SECTION A [40 MARKS]

ANSWER **ALL** QUESTIONS

Question 1 **[40]**

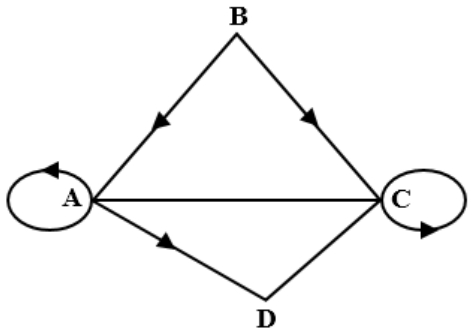
Direction: For each question, there are four alternatives: A, B, C and D. Choose the correct alternative and circle it. DO NOT circle more than ONE alternative. If there are more than ONE choice circled, NO score will be awarded.

i) If $M = 2^a \times 3^6 \times 5^9$, what value of '*a*' would make M a perfect cube?

A 3
B 4
C 7
D 8

ii) The number of one-stopover trips from A to C is

A 2.
B 3.
C 4.
D 5.



iii) Sherab bought 50 shares with the face value of Nu 500 but was selling at Nu 525. He earned a dividend amount of Nu 4,800. What is the rate of dividend?

A 18.6%
B 18.8%
C 19.0%
D 19.2%

iv) What is the value of $\sin 45° \csc 45° + \sec 30° \tan 60° + \cos 30° \cot 60°$?

A $\frac{3}{2}$
B $\frac{5}{2}$
C $\frac{7}{2}$
D $\frac{9}{2}$

v) The function $f(x) = -(x-1)^2 + 4$ is equivalent to

A $g(x) = x^2 + 2x + 5$.

B $h(x) = x^2 + 2x + 3$.

C $i(x) = -x^2 + 2x + 5$.

D $j(x) = -x^2 + 2x + 3$.

vi) The relation $y = 5 + 2x$ is a function because

A for every ***x*** value, there is a different ***y*** value.
B for every ***y*** value, there is a different ***x*** value.
C ***y*** can be expressed in terms of ***x***.
D ***x*** can be expressed in terms of ***y***.

vii) The point of intersection of the system: $y = 2x - 1$ and $y = 3x + 2$ is

A $(-7, -3)$.

B $(-3, -7)$.

C $(3, 11)$.

D $(11, 3)$.

viii) Seldon currently sells about 48 small baskets a month for Nu 60 each. She predicts that for every increase of Nu 15 per basket, she will sell three fewer baskets. Determine the best price that will result in maximum total sales.

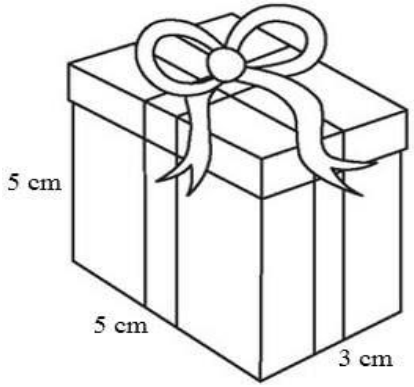
A Nu 30
B Nu 90
C Nu 150
D Nu 210

ix) A ladder is leaning against a water tank. The top of the ladder is 10 m up the water tank. The ladder is 5 m longer than the distance from the bottom of the tank to the bottom of the ladder. Find the distance from the bottom of the tank to the bottom of the ladder?

A 7.5 m
B 7.6 m
C 7.7 m
D 7.8 m

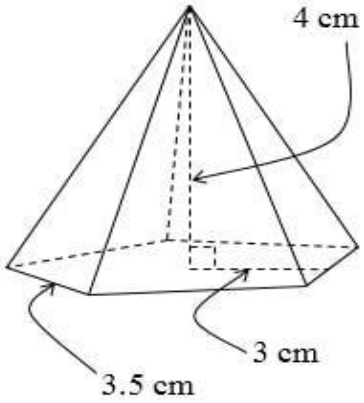
x) Yuden wants to wrap this gift box. The amount of wrapping paper required is

A $75\ cm^2$.
B $110\ cm^2$.
C $115\ cm^2$.
D $120\ cm^2$.



xi) Calculate the volume of this regular pentagon-based pyramid.

A $140\ cm^3$
B $105\ cm^3$
C $70\ cm^3$
D $35\ cm^3$



xii) A rectangular prism box has a total surface area of $294\ cm^2$. What is the maximum capacity the box can hold?

A $337\ cm^3$
B $340\ cm^3$
C $343\ cm^3$
D $346\ cm^3$

xiii) If $\cot A = \frac{4}{3}$ and A lies in quadrant III, the value of cosA is

A $-\frac{3}{4}$.
B $\frac{3}{4}$.
C $-\frac{4}{5}$.
D $\frac{4}{5}$.

xiv) These four cylindrical barrels have a capacity of 50 L with the following diameters and heights.

Barrels	Diameters(cm)	Heights(cm)
I	30	70.7
II	40	39.8
III	50	25.5
IV	60	17.7

Which is the most efficient barrel?

A I
B II
C III
D IV

xv) To celebrate his birthday, Dochen placed an order for a special cake that is in the shape of a regular hexagonal-based prism. In how many ways can he cut the cake into two congruent halves?

A 4
B 5
C 6
D 7

xvi) The line segment that connects a vertex to the opposite side at 90^0 in any triangle is called

A median.
B altitude.
C bisector.
D perpendicular.

xvii) Which of the following pair of events is independent?

A Rolling a 4 on a die in second roll, if the first roll was 6.
B Rolling a 2 on a die in the first roll and a sum of 5 in second roll.
C Drawing an ace in the second draw, if the first card drawn was a queen and not replaced.
D Drawing a black counter in the second draw, if the first counter drawn was black and not replaced.

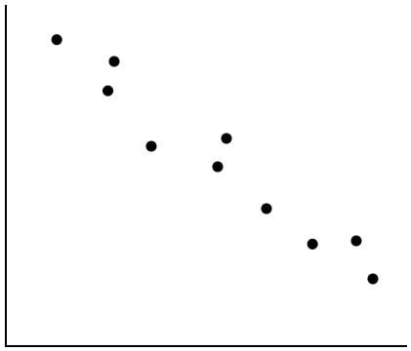
xviii) The table shows the heights of 30 students of grade X.

Heights(cm)	Frequency
120 – 130	2
130 – 140	5
140 – 150	10
150 – 160	9
160 - 170	4

What is the median height of the students?

A 141.0 cm
B 142.5 cm
C 148.5 cm
D 156.0 cm

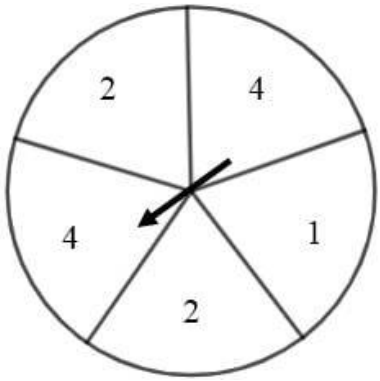
xix) The best correlation that describes the graph is



A weak positive correlation.
B weak negative correlation.
C strong positive correlation.
D strong negative correlation.

xx) Yeshey spun this spinner twice. The first spin was a 2, what is the probability of spinning a sum of 6 in the second spin?

A $\frac{4}{25}$
B $\frac{5}{25}$
C $\frac{6}{25}$
D $\frac{7}{25}$



SECTION B [60 MARKS]

ATTEMPT **ANY SIX** QUESTIONS

[Under this section, there are 8 questions (Question 2 – 9)]

Question 2

a) The table shows the number of buses travelling within three Dzongkhags.

Dzongkhags		Number of buses
From	**To**	
Thimphu	Paro	1
Thimphu	Wangdue	1
Paro	Thimphu	2
Paro	Wangdue	1
Wangdue	Thimphu	1
Wangdue	Paro	1

i. Create a digraph to represent the information. **[1]**

ii. Calculate one-stopover trips from Thimphu to Paro. **[2]**

b) Karma and Yuden went to a burger hub. Karma ordered 3 burgers and 3 slices of pizza amounting to Nu 420. Yuden ordered one more burger and one less slice of pizza than Karma which amounted to Nu 460. What is the cost of each type of fast food? **[4]**

c) The volume of a hemisphere is $2{,}175 cm^3$. Determine its radius. **[3]**

Question 3

a) Sonam took a vehicle loan of Nu 400,000 with a down payment of 40%. He agreed to pay Nu 6,500 monthly to pay off the loan with an interest rate of 9.5% p.a. compounded monthly. Find the balance at the end of the first month. **[3]**

b) For the function $f(x) = 2(x-2)(x+1)$, calculate the coordinates of the vertex. What does the coordinates of the vertex represent? **[2]**

c) Prove that:

i. $\frac{\cos\theta}{\sec\theta - \tan\theta} = 1 + \sin\theta$ **[3]**

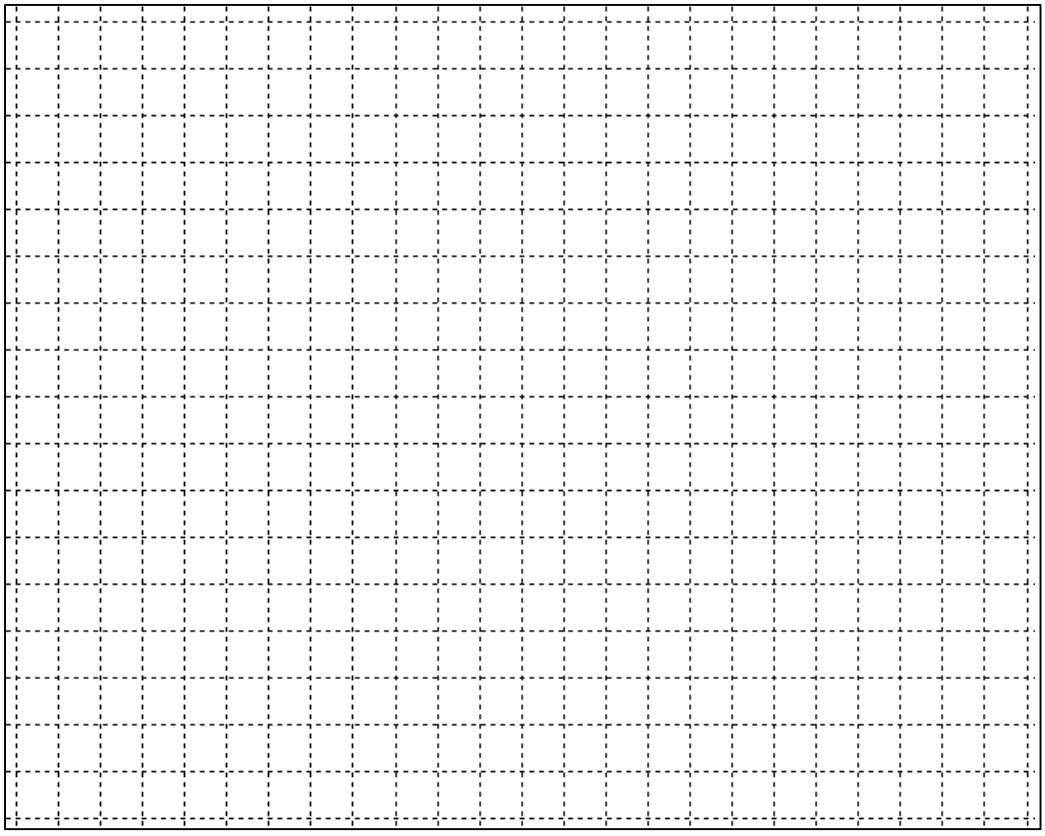
ii. $\frac{\sec^2\theta - 1}{\tan^2\theta} = 1$ **[2]**

Question 4

a) A movie rental company charges Nu 300 annual fee, then Nu 50 for each movie you rent.

i. Write an equation to model the situation. **[1]**

ii. Sketch the graph. **[2]**

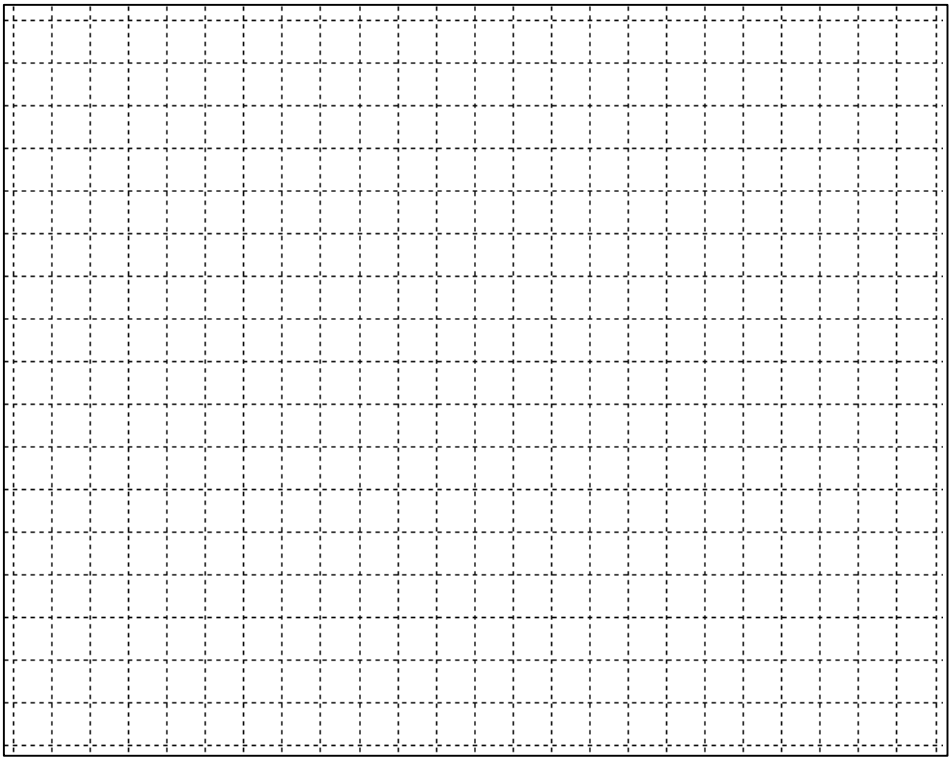


iii. What is the cost if you have rented 25 movies in a year? **[1]**

b) The table shows the number of goals scored by Lionel Messi (National player of Argentina) in the last 10 years.

Year	Number of goals
2010	60
2011	73
2012	60
2013	41
2014	58
2015	41
2016	54
2017	45
2018	51
2019	50

i. Create a scatter plot for the data. **[3]**



ii. Is the line of best fit appropriate? Explain. **[2]**

iii. Write the correlation coefficient. **[1]**

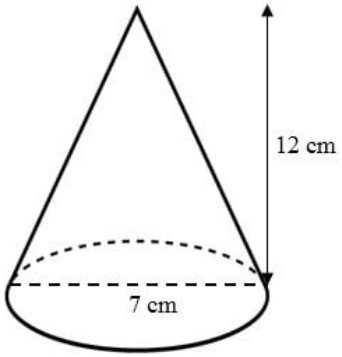
Question 5

a) For the function $f(x) = -\frac{2}{3}(x+3)^2 - 2$:

i. write the value of dilation factor, horizontal and vertical translation. **[3]**

ii. write the function in mapping notation. **[1]**

b) Calculate the surface area of the given shape. **[2]**

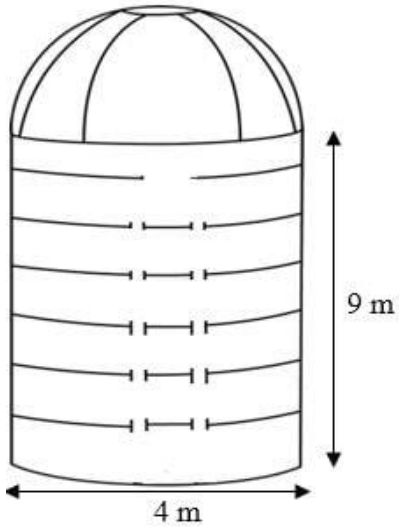


c) Pelzang is using cloth to cover a rectangular prism box. The box has a volume of 8 m^3 and the cloth costs Nu 40 per m^2. What is the least it could cost to cover the box? **[2]**

d) A box contains yellow and green counters. Two counters are pulled out one at a time without replacing the first one. The probability of selecting a yellow counter first is 0.8. The probability of selecting a yellow and then a green is 40%. What is the probability of selecting a green counter if a yellow is selected first? **[2]**

Question 6

a) Sharmila wants to paint the exterior of this silo.
How many square metres of paint does she require? **[3]**



b)

i. Order the following from the greatest to the least. **[2]**

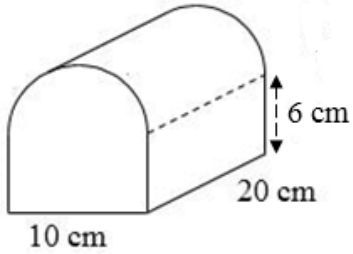
$4\sqrt{5}$, $5\sqrt{3}$, $3\sqrt{7}$, $3\sqrt{11}$, $6\sqrt{2}$

ii. Find the missing value of $\sqrt{48} - \sqrt{a} = -4\sqrt{3}$. **[3]**

c) Solve $x^2 - 5x + 6 = 0$. What do the values of x tell you? **[2]**

Question 7

a) Norbu bakery manufactures a bread of this shape.



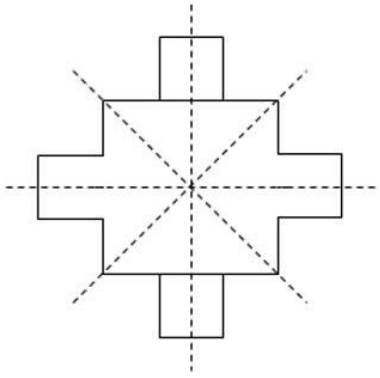
Calculate the volume of the bread. **[3]**

b) Construct a square of 5 cm and then construct a circle that passes through the vertices of the square. Make a conclusion based on your construction. **[5]**

c) Matrix $A = \begin{bmatrix} 2 & 0 & -1 \\ -4 & 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} -3 & 2 & 0 \\ 1 & -1 & 4 \end{bmatrix}$, calculate $A - 3B$. **[2]**

Question 8

a) Rinzin was made to draw the lines of symmetry for a shape. He came up with this figure.



Did Rinzin draw the correct number of lines of symmetry? Justify. **[3]**

b) The table shows the points scored by Pampu in the last 21 basketball games. **[3]**

Stem	Leaves
0	7 7 8 9
1	0 1 2 3 4 5 6 8 8 8
2	0 1 2 2 5
3	1 4

Create a histogram and identify the type of distribution.

c) An eraser manufacturing company produces erasers in the shape of a cube with side length 5 cm. How many such erasers can be packed in a box with a volume of 6,250 cm^3? **[2]**

d) Create the following types of matrices:

i. a 3×2 matrix with -3 at (1, 2) **[1]**

ii. a 2×2 identity matrix **[1]**

Question 9

a) The data shows the scores obtained by 30 students in a mathematics test.

30	35	24	39	42	17
18	38	49	41	26	18
42	18	35	26	25	12
21	31	30	42	27	47
24	16	33	45	37	44

Construct a box and whisker plot for the data. Determine the mode of the data. **[4]**

b) Two square based prisms have a total surface area of 120 cm^2 each with the following bases:

- Prism I: 3 cm by 3 cm
- Prism II: 4 cm by 4 cm

Which prism will be more efficient? Show your work. **[3]**

c) Complete the table. **[3]**

Function	**Coordinates of the vertex**	**Mapping notation**
$f(x) = -\frac{1}{2}x^2 - 3$	----------	----------
----------	----------	$(x, y) \rightarrow (x+4, -y-3)$
----------	(3, 0)	----------

FORMULAE

Strand A : Numbers and Operations

$\text{Discount\%} = \frac{\text{discount}}{\text{MP}} \times 100\%$ $\quad$ $\text{Discount} = MP - SP$

$\text{Markup} = \text{MP} - \text{CP}$ $\quad$ $\text{Markup\%} = \frac{\text{markup}}{\text{CP}} \times 100\%$

$\text{SI} = \text{prt} \ or \ \frac{PRT}{100}$ $\quad$ $\text{A} = p\left(1 + \frac{r}{n}\right)^{nt} \ or \ p\left(1 + \frac{r}{n \times 100}\right)^{nt}$

$\text{DA} = fv \times r \times n$ $\quad$ $\text{Yield\%} = \frac{DA}{OI} \times 100\%$

Strand B : Patterns and Algebra

$f(x) = ax^2 + bx + c$

$f(x) = a(x - p)(x - q)$

$f(x) = a(x - h)^2 + v$

Strand C : Measurement

Volume:

$V_{\text{rectangular prism}} = \text{lwh}$ $\quad$ $V_{\text{cube}} = \text{e}^3$

$V_{\text{any prism}} = \text{Ah}$ $\quad$ $V_{\text{pyramid}} = \frac{\text{Ah}}{3}$

$V_{\text{cylinder}} = \pi \text{r}^2\text{h}$ $\quad$ $V_{\text{cone}} = \frac{\pi \text{r}^2\text{h}}{3}$

$V_{\text{sphere}} = \frac{4}{3}\pi \text{r}^3$

Surface Area:

$SA_{\text{rectangular prism}} = 2(\text{lw} + \text{wh} + \text{lh})$ $\quad$ $SA_{\text{cube}} = 6\text{s}^2$

$SA_{\text{any prism}} = 2\text{A} + \text{hP}$ $\quad$ $SA_{\text{pyramid}} = \text{A} + \text{Area of lateral faces}$

$SA_{\text{cylinder}} = 2\pi \text{r}^2 + 2\pi \text{rh}$ $\quad$ $SA_{\text{cone}} = \pi \text{r}^2 + \pi \text{rs}$

$SA_{\text{sphere}} = 4\pi \text{r}^2$

Strand E : Data management and probability

$\text{Mean} = \frac{\sum fx}{\sum f}$ $\quad$ $Q_1 = L + \frac{i}{f}\left(\frac{n}{4} - c\right)$

$Q_2 = L + \frac{i}{f}\left(\frac{n}{2} - c\right)$ $\quad$ $Q_3 = L + \frac{i}{f}\left(\frac{3n}{4} - c\right)$

Rough Work

Rough Work

Rough Work

Rough Work