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Alternative No:

Supervising Examiner's/  
Invigilator's initial:

**Mathematics**

**Writing Time: 3 hours**  
**Total Marks : 100**

**READ THE FOLLOWING DIRECTIONS CAREFULLY:**

1. **Do not** write for the first **fifteen minutes**. This time is to be spent reading the questions. After having read over the questions, you will be given **Three hours** to answer all questions.
2. Write your **index number** in the space provided on the **top right hand corner of this cover page only**.
3. In this paper, there are **three sections**: Section A, Section B and Section C. You are expected to answer **ALL** the questions in Section A and Section B. Under Section C, there are 8 questions (question numbers 14 -21). Each question has two parts, I and II. Attempt either I or II from each question. The intended marks for a question or its parts are stated in the brackets.
4. Read the directions to each question carefully and write **all** your answers in the space provided in the **question booklet** itself.
5. Remember to write **quickly** but **neatly**.
6. You are not allowed to remove any page from this booklet.
7. **Do not** leave the examination hall before you have made sure that you have answered all the required number of questions.
8. The use of calculator (fx-82/fx-100) without memory is allowed.

*For Chief Marker's and Markers' Use Only*

Section	A													B								C							
Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21								
Award																													
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**Section A (2 x 10 = 20 marks)**

*Answer ALL the questions*

**Question 1**

i) Identify the column matrix from the following matrices

**A**  $\begin{bmatrix} 2 & 3 & 4 \end{bmatrix}$

**B**  $\begin{bmatrix} 2 & 4 \\ 5 & 6 \end{bmatrix}$

**C**  $\begin{bmatrix} 5 & 6 \\ 2 & 4 \\ 3 & 1 \end{bmatrix}$

**D**  $\begin{bmatrix} 3 \\ 5 \\ 7 \end{bmatrix}$

ii) Which of the following radicals are equal?

**A**  $10\sqrt{3} = \sqrt{300}$

**B**  $2\sqrt{10} = \sqrt{200}$

**C**  $\sqrt{9}\sqrt{10} = \sqrt{180}$

**D**  $6\sqrt{5} = \sqrt{150}$

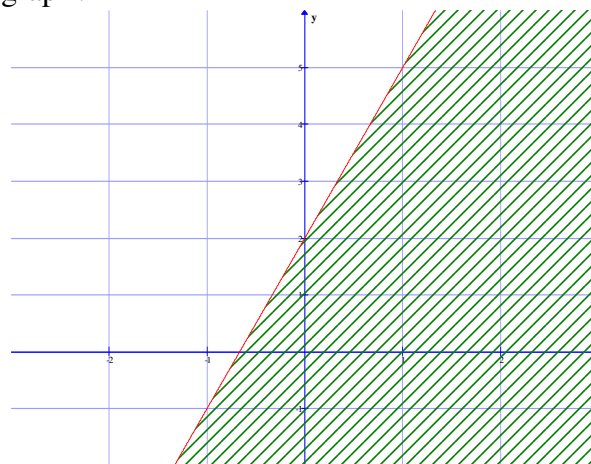
iii) What is the slope of the given graph?

**A**  $\frac{1}{3}$

**B** 4

**C** 3

**D**  $\frac{1}{4}$



iv) The significant figure of  $3.08 \times 10^3$  is

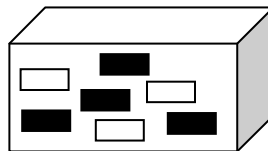
- A 3
- B 6
- C 2
- D 4

v) What is the equation in the form  $ax^2 + bx + c = 0$  that would match the roots 3 and 8?

- A  $x^2 - 11x + 24 = 0$
- B  $x^2 + 11x + 24 = 0$
- C  $x^2 + 11x - 24 = 0$
- D  $x^2 - 11x - 24 = 0$

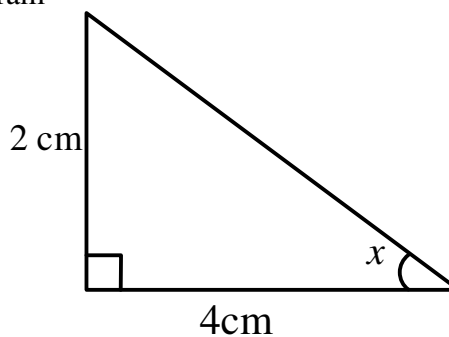
vi) What is the probability of drawing a white tile from the box on the second draw if the first trial drawn is black and you replace it.

- A  $\frac{1}{7}$
- B  $\frac{4}{7}$
- C  $\frac{3}{7}$
- D  $\frac{2}{7}$



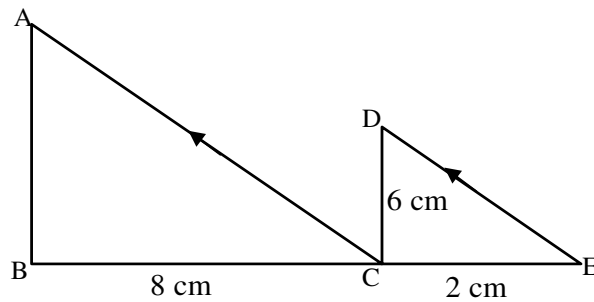
vii) Find the angle  $x$  in the given diagram

- A  $60^\circ$
- B  $62^\circ$
- C  $63^\circ$
- D  $30^\circ$



- viii) The number of the axes of rotation of a rectangular prism that is not a cube are
- A 2
  - B 3
  - C 5
  - D 8
- ix) What would be the final function if you translate 4 right and translate 3 up to the function  $f(x) = x^2$
- A  $f(x) = (x-4)^2 - 3$
  - B  $f(x) = (x+4)^2 - 3$
  - C  $f(x) = (x-4)^2 + 3$
  - D  $f(x) = (x+4)^2 + 3$
- x) The length of side AB in the given diagram is

- A 1.5 cm
- B 24 cm
- C 2.7 cm
- D 12 cm



**Section B ( 32 Marks)**  
*Answer ALL the questions*

**Question 2**

a) Number of buses plying between four towns are given below. Create a digraph to represent the information

- 2 buses from Thimphu to Paro
- 2 buses from Thimphu to Punakha
- 6 buses from Thimphu to Phuentsholing
- 1 bus from Phuentsholing to Paro
- 1 bus from Phuentsholing to Punakha
- 1 bus from Paro to Punakha

[2]

b) Create an adjacency matrix for the digraph above.

[1]

**Question 3**

- a) Karma wants to pay off a loan of Nu 20,000. Which is the better option for him to pay off the loan?

**Option A:** Pay off the loan at the end of one year at an interest rate of 14% p.a compounded monthly.

**Option B:** Pay off Nu 23,000 at the end of one year.

[2]

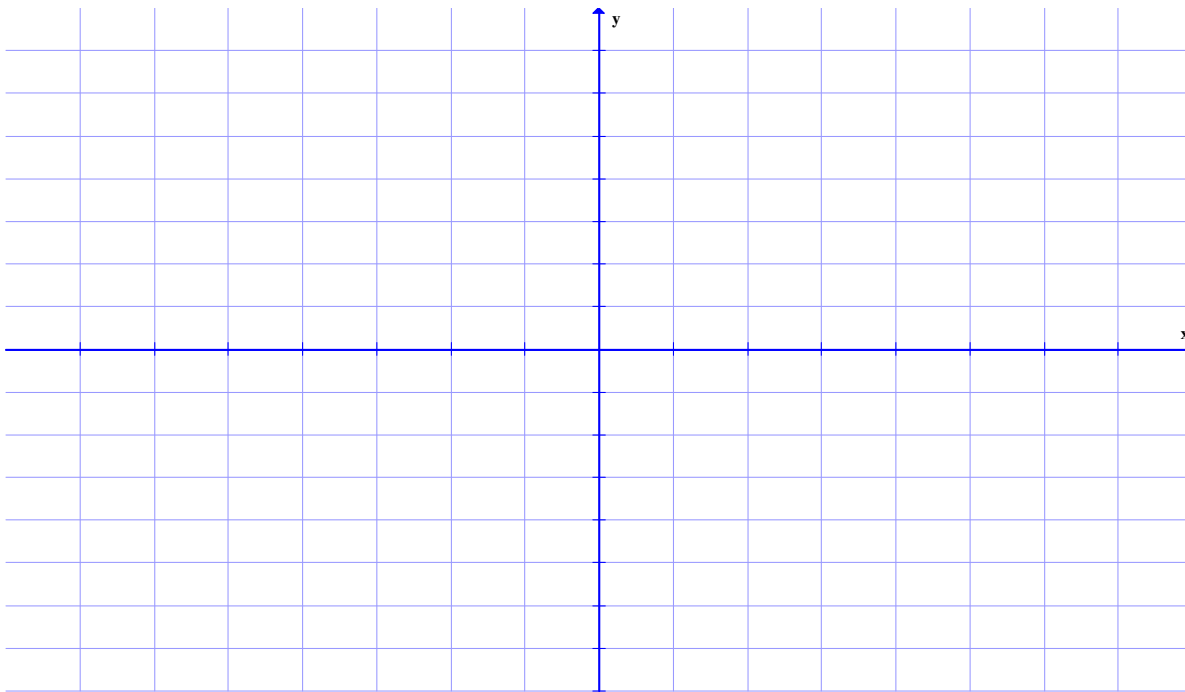
- b) Calculate the value of  $y$  in the equation  $\sqrt{36a^y} \times \sqrt{48} = 24a^7 \sqrt{3a}$

[2]

**Question 4**

Sketch the graph of  $y > -\frac{2}{3}x - 1$

[2]





**Question 5**

a) Complete the following table for  $f(x) = 25 - 7x$

[1]

$x$	$f(x) = 25 - 7x$
2	
1	
0	
-1	
-2	

b) i) Does the table of values above represent a function? Explain.

[1]

ii) How can you tell if a graph represents a function?

[1]

**Question 6**

a) Write the number that has two zeros and four significant figures. [1]

b) Write a number that has six digits but only one significant figure. [1]

c) Write a number that has three significant figures. [1]

**Question 7**

The length of a table is 3 cm longer than its width. Area of the table is  $54 \text{ cm}^2$ . Calculate the dimensions of the table? [2]

**Question 8**

Write the geometric transformation in and the order that should be applied to  $f(x) = x^2$  to result in each of the following functions. [3]

a)  $f(x) = x^2 - 30$

b)  $f(x) = 3(2 - x)^2$

c)  $f(x) = 2x^2 - 30$

**Question 9**

In the following table, 220 students in Thimphu were surveyed about the number of times they watch television each week. Estimate the five point summary. [3]

x	f(x)
10-15	2
15-20	12
20-25	23
25-30	97
30-35	40
35-40	38
40-45	8

**Question 10**

The following box and whisker plots represent the masses of three different varieties of apples grown in Bhutan. A sample of 80 apples was used for each. Answer the questions that follow. [3]



a) Which sample has a close to normal distribution? Explain.

b) Which sample is skewed? Explain.

**Question 11**

Dema wants to use a ladder to climb the wall and it is safest when it forms an angle of  $50^\circ$  to  $70^\circ$  with the ground. If she uses a 9 m ladder, what are the minimum and maximum distances she should place it from the wall?

[2]

**Question 12**

The perimeter of a regular octagon is 64 cm. What is its area?

[2]

**Question 13**

Construct the in-circle of  $\triangle ABC$ , where  $AB = 4.7\text{ cm}$ ,  $BC = 6.6\text{ cm}$  and  $AC = 7.5\text{ cm}$

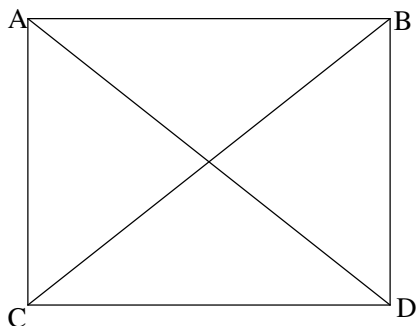
[2]

**Section C (6 x 8 = 48 Marks)**

*Attempt either I or II from each question.*

**Question 14 (I)**

- a) The digraph given below represents the football tournament played among four teams. Studying the digraph answer the questions that follow.

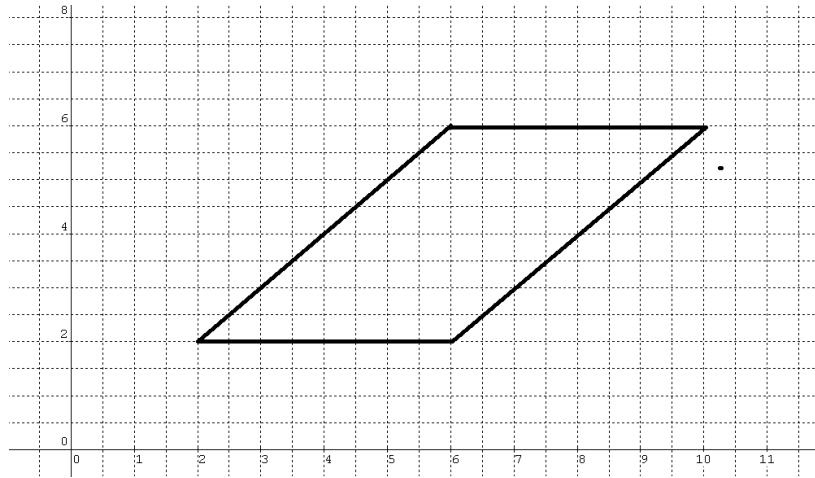


i) Create adjacency matrix.

ii) Square the above matrix and find the resultant matrix.

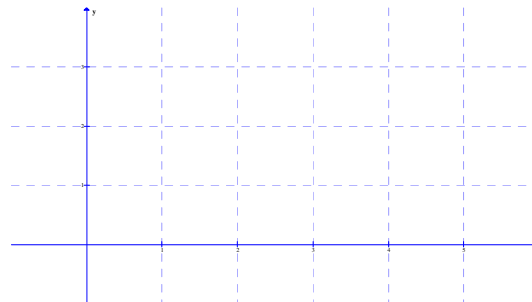
[ 1 ½ ]

b) i) Multiply the matrix of the coordinates for the following shape by  $\frac{1}{2}$ .



ii) Describe the resulting shape.

[2]





OR

**Question 14(II)**a) If  $Z = \begin{bmatrix} 4 & 1 \\ -1 & 2 \end{bmatrix}$ , then find

i) Dimension of the matrix Z. [1]

ii) The value of  $6z - z^2$  [2]

b) Kelden Dorji multiplied two of the matrices given below and resulted in a product matrix. [3]

$$X = \begin{bmatrix} 1 & 2 & 1 & 0 \\ 3 & 0 & 2 & 3 \end{bmatrix}$$

$$Y = \begin{bmatrix} 0 \\ -5 \end{bmatrix}$$

$$Z = \begin{bmatrix} 1 \\ -3 \\ 5 \\ -6 \end{bmatrix}$$

i) Which matrix is the product matrix?

- ii) Which two matrices are multiplied?
  
- iii) Create a matrix that can be multiplied with the product matrix.

**Question 15(I)**

- a) A pair of leather shoes costs Nu 600 and it is to be sold at Nu 750. Find the percent markup. [3]

- b) The Bhutan National Bank advertises a lending rate of 8% p.a compounded quarterly. What is the equivalent rate compounded annually?

**OR**

**Question 15 (II)**

- a) Miss Lhamo purchased 300 shares of Nu 100 at Nu 150 from Druk Punjab Bank. The bank declares a dividend of 12% by the end of the year. Calculate: [3]
- i) The money invested by Miss Lhamo to buy shares.

ii) Miss Lhamo's annual dividend.

iii) Miss Lhamo's percent of return on the investment.

b) Determine which expression is greater.

[3]

i)  $12\sqrt{3}$  or  $\sqrt{400}$

ii)  $\sqrt{15} + \sqrt{4}$  or  $\sqrt{11} + \sqrt{8}$

**Question 16(I)**

a) Pema deposited Nu 1000 in Nu 10 and Nu 20 notes in the Bank of Bhutan.

i) Write an equation to model this situation. [1]

ii) Write a function that tells the number of Nu 10 notes if you know the number of Nu 20 notes. [1]

iii) Youden says  $y = 3$  is not a function. Is she right? Justify your answer. [1]

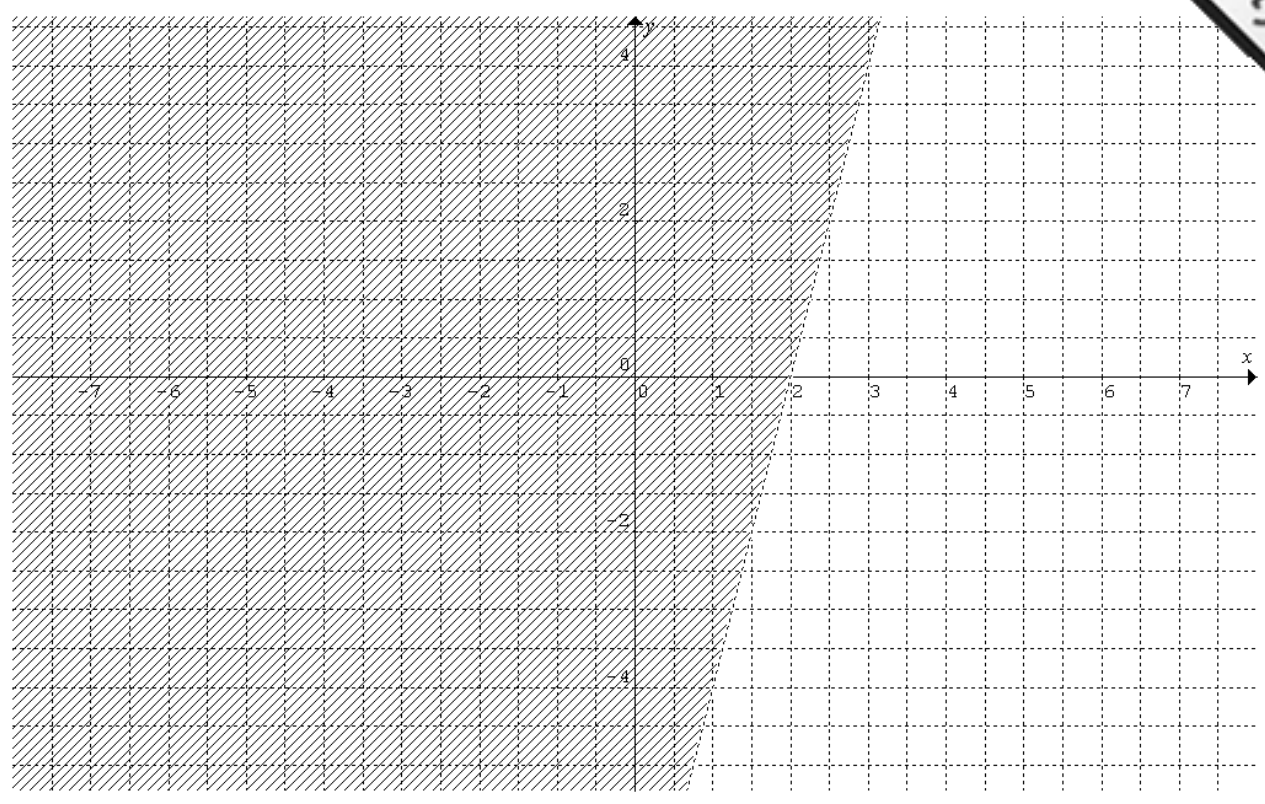
- b) Sangay sold some pens to the students. They bought some pens for Nu 10 and some pens for Nu 12. All together they have spent Nu 186 and bought 17 pens. How many pens of each type did they buy? [3]

OR

**Question 16(II)**

- a) Determine the point of intersection of this system of linear equation  $\frac{3}{4}x - \frac{2}{3}y = 3$  and  $\frac{1}{2}x - \frac{1}{2}y = 3$  [3]

b) Write an inequality for the graph given below



**Question 17 (I)**

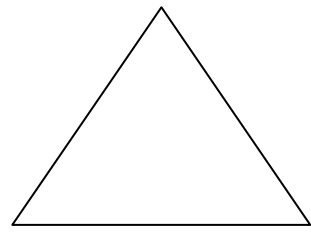
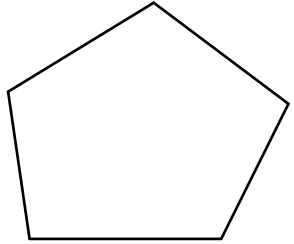
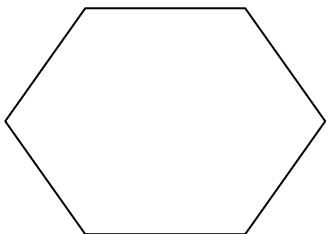
a) i) Calculate the total surface area of a cylinder with a diameter of 12 cm and height of 6 cm.

ii) Calculate the radius of a sphere which has the same total surface area as that of the cylinder above.

[1 ½]



i) The regular polygons given below have same perimeter. Predict which polygon has the greatest area? Explain. [ 1 ]



ii) Which polygon is the most efficient? Explain. [ 1 ½ ]

OR

**Question 17(II)**

a) i) Norbu says his weight is 80 kg. Choki claims to weigh 77 kg. Can Choki conclude that she is lighter than Norbu? [1]

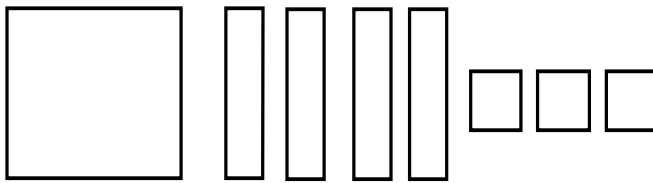
ii) Sonam measured a side of a table to be 56 cm when he used centimeter ruler. If he had a centimeter ruler and a millimeter ruler that measures to 10 cm and 10 mm, what might he have found the respective lengths to be? [2]

- b) It costs Nu 30 to fill a cubic container of sweets measuring 10 cm along each edge. Determine the cost of filling a spherical container of sweets with same surface area?

**Question 18(I)**

a) i) Write the polynomial represented by the algebra tiles below.

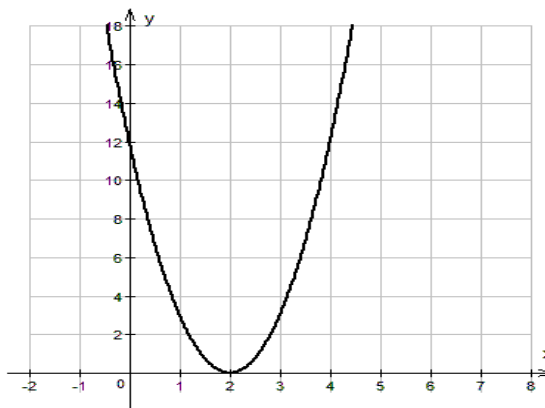
[1]



ii) Sketch what these tiles would look like if they are rearranged in a rectangle and determine the factors of the polynomial.

[2]

b) Determine the equation of the parabola.



OR

**Question 18(II)**

a) Determine the zeros and co-ordinates of the vertex of the function

$$f(x) = (x - 4)(x + 3)$$

[3]

- b) The hypotenuse of a right triangle is 1 m longer than the leg. The other leg is 7 m shorter than the longer leg. Determine the lengths of the three sides of the triangle.

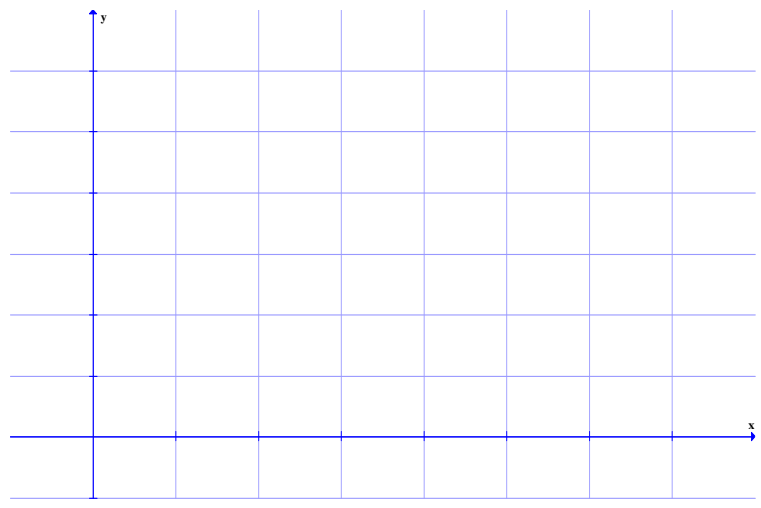
**Question 19 (I)**

- a) Karma tossed a coin and then rolled a die.
- i) What is the probability of getting a Khorlo and an even number? [1]
  
  - ii) What is the probability of getting Tashi-Ta-Gye and an odd number? [1]
  
  - iii) Are the events in part (i) and (ii) independent? Explain. [1]

b) The data below represent the life span of cell phone batteries tested in the laboratory.

Life span of battery (minutes)	Frequency
260 - 270	2
270 - 280	3
280 - 290	5
290 - 300	7
300 - 310	5
310 - 320	4

i) Create a histogram and a frequency polygon. [2]

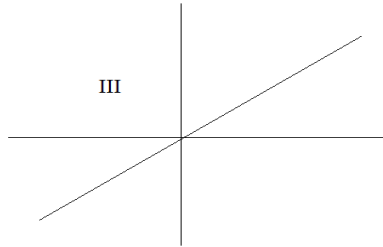
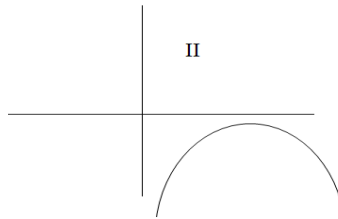
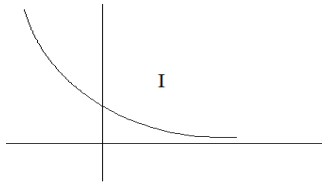


ii) Describe the shape of the frequency polygon and identify the distribution. [1]



b) Identify the relationship from the following graphs.

[3]



I

II

III



**Question 20 (I)**

a) Tashi walked 6 km at a bearing of  $140^\circ$  and 8 km at a bearing of  $45^\circ$ .

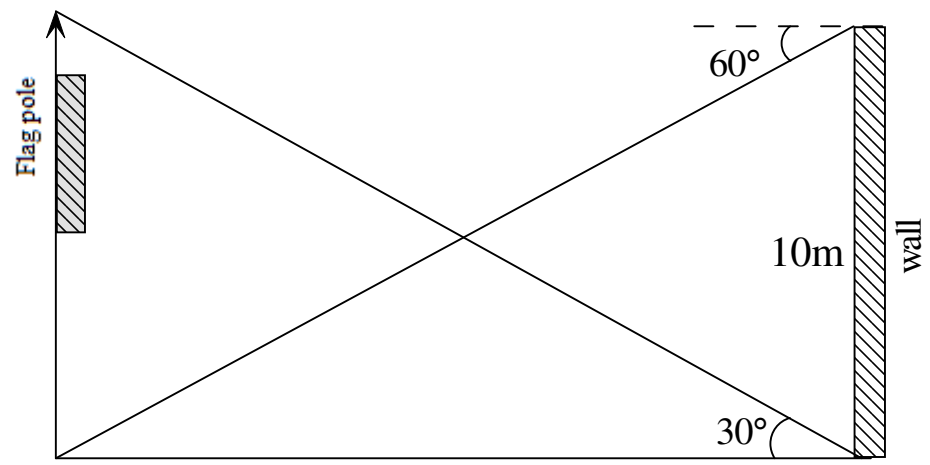
i) Represent his two part trip as a single vector.

[1]

ii) What is the bearing distance?

[2]

b) Study the diagram given below.



Find:

i) The distance between the wall and the flag pole. [1 ½]

ii) The height of the flag pole. [1 ½]

OR

**Question 20 (II)**

a) In a right triangle  $\sin x = \frac{4}{5}$ , calculate the following trigonometric ratios. [4]

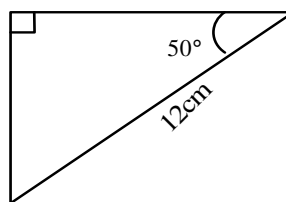
i)  $\cos x$

ii)  $\operatorname{cosec} x$

iii)  $\cot x$

iv)  $\sec x$

b) Calculate the area of the given triangle.



[2]

**Question 21 (I)**

a) Construct  $\triangle ABC$  and its altitude from A.  $AB = 7.4$  cm,  $BC = 8.9$  cm, and  $AC = 5.3$  cm. Determine the area of the triangle.

[3]

b) Give reasons why a median divides a triangle into equal triangles having equal area. [3]

**OR**

**Question 21 (II)**

a) i) Name the quadrilateral which has only its diagonals as its lines of symmetry. [1]

ii) Draw lines of symmetry of an equilateral triangle. [1]

b) i) Draw two shapes one with two planes of symmetry and the other with four lines of symmetry. [2]

ii) Draw two 2-D shapes one with turn symmetry of order 2 and other with order 4 that is not a square. [2]

# Rough Work

# Rough Work