radio"/> <input checked="" type="radio"/> <input checked="" type="radio"/> | =0  |
| <input checked="" type="radio"/> <input checked="" type="radio"/> <input checked="" type="radio"/> <input type="radio"/>            | =1  |
| <input checked="" type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input checked="" type="radio"/>            | =2  |
| <input checked="" type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/>                       | =3  |
| <input checked="" type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input checked="" type="radio"/>            | =4  |
| <input checked="" type="radio"/> <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/>                       | =5  |
| <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/> <input checked="" type="radio"/>                       | =6  |
| <input checked="" type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/>                                  | =7  |
| <input type="radio"/> <input checked="" type="radio"/> <input checked="" type="radio"/> <input checked="" type="radio"/>            | =8  |
| <input type="radio"/> <input checked="" type="radio"/> <input checked="" type="radio"/> <input type="radio"/>                       | =9  |
| <input type="radio"/> <input checked="" type="radio"/> <input type="radio"/> <input checked="" type="radio"/>                       | =10 |

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Which of the following represents the number 11?

- A. 
- B. 
- C. 
- D. 

## 2001, Mathematics - Grade 10

### Question 18: Multiple Choice

*Data Analysis, Statistics, and Probability*



The table below shows the distribution of CD sales of different types of music in a local store over a three-year period.

CD Sales			
Type	Year 1	Year 2	Year 3
Rock	39.4%	36.2%	35.6%
Pop	17.8%	16.5%	15.5%
Rap	11.6%	10.4%	10.7%
Country	7.7%	7.9%	7.8%
Other	23.5%	29.0%	30.4%
<b>Total Sales (in thousands)</b>	<b>\$1,732.10</b>	<b>\$2,269.30</b>	<b>\$2,639.80</b>

Based on this information, from Year 1 to Year 3 the **total dollar value** of this store's sales of pop music

- A. increased.
- B. decreased.
- C. stayed the same.
- D. Not enough information is given to tell.

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## 2001, Mathematics - Grade 10

### Question 20: Multiple Choice

*Patterns, Relations, and Algebra*

Use the pattern below to answer question 20.

**1, 3, 7, 15, 31, 63**

The 14th term in this pattern is 16,383. What is the 15th term?

- A. 16,385
- B. 16,415
- C. 32,767
- D. 32,781



## 2000, Mathematics - Grade 10

### Question 16: Open Response

*Patterns, Relations, and Algebra*

A 15-player tournament consists of a series of matches between two contestants. A contestant is eliminated after losing one match. When there is an odd number of players, one player is **not** paired with a partner and automatically advances to the next round as though he/she had won a match.

- a. Draw a diagram to show how the tournament could be set up.
- b. What is the smallest number of two-contestant matches that the winner must play in order to become the champion?
- c. What is the **total** number of matches that must be played in the tournament to determine a winner?
- d. Suppose 63 people entered a similar tournament. What is the total number of matches that must be played in the tournament to determine a winner?



## 2000, Mathematics - Grade 10

### Question 25: Multiple Choice

*Number Sense and Operations*

The following table shows the total number of line segments that can be drawn connecting two points in a set of coplanar, noncollinear points.

Number of Points	3	4	5	6	...	10	11
Number of Line Segments	3	6	10	15	...	45	?

How many line segments can be drawn connecting two points in a set of 11 noncollinear points?

- A. 55
- B. 50
- C. 48
- D. 110



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**1999, Mathematics - Grade 10**

**Question 41: Open Response**



*Patterns, Relations, and Algebra*

The number of bacteria in a sample doubles every four hours. At the end of 24 hours there are 30,720 bacteria present in a sample.

- How many bacteria were present initially? Show your work.
- During which four-hour period will 5 million bacteria first be present? Show your work.
- Write a mathematical expression to determine the number of bacteria present at the end of any four-hour period.

**1999, Mathematics - Grade 10**

**Question 29: Multiple Choice**

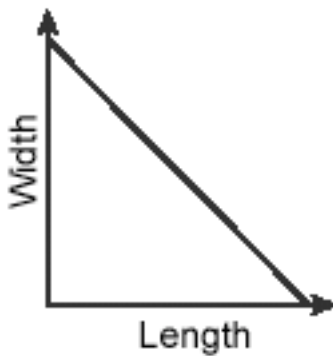


*Patterns, Relations, and Algebra*

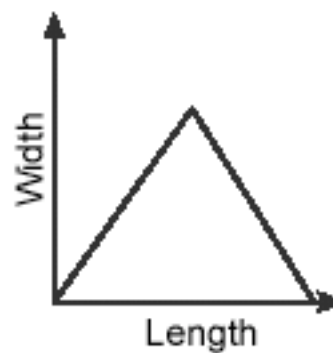
Use the table below to answer question 29.

Rectangles With Area of 24 Square Units								
Length (in units)	1	2	3	4	6	8	12	24
Width (in units)	24	12	8	6	4	3	2	1

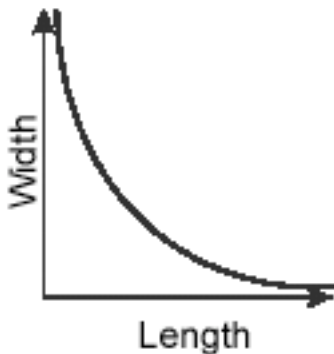
A.



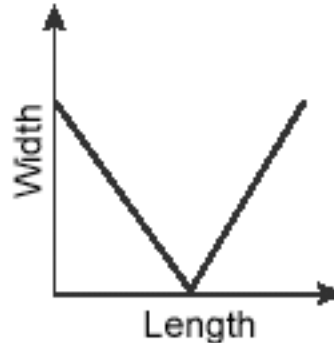
C.



B.



D.



Name: \_\_\_\_\_

**1999, Mathematics - Grade 10**

**Question 19: Multiple Choice**

*Patterns, Relations, and Algebra*



The Pizza Palace's price list for plain pizzas is shown below.

DIAMETER	COST
10"	\$5.00
12"	\$7.20
14"	\$9.80
16"	\$12.80

Based on this information, what would a 20" pizza likely cost?

- A. \$10.00
- B. \$14.40
- C. \$14.80
- D. \$20.00

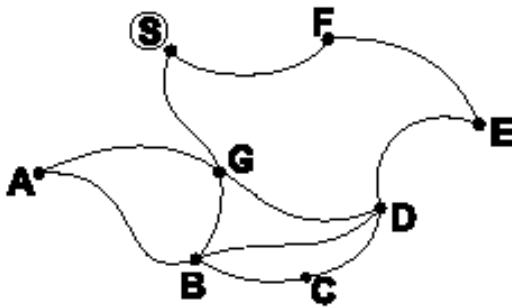
**1999, Mathematics - Grade 10**

**Question 12: Short Answer**

*Number Sense and Operations*



Use the figure below to answer question 12.



The figure shows a map of the points of interest on the Liberty Path. Point S represents the starting and ending point for all tours on the paths between the seven points of interest labeled A through G. Name one tour in which each point of interest is visited exactly once without retracing any path. To name the tour, list the points in the order you would pass through them.

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**1998, Mathematics - Grade 10**

**Question 29: Short Answer**

*Patterns, Relations, and Algebra*



Number of sides of a polygon	3	4	5	6	–	15
Sum of interior angles	180°	360°	540°	720°	–	?

What is the sum of the interior angles of a 15-sided polygon?

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**1998, Mathematics - Grade 10**

**Question 18: Multiple Choice**

*Patterns, Relations, and Algebra*



The table below reflects the number of different handshakes (H) for groups of  $n$  relatives.

n	7	8	12	20
H	21	28	66	190

For any size gathering of people, which formula gives the correct number of handshakes for  $n$  people?

A.  $H = \frac{n(n+1)}{2}$

B.  $H = \frac{(n-1)^2}{2}$

C.  $H = \frac{n(n-1)}{2}$

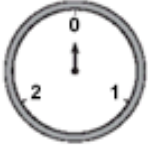
D.  $H = \frac{n^2+1}{2}$

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**1998, Mathematics - Grade 10**

**Question 3: Multiple Choice**

*Number Sense and Operations*



If the hand of the clock above is rotated in a clockwise direction it moves as follows:

Number of Rotations	Number of Degrees	Clock Hand Location
1	120°	1
2	240°	2
3	360°	0
4	480°	1
5	600°	2

After which of the rotations below will the clock hand be on 1?

- A. 63
- B. 52
- C. 41
- D. 30