Faculty of Information and Communication Technology
ICT First Years and Foundation Unit

Tshwane University of Technology
We empower people

Sick Test
MEMO
Computational Mathematics and Discrete Mathematics
(Extended) (Year 1)

COHF05D & DSMF06D

I declare that I am familiar with, and will abide to the Examination rules of Tshwane University of Technology

_____

Signature

26 October 2022 Duration: 120 min Total: 100 Full Marks: 95 Number of Pages: 22	Examiner: MS Sediela Moderator: C Coetzee	
	Number on Class List	
	GROUP	

Student Number

Surname	Initials

Instructions:

All questions must be answers on the question paper.

Only blue and black pens are allowed. Answers in pencil will not be marked.

Scientific, non-programmable calculators are allowed.

Cellular Phones are not allowed.

No sharing of calculators and/or stationery.

Round decimal answers to 2 decimal places**.**

Simplify fraction answers.

Show all calculations when requested.

Question 1: Show your calculations. [14]

1.1 A factory produces soccer balls. The balls are packed in containers of 15 balls each. If they manufacture 2300 balls per day **(Make use of floor, ceiling or mod):** (2)

1.1.1 How many full container can they dispatch at the end of the day? (1)

Solution:

$$2300 \backslash 15 = 153\ full\ containers$$ ✓

1.1.2 How many balls will be left after the full containers are dispatched? (1)

Solution:

$$2300\ mod\ 15 = 5\ balls$$ ✓

1.2 Two wires are 12 m and 15 m long. The wires are to be cut of pieces of equal length. What is the maximum length that the wires can be cut? (2)

Solution:

2	12
2	6
3	3
	1

½

3	15
5	5
	1

½

$$HCF = 3\ cm$$ ✓

1.3	During the Easter holiday, Tumelo and James collected information about the number of cars that passed through Pumulani Toll Plaza heading to Limpopo from 13:00 to 14:00. They have observed that the type of cars that passed through were SUVs, Sedans, and Vans. They have recorded that a total of 2500 cars passed though during their observation. One-fourth $(\frac{1}{4})$ of the total number of cars were SUVs, and three-fifths $(\frac{3}{5})$ of the remaining number of cars were Sedans, and the rest were Vans. **Answer the following questions:**	(6)

1.3.1	What fraction of the cars were Sedans? **Solution:** $1 - \frac{1}{4}$ ✓ $\frac{3}{4}\ remaining$ ✓ $Sedans\ fraction: \frac{3}{4} \times \frac{3}{5}$ ✓ $Sedans\ fraction: \frac{9}{20}$ ✓	(4)
1.3.2	What fraction of the cars were Vans? **Solution:** $Vans\ fraction: \frac{3}{4} - \frac{9}{20}$ ½ $Vans\ fraction: \frac{15}{20} - \frac{9}{20}$ ½ $Vans\ fraction: \frac{6}{20}$ ½ $Vans\ fraction: \frac{3}{10}$ ½	(2)

1.4	A bag of oranges used to cost R30.00. The price was increased to R45.00. What is the percentage with which the price of the oranges has been increased? **Solution:** $$\boldsymbol{Percentage\ Increase} = \frac{45-30}{30} \times 100$$ ✓ $$\boldsymbol{Percentage\ Increase} = 50\%$$ ✓	(2)
1.5	At the TUT mail department, one employee can put 200 certificates into envelopes in three hours. How long would it take if the department employs 6 employees to put 200 certificates into envelopes, working at the same pace? **Solution:** $$\boldsymbol{employees : hours}$$ $$1 : 3$$ $$6 : x$$ $$\frac{1}{6} = \frac{x}{3}$$ $$6x = 3$$ ✓ $$x = \frac{1}{2}\ hours\ or\ 0.5\ hours$$ ✓	(2)

Space for rough work:

Question 2: Show your calculations. [10]

2.1	$\boldsymbol{Solve\ for\ x}$: $$4x^3 + 16x^2 - 48x = 0$$ **Solution:** $$4x(x^2 + 4x - 12) = 0 \quad ½$$ $$(x + 6)(x - 2) = 0 \quad ½$$ $$(x + 6) = 0\ or\ (x - 2) = 0 \quad ½$$ $$x = -6\ or\ x = 2 \quad ½$$	(2)
2.2	Simplify the following expression: $$\frac{3x^4 - 3}{x^2 - 6x + 5} \times \frac{x^2 - 3x - 10}{x^2 + 3x + 2} \div \frac{6x^2 + 6}{12x}$$ **Solution:** $$\frac{3(x^4-1)}{(x-1)(x-5)} \times \frac{(x-5)(x+2)}{(x+1)(x+2)} \times \frac{12x}{6(x^2+1)} \quad ✓✓$$ $$\frac{3(x-1)(x+1)(x^2+1)}{(x-1)(x-5)} \times \frac{(x-5)(x+2)}{(x+1)(x+2)} \times \frac{12x}{6(x^2+1)} \quad ✓$$ $$6x \quad ✓$$	(4)

2.3	Three years ago James was eleven times older than Patrick. Find James and Patrick current age if their combined age is now 30 years. Let x be Patrick's age 3 years ago. Fill in the below table:	(4)

	3 years ago	Now
James	$\mathbf{11x}$	$\mathbf{11x+3}$ ½
Patrick	$\boldsymbol{x}$	$\boldsymbol{x+3}$ ½

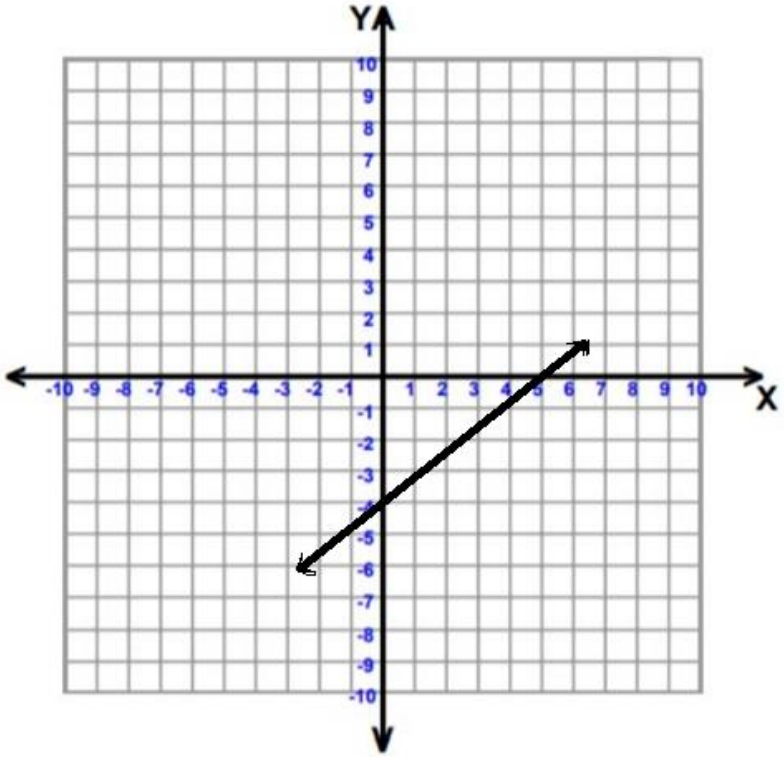
Find their ages.

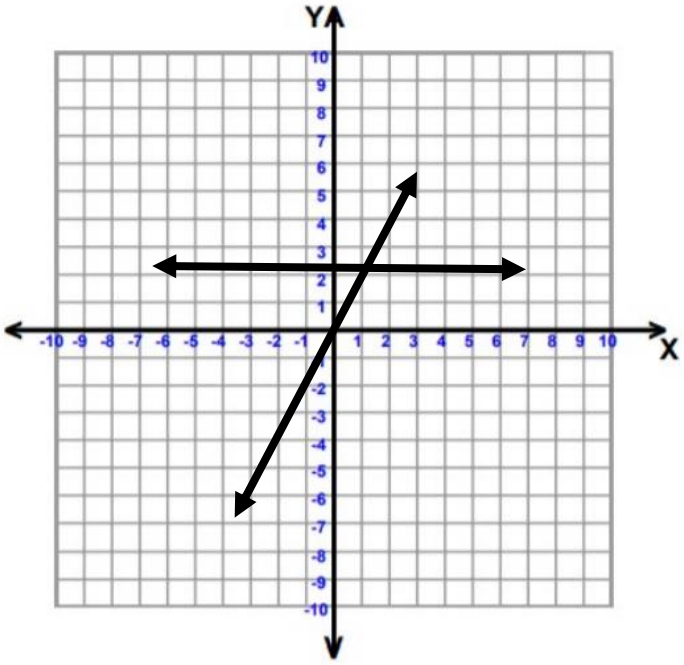
Solution:

$$\mathbf{11x+3+x+3=30} \quad \checkmark$$
$$\mathbf{12x+6=30}$$
$$\mathbf{12x=24}$$
$$\boldsymbol{x=2} \quad \checkmark$$

$$\boldsymbol{James = 11(2)+3 = 25\ years\ old} \quad ½$$
$$\boldsymbol{Patrick = 2+3 = 5\ years\ old} \quad ½$$

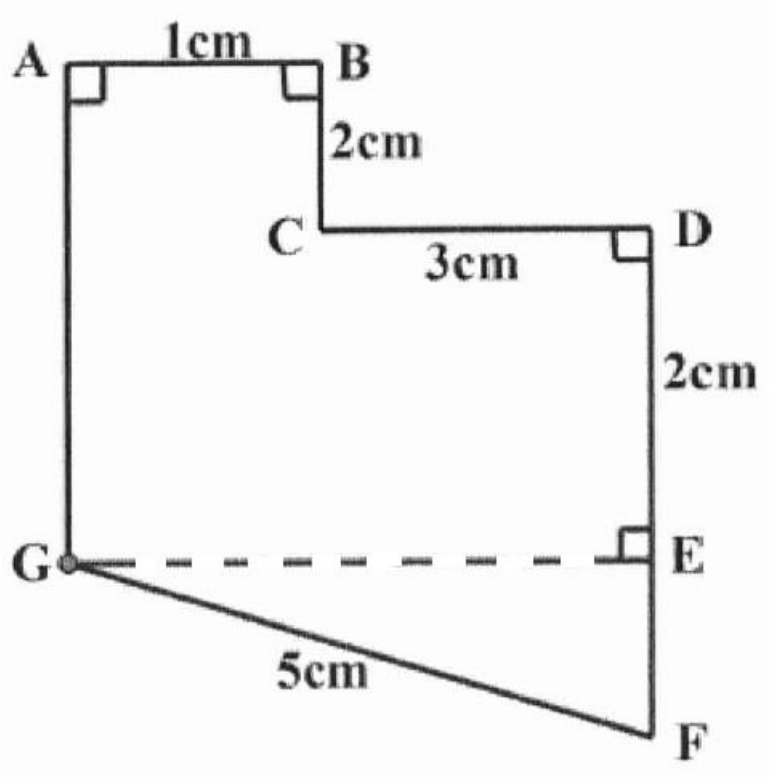
Question 3: Show your calculations. [8]

3.1	Determine the equation of a straight-line graph represented in the given cartesian plane:  **Solution:** $m = \frac{0-(-4)}{5-0}$ ✓ $m = \frac{4}{5}$ $c = -4$ ✓ $y = \frac{4}{5}x - 4$ ✓	(3)

3.2	Consider the following equation of line graphs: $$y = 4x - 2 \text{ and } y = -\frac{1}{4}x + 5$$ Without drawing these graphs, what is the significance about these graphs? **Answer:** **The two line are perpendicular to each other.** ✓	(1)
3.3	Solve the following lines simultaneously by drawing the straight-line graphs: Line 1: $y = 2x + 2$ *and*, Line 2: $y = 4$ ✓✓  **X = 1** ✓ **Y = 4** ✓	(4)

Question 4: Show your calculations. [11]

4.1 Given the following diagram: (6)



(12)

4.1.1 Calculate the length of EF. (3)

Solution:

$$EG = 1 + 3 = 4\ cm$$ ✓

$$FG^2 = EG^2 + EF^2$$

$$5^2 = 4^2 + EF^2$$ ✓

$$25 = 16 + EF^2$$

$$EF^2 = 9$$

$$EF = 3\ cm$$ ✓

		4.1.2	Calculate the Area of the shape. **Solution:** $Area = (1 \times 2) + (4 \times 2) + \frac{1}{2}(4 \times 3)$ ✓✓ $Area = 2 + 8 + 6$ $Area = 16\ cm^2$ ✓	(3)		

Space for rough work:

4.2	Lethabo wants to replace the paving bricks on her driveway. The size of the driveway is 7 meters by 10 meters. The new bricks are 10 cm by 20 cm. Answer the following:	(5)

4.2.1	How many brick does she need to cover the driveway? **Solution:** $Area\ of\ driveway = 7 \times 10 = 70\ m^2$ ✓ $1\ brick = 10\ cm \times 20\ cm$ $1\ brick = 0.1 \times 0.2$ $1\ brick = 0.02\ m^2$ ✓ $no.of\ bricks = 70 \div 0.02 = 3500\ bricks$ ✓	(3)
4.2.2	The bricks are sold in batches of 1000. You are not allowed to buy parts of batches. How many batches must she buy to pave the driveway? **Solution:** $\mathbf{3500 \div 1000 = 3.5 \approx 4\ batches}$ ✓✓	(2)

Question 5: Show your calculations. [12]

5.1 State whether the following are true or false: (2)

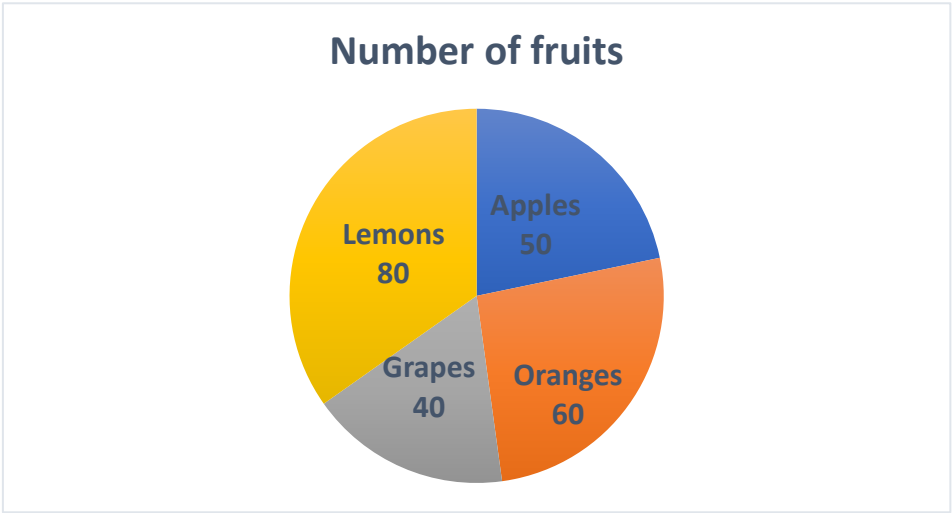
	Question	True	False
5.1.1	The entire group of interest for a statistical conclusion, is called a population	X ½	
5.1.2	When using probability sampling, the sample is selected based on the subjective judgement of the researcher.		X ½
5.1.3	Interviewing is a data collection method.	X ½	
5.1.4	When using non-probabilistic sampling, everyone in the population has an equal chance of getting selected.		X ½

5.2 Mr Ramabu is the head for the Studython and has been monitoring the attendance for the past 10 days. Below is the data that he collected about the number of leaners who attended the Studython: (6)

123, 150, 150, 153, 155, 161, 164, 166, 176, 176

5.2.1	Which data collection method was used for this study? **Observation** ✓	(1)
5.2.2	What is the mode of the data set? **150 and 176** ✓	(1)

	5.2.3	Calculate the average number of learners who attended the Studython. **Solution:** $$average = \frac{123+\cdots+176}{10}$$ ½ $$average = \frac{1574}{10}$$ $$average = 157.4$$ ½ $$average \approx 158$$	(1)	
	5.2.4	If the standard deviation is 14.60, between which number of leaners do 95% of the data set occur? **Solution:** $$158 + (2 \times 14.6) = 187.2 \approx 188$$ ✓ $$158 - (2 \times 14.6) = 128.8 \approx 129$$ ✓	(2)	

	5.2.5	What type of graph is the most suitable to represent the data? **Histogram** ✓	(1)	
5.3	Given the following graph: 			(4)
	5.3.1	What kind of graph is this? **Pie Chart** ✓	(1)	
	5.3.2	Calculate and fill in the percentage and angle of each sector of the pie chart:	(2)	
	5.3.3	What other chart can be used to represent the data? **Bar Graph** ✓	(1)	

Level	**Percentage**	**Angle**
Lemons	$\frac{80}{230} \times 100$ 34.78% ½	$\frac{80}{230} \times 360$ 125.22 ½
Grapes	$\frac{40}{230} \times 100$ 17.39% ½	$\frac{40}{230} \times 360$ 62.61 ½

Question 6 [14]

6.1 (3)

Consider the following sets:

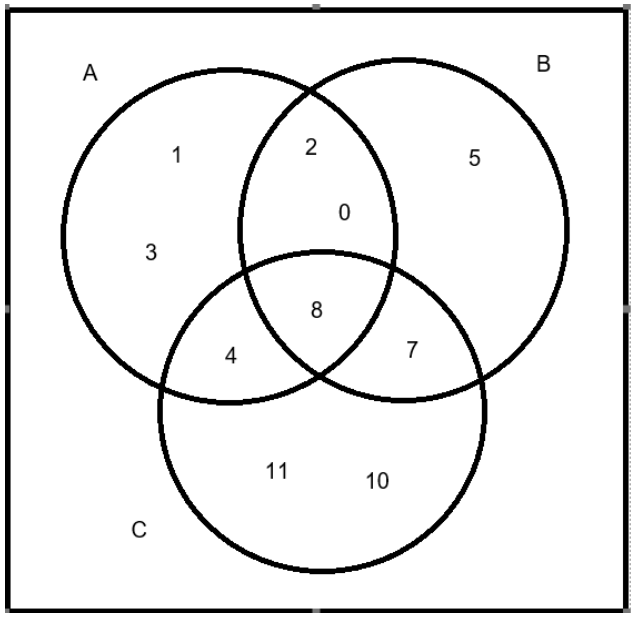
$$A = \{5, 6, 7\}, \quad B = \{1, 3, 6, 9\} \text{ and } C = \{2, 9\}.$$

List the following sets:

$A - B$	$\{5, 7\}$ ✓	(1)
$C \times A$	$\{2, 5\}, \{2, 6\}, \{2, 7\}, \{9, 5\}, \{9, 6\}, \{9, 7\}$ ✓	(1)
$A \Delta B$	$\{5, 7, 1, 3, 9\}$ ✓	(1)

6.2 (5)

Given the following Venn diagram:



List elements of the following sets:

	Question	Answer	
6.2.1	$A \cap B$	$\{0, 2, 8\}$	(1)
6.2.2	$(A \cap B) \cap C$	$\{8\}$	(1)
6.2.3	$(A \cup B) \cap C$	$\{4, 7, 8\}$	(1)
6.2.4	$C - (A \cup B)$	$\{10, 11\}$	(1)
6.2.5	$\overline{B} \cap A$	$\{1, 3, 4\}$	(1)

6.3 Given the following set: (6)

$$\boldsymbol{M = \{apple, orange, tomato\}}$$

Answer the following questions:

Question		Answer	
6.3.1	n(M)	**3**	(1)
6.3.2	n(P(M))=	**8**	(1)

Use a binary table to determine all possible subsets of set M. (4)

Decimal Numbers	Binary Numbers			Subsets
	Apple	Orange	Tomato	
0	0	0	0	{ }
1	0	0	1	{Tomato}
2	0	1	0	{Orange}
3	0	1	1	{Orange, Tomato}
4	1	0	0	{Apple}
5	1	0	1	{Apple, Tomato}
6	1	1	0	{Apple, Orange}
7	1	1	1	{Apple, Orange, Tomato}
½ per correct row				

Space for rough work:

Question 7: Show your calculations. [15]

7.1	Given the following argument: $\boldsymbol{Jan\ and\ Mary\ are\ both\ gone\ to\ the\ meeting, so\ you\ are\ going\ to\ give\ the\ class.}$ Identify the premise and the conclusion: **Premise:** $\boldsymbol{Jan\ and\ Mary\ are\ both\ gone\ to\ the\ meeting}$ ✓ **Conclusion:** $\boldsymbol{you\ are\ going\ to\ give\ the\ class.}$ ✓	(2)
7.2	*Let the propositions J and M be defined as:* $\boldsymbol{J}$: $\boldsymbol{Jan\ work\ at\ night.}$ $\boldsymbol{M}$: $\boldsymbol{Mary\ work\ at\ night.}$	(5)

7.2.1	Translate the symbolic form $\sim \boldsymbol{J} \vee \boldsymbol{M}$ in words: **Solution:** $\boldsymbol{Jan\ did\ not\ work\ at\ night\ or\ Mary\ work\ at\ night}$ ✓✓	(2)
7.2.2	Translate the following sentence in a well-formed symbolic form: $\boldsymbol{Both\ Jan\ and\ Mary\ do\ not\ work\ at\ night.}$ **Solution:** $\sim \boldsymbol{J} \wedge \sim \boldsymbol{M}$ ✓✓	(2)

	7.2.3	Given the following conditional statement: $M \longrightarrow J$ Write the inverse and the contrapositive of the given conditional statement: Inverse: $\sim M \longrightarrow \sim J$ ½ Contrapositive: $\sim J \longrightarrow \sim M$ ½	(1)	
7.3		Identify the main operator in the following: $\sim(A \leftrightarrow \sim(B \vee C))$ — Main Operator: $\sim$ ✓ $A \wedge B \vee \sim C$ — Main Operator: $\vee$ ✓		(2)
7.4		Complete the truth table below to determine if the following statement is a tautology, a contradiction or contingency. $P \longrightarrow R \leftrightarrow \sim R \longrightarrow \sim P$		(6)

P	R	$\sim P$	$\sim R$	$P \longrightarrow R$	$\sim R \longrightarrow \sim P$	$P \longrightarrow R \leftrightarrow \sim R \longrightarrow \sim P$
T	T	**F**	**F**	**T**	**T**	**T**
T	F	**F**	**T**	**F**	**F**	**T**
F	T	**T**	**F**	**T**	**T**	**T**
F	F	**T**	**T**	**T**	**T**	**T**
Marks:		**(1)**	**(1)**	**(1)**	**(1)**	**(1)**

The statement is a Tautology **(1)**

Question 8: Show your calculations. [16]

8.1 Given the number $\mathbf{7EB_{16}}$: (4)

8.1.1 Convert to Binary: (2)

7				E				B			
0	1	1	1	1	1	1	0	1	0	1	1

$$\mathbf{7EB_{16} = 11111101011_2}$$ ✓✓

8.1.2 Convert to Octal: (2)

0	1	1	1	1	1	1	0	1	0	1	1
3			7			5			3		

$$\mathbf{7EB_{16} = 3753_8}$$ ✓✓

8.2	Find **+25$_{10}$** and **-25$_{10}$** in sign and size code representation using 6 bits. **Solution:** $+25_{10} = 011001_2$ ✓ $-25_{10} = 111001_2$ ✓	(3)
8.3	Find the product of **1001$_2$** and **100$_2$** **Solution:** 1001 x 100 0000 ✓ +0000 00000 ✓ +1001 100100$_2$ ✓	(3)

	Rem
2 | 25	1
2 | 12	0
2 | 6	0
2 | 3	1
2 | 1	1
0	

8.4	Calculate the following by making use of the 2's complement: $$\mathbf{01000010_2 - 00010001_2}$$ **Solution:** $$\mathbf{01000010_2 + K_2(\,00010001_2)}$$ ✓ $\boldsymbol{K_2}$ $\quad(\,\mathbf{00010001_2})$ $\boldsymbol{Compliment}$: $\quad\mathbf{11101110_2}$ ✓ $\boldsymbol{Add\ 1}$: $\quad\mathbf{00000001_2}$ ✓ $\mathbf{11101111_2}$ ✓ $\mathbf{01000010_2}$ $\mathbf{+11101111_2}$ $\mathbf{100110001_2}$ $(\boldsymbol{discard\ 9th\ bit})$ ✓ $\mathbf{01000010_2 - 00010001_2 = 00110001_2}$ ✓	(6)

Space for rough work: