

PROTOTYPE EXAMINATION

Mathematics

First Year of Secondary Cycle Two
(Secondary III)

Part II

Name : _____

Class : _____

School: _____

Task
Booklet

2009

Time: 3 hours

The following are the evaluation criteria for the two competencies required to complete the tasks this booklet.

COMPETENCY: *USES MATHEMATICAL REASONING*

- Criterion 1 Formulation of a conjecture appropriate to the situation
- Criterion 2 Correct application of concepts and processes suited to the situation
- Criterion 3 Proper implementation of mathematical reasoning suited to the situation
- Criterion 4 Proper organization of the steps in a proof suited to the situation
- Criterion 5 Correct justification of the steps in a proof suited to the situation

COMPETENCY: *COMMUNICATES BY USING MATHEMATICAL LANGUAGE*

- Criterion 1 Correct translation of a mathematical concept or process into another register of semiotic representation
- Criterion 2 Correct interpretation of a mathematical message involving at least two registers of semiotic representation
- Criterion 3 Production of a message appropriate to the communication context
- Criterion 4 Production of a message in keeping with the terminology, rules and conventions of mathematics

Instructions

1. Fill in all the required information in the spaces provided in this booklet.
2. There are 10 tasks in this booklet. For each task, you must show all your work to justify your answer. Your work must be organized and clearly presented.

If necessary:

3. Use a ruler, a set square, a compass, a protractor and graph paper.
4. Use a calculator with or without a graphic display (you must indicate the sequence of operations involved, but you do not have to rewrite all the detailed calculations performed with the calculator).
5. Refer to the memory aid you prepared on your own before the examination. The memory aid consists of one letter-sized sheet of paper ($8\frac{1}{2} \times 11$). Both sides of the sheet may be used. Any reproduction of this memory aid is forbidden.

Only the above-mentioned materials may be used.

Note: Figures are not necessarily drawn to scale.

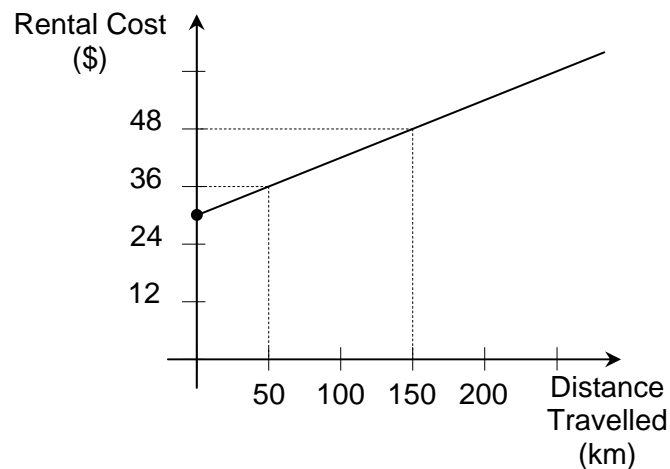
1. GETTING AROUND TOWN

Leo wants to rent a scooter to go sightseeing in Cairo, Egypt. He has rates from two rental companies. Here is the information he was given.

COST OF RENTING A SCOOTER FROM COMPANY A
IN RELATION TO THE DISTANCE TRAVELLED

Distance Travelled (km)	Rental Cost (\$)
25	28.50
40	31.20
50	33.00

COST OF RENTING A SCOOTER FROM COMPANY B
IN RELATION TO THE DISTANCE TRAVELLED



Leo wants to pay as little as possible to rent a scooter.

He decides to rent a scooter from Company B.

Has Leo made the right choice? Explain your answer.

Show all your work

For the scorer's use only

Uses <i>mathematical reasoning</i>	
Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 3	
Cr. 2	
Cr. 4	
Cr. 5	
Cr. 1	

2. KNOW YOUR DESTINATION

Karim is a tour guide in Egypt. The travel agency he works for is doing a statistical study on tourists' knowledge of Egypt when they first arrive in the country.

The groups Karim guides are usually made up of 20 tourists. Upon their arrival in Egypt, Karim writes each person's name on a piece of paper. Then he picks 5 names at random. He asks the people whose names have been drawn to answer a few questions.

Here is one of the questions, along with the answers given by tourists in the last 6 groups that Karim has been a tour guide for.

“How many Egyptian cities can you name?”

NUMBER OF CITIES IDENTIFIED BY
TOURISTS ARRIVING IN EGYPT

Number of Cities Identified	Number of Tourists
2	1
3	2
4	7
5	8
6	5
7	4
8	1
9	2
Total:	30

Karim must now submit a report giving the results of his statistical study.

This report must:

- ♦ indicate the type of statistical study he conducted
- ♦ indicate the target population
- ♦ include a box-and-whisker plot showing the dispersion of the data he collected

Show all your work

REPORT PRESENTING KARIM'S STATISTICAL STUDY

For the scorer's use only

***Communicates by using
mathematical language***

Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 2	
Cr. 1	
Cr. 3	
Cr. 4	

3. GAS CONSUMPTION

The Fletcher and Goodwin families are travelling in Egypt. Each family rents a car to get around in. When they pick up their cars, both gas tanks are full.

CAR RENTED BY THE FLETCHERS

The function f described below represents the amount of fuel in the gas tank of the car rented by the Fletchers in relation to the distance travelled since the tank was filled.

$$f(x) = -0,1x + 60$$

x : distance travelled, in kilometres, since the tank was filled

$f(x)$: amount of fuel in the gas tank, in litres

The domain of function f is $[0, 600]$.

CAR RENTED BY THE GOODWINS

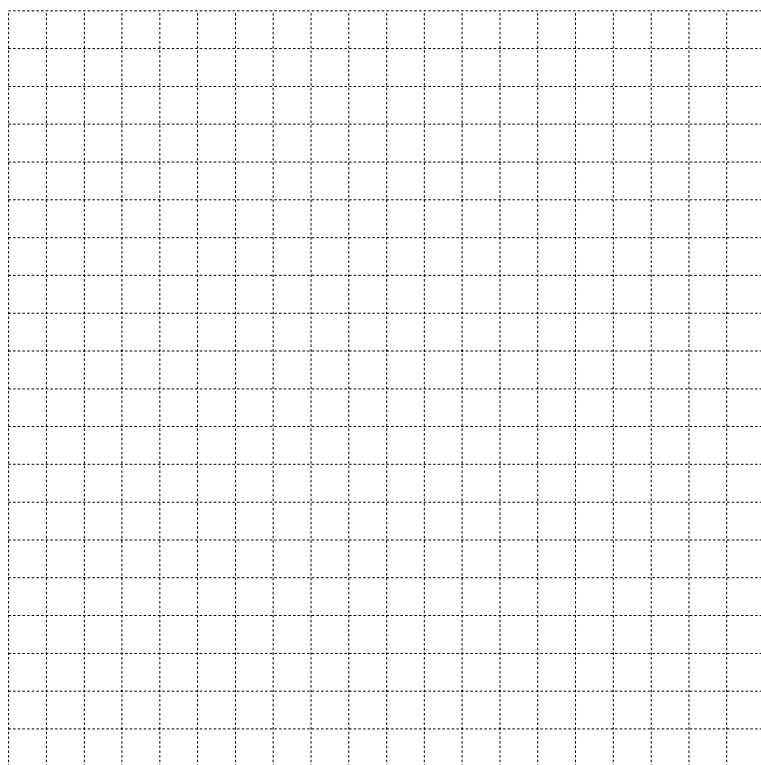
The Goodwins rented a different type of car.

The maximum capacity of the gas tank in the Goodwins' rental car is 10 litres more than the maximum capacity of the gas tank in the Fletchers' rental car.

To travel 100 km, the Goodwins' rental car uses 4 more litres of gas than the Fletchers' rental car.

Draw a graph comparing the amount of gas in the tank of each car in relation to the distance travelled, in kilometres, since the tank was filled.

Show all your work



For the scorer's use only

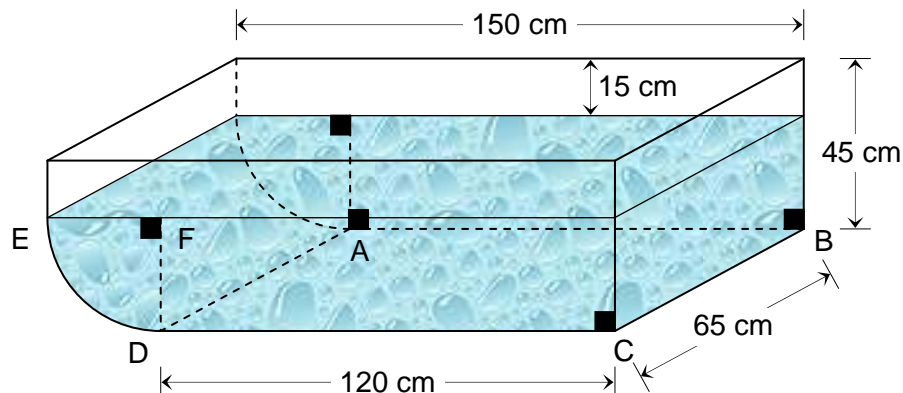
Communicates by using mathematical language

Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 2	
Cr. 1	
Cr. 3	
Cr. 4	

4. CLEOPATRA'S GOATS

Legend has it that Cleopatra, Queen of Ancient Egypt, took baths in goats' milk.

Imagine that her bathtub looks like the one in the diagram below. In this diagram, quadrilateral ABCD is a rectangle. Arc ED is an arc of a circle with centre F.



Before Cleopatra steps into the bathtub, it is filled with milk to a point 15 cm from the top.

Assume that Cleopatra takes a goats' milk bath 4 times a month.

One goat produces approximately 572 litres of milk a year.

How many goats would Cleopatra have to have in her herd to produce the milk used in her baths in one year?

Show your work

Cleopatra would have _____ goats in her herd to produce the milk used in her baths in one year.

For the scorer's use only

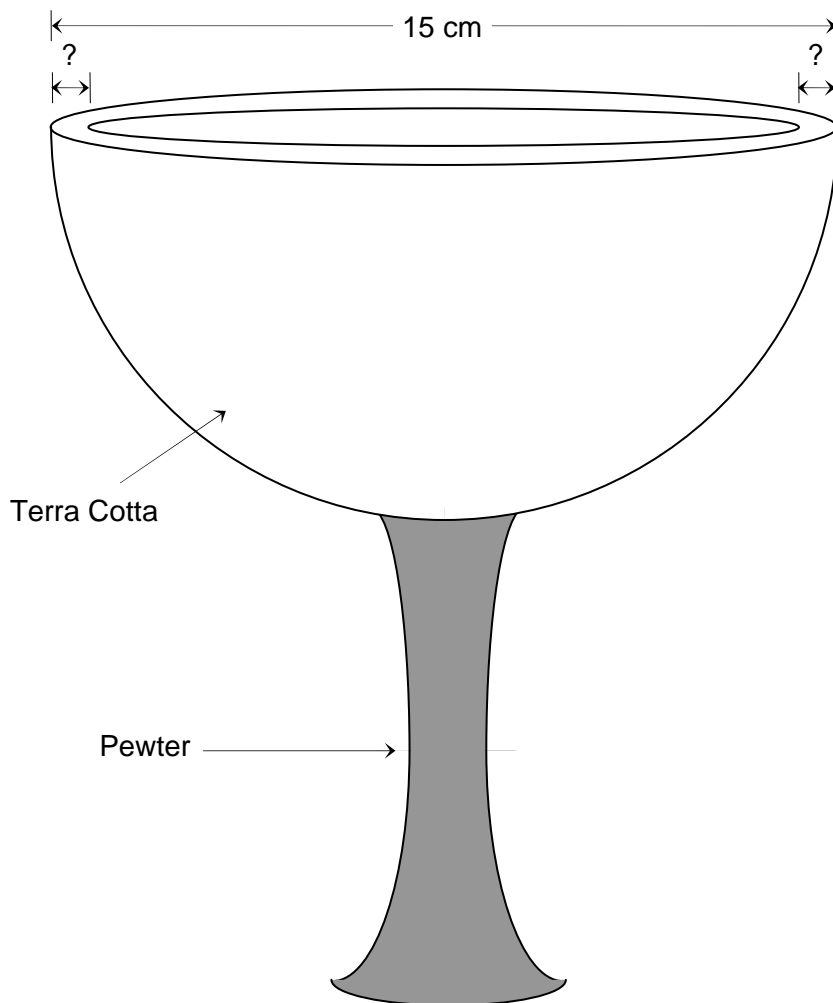
Uses mathematical reasoning	
Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 3	
Cr. 2	
Cr. 4	
Cr. 5	
Cr. 1	

5. PEWTER STEMWARE

In Ancient Greece, bowls, vases and goblets were usually made out of terra cotta, or baked clay.

A terra cotta goblet with a pewter stem was discovered during an archaeological dig. The terra cotta goblet is in the shape of a half sphere of uniform thickness.

The exterior diameter of the goblet is 15 cm.



To make a reproduction of this goblet, 170 cm^3 of terra cotta was used. This reproduction will be used in history class.

To the nearest hundredth of a centimetre, how thick is the terra cotta goblet?

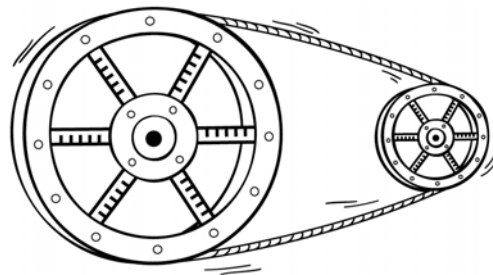
Show all your work

To the nearest hundredth of a centimetre, the terra cotta goblet is _____ cm thick.

For the scorer's use only

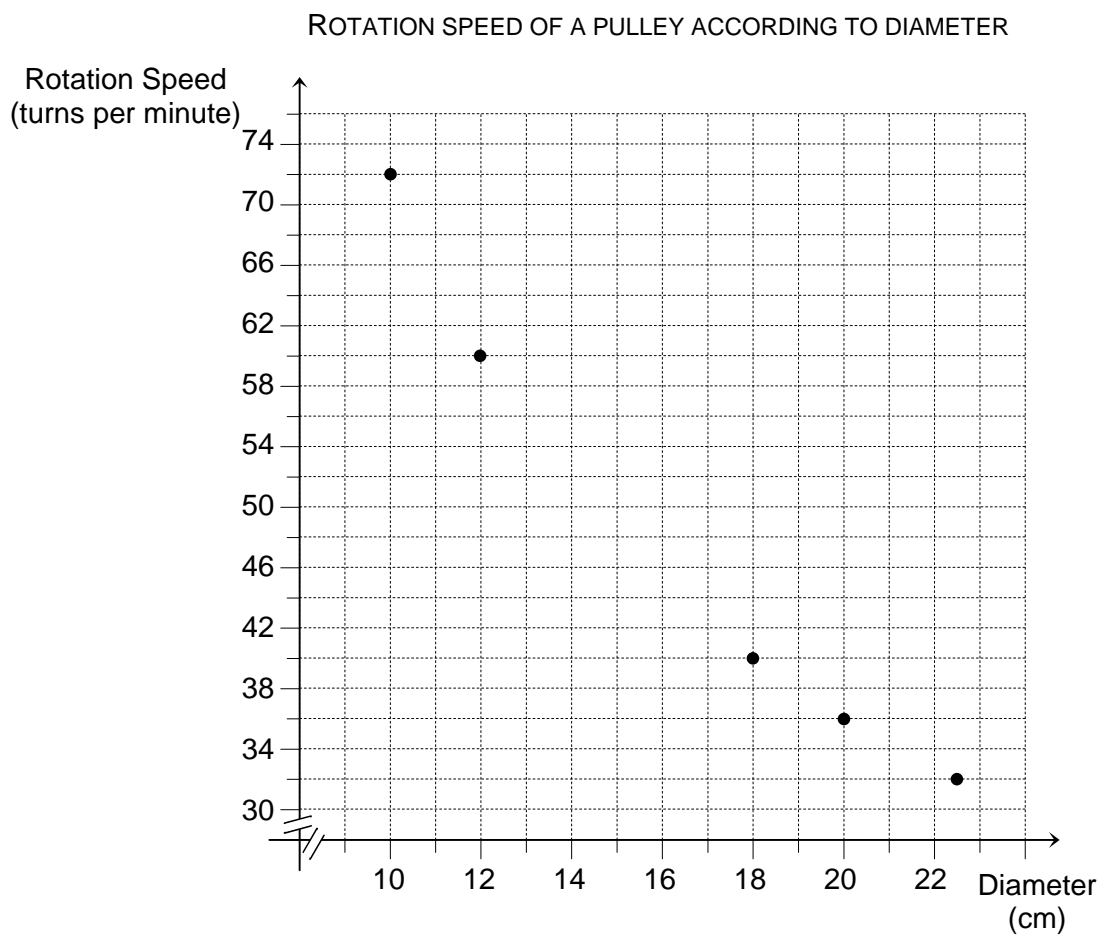
Uses mathematical reasoning	
Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 3	
Cr. 2	
Cr. 4	
Cr. 5	
Cr. 1	

6. PULLEYS



On a factory assembly line, two pulleys of different diameters are attached by a belt.

The rotation speed of a pulley depends on its diameter. The following graph shows the rotation speed according to diameter for 5 different pulleys.



What is the diameter of the pulley with a rotation speed of 90 turns per minute?

Show all your work

The pulley with a rotation speed of 90 turns per minute has a diameter of _____ cm.

For the scorer's use only

Uses mathematical reasoning	
Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 3	
Cr. 2	
Cr. 4	
Cr. 5	
Cr. 1	

7. CALENDAR DATES

Below are calendar pages for June, July and August 2009.

June 2009						
S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

July 2009						
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

August 2009						
S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

- ◆ Choose one of these months. On the calendar page for the month you have chosen, draw a square that includes 9 dates.
- ◆ Calculate the product of the first and ninth dates in the square.
- ◆ Calculate the product of the third and seventh dates in the square.
- ◆ Calculate the difference between these two products.

If your calculations are correct, the difference will be 28.

1st date		3rd date
7th date		9th date

Consider the grey square on the calendar page for August:

- ◆ Product of the first and ninth dates: $12 \times 28 = 336$
- ◆ Product of the third and seventh dates: $14 \times 26 = 364$
- ◆ Difference between the two products: $364 - 336 = 28$

12		14
26		28

If you repeat these operations with another square consisting of 9 dates, you will again obtain a difference of 28.

Show that the difference between the product of the 3rd and 7th dates and the product of the 1st and 9th dates is always equal to 28, regardless of the 1st date chosen in the square.

Show all your work

For the scorer's use only

Uses mathematical reasoning	
Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 3	
Cr. 2	
Cr. 4	
Cr. 5	
Cr. 1	

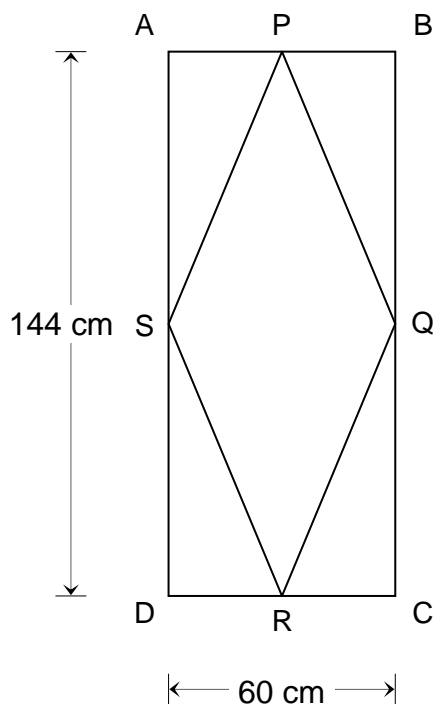
8. DIAMOND PATTERN

Marina wants to paint a window to look like stained glass. The window is rectangular and measures 144 cm by 60 cm. She has chosen to paint a diamond pattern on it.

Below are the steps for obtaining this pattern:

- ♦ Find the midpoint of each side of the window.
- ♦ Join the midpoints of consecutive sides by gluing down strips of imitation pewter.
- ♦ Paint each of the 5 resulting sections a different colour.

Rectangle ABCD below represents Marina's window. Points P, Q, R and S are the midpoints of the sides of rectangle ABCD.



The imitation pewter is sold in 2-m rolls. Each roll costs \$23.

How much will Marina have to spend to buy the imitation pewter she needs to create this diamond pattern?

Show all your work

Marina will have to spend \$_____ to buy the imitation pewter she needs to create this diamond pattern.

For the scorer's use only

Uses mathematical reasoning	
Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 3	
Cr. 2	
Cr. 4	
Cr. 5	
Cr. 1	

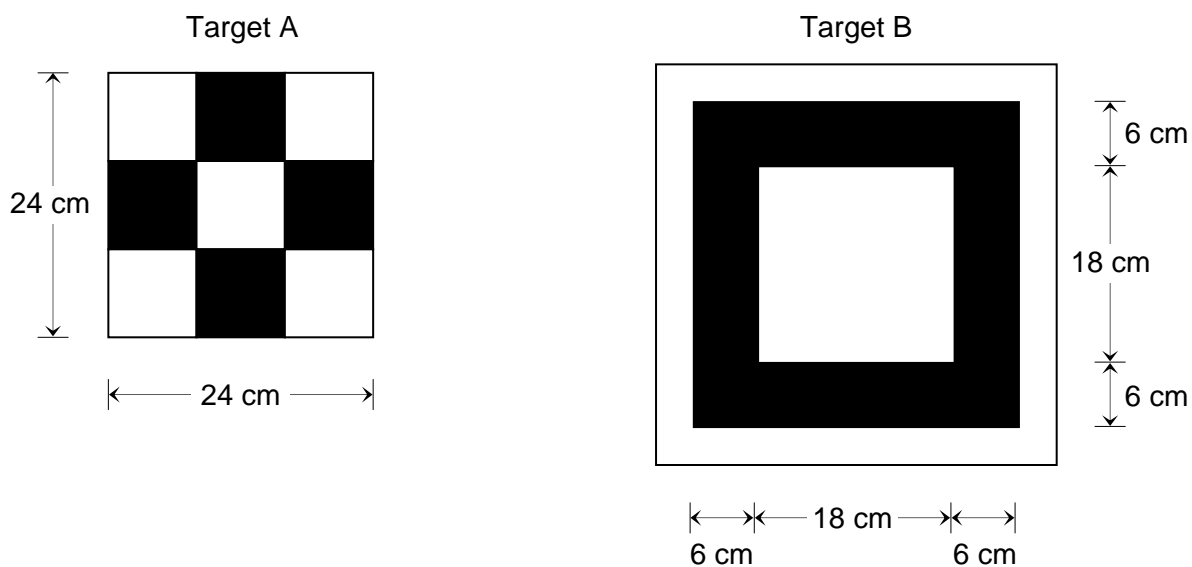
9. TWO TARGETS

A game of darts has two square targets.

Target A is divided into 9 congruent squares, 4 of which are black. The other squares are white. Each side of target A is 24 cm long.

The centre of target B is a white square with each side measuring 18 cm. This white square is surrounded by a black band that is 6 cm wide. The rest of the target is white.

The two targets are shown below.



If a dart is thrown at random, the probability that it will hit a black area is the same for both targets.

How long is each side of target B?

Show all your work

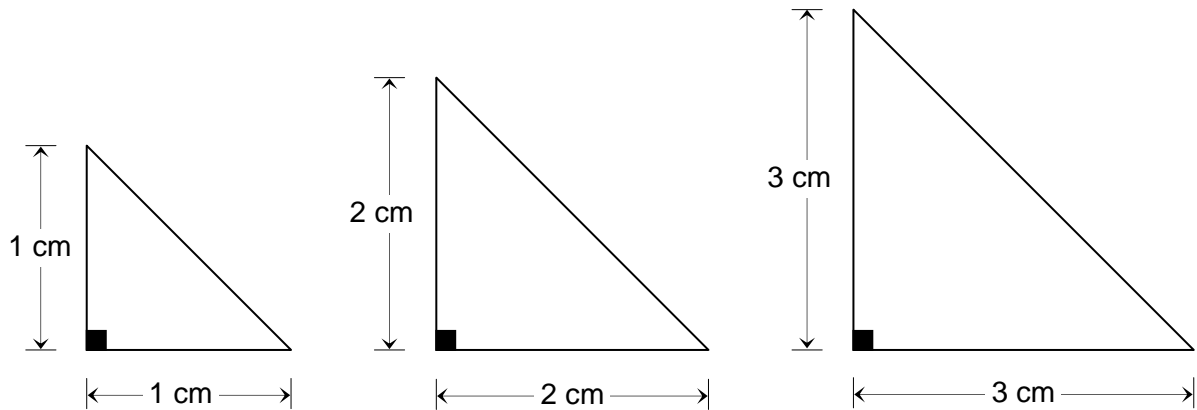
Each side of target B is _____ cm long.

For the scorer's use only

Uses mathematical reasoning	
Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 3	
Cr. 2	
Cr. 4	
Cr. 5	
Cr. 1	

10. ISOSCELES RIGHT TRIANGLES

Below are the first three triangles in a series of isosceles right triangles. The lengths of the sides of the right angles are whole numbers.



Formulate a conjecture describing the difference between the length of the hypotenuse of a triangle in this series and the length of the hypotenuse of the triangle that precedes it in the series.

Show all your work

Conjecture

For the scorer's use only

Uses mathematical reasoning	
Evaluation Criteria	Observable Indicators Corresponding to Level
Cr. 3	
Cr. 2	
Cr. 4	
Cr. 5	
Cr. 1	

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