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

Tshwane University of Technology
We empower people

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

Signature

Semester Test 1

Computational Mathematics and Discrete Mathematics (Extended) (Year 1)

COHF05D & DSMF06D

MEMO

15 May 2023

Duration: 120 min
Total: 74
Full Marks: 70
Number of Pages: 14

Examiner: MS Sediela

Moderator: C Coetzee

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.

All exponents must be positive in final answers.

Show all calculations when requested.

Question 1: Indicate if the following are true or false. [1 x 10]

	Questions	True	False
1.1	The natural number one is a prime number.		X
1.2	Pi (π) value is rational number.		X
1.3	The first factor of a given number is 1, and the last factor is the number itself.	X	
1.4	Nominal numbers can be used in arithmetic calculations.		X
1.5	$\sqrt{-4}$ is neither rational nor irrational number and it is a real number.	X	
1.6	The place value of the digit 5 in the following number is thousandths. $\mathbf{1623.2456}$	X	
1.7	$\boldsymbol{b} \times \frac{\mathbf{1}}{\boldsymbol{b}} = \mathbf{1}$ represents the multiplicative inverse property.	X	
1.8	Parallel lines are two non-intersecting lines.	X	
1.9	If line A is perpendicular to line B, and line C is perpendicular to line B, then line A is perpendicular to line C.		X
1.10	The gradient of a vertical line is undefined.	X	

Space for rough work.

Question 2: Fill in the final answer only. [13]

	Questions	Answer	
2.1	Calculate the sum of all the odd prime numbers less than 11.	15 ✓	(1)
2.2	What is the Greatest Common Denominator (GCD) of $\frac{3}{5x}$ and $\frac{6}{2x^2y}$?	$10x^2y$ ✓	(1)
2.3	Convert to scientific notation: 0.00256	2.56×10^{-3} ✓	(1)
2.4	Increase 250 in a ratio $2:5$.	625 ✓	(1)
2.5	How many terms are in the following expression: $5x^2 - 6y^2 \div 2x + y^3$	3 ✓	(1)
2.6	After spending $\frac{2}{3}$ of her pocket money on clothes and $\frac{1}{4}$ on sweets, Thaleni had **R69.45** left. How much did she have originally?	R833.40 ✓✓	(2)
2.7	If the price of fuel increased from **R21.50** to **R22.20**, what was the percentage increase.	3.26 % ✓✓	(2)
2.8	A two-fifth $(\frac{2}{5})$ of John's password is 3950.4, what is John's password?	9876 ✓✓	(2)
2.9	A class has **18** boys and **30** girls. If **6** other boys join the class, determine how many girls would be needed to keep the ratio of the number of boys to the number of girls the same.	40 girls ✓✓	(2)

Space for rough work:

Question 3: Show your calculations. [18]

3.1	Students are going to a sports event. The university sponsors 5 buses and 5 taxis. According to law, each bus may only transport 63 and each taxi 16 students. 470 students indicated they want to go to the event. Will they need more buses or more taxis? If so, how many more of each? *No overloading is allowed!* **Solution:** $5 \times 63 + 5 \times 16 = 395\ students$ ✓ $470 - 395 = 75\ students$ ✓ $\left\lceil \frac{75}{63} \right\rceil = 1\ additional\ bus$ ✓ $75\ mod\ 63 = 12$ ✓ $\left\lceil \frac{12}{16} \right\rceil = 1\ additional\ taxi$ ✓ $or\ (give\ marks\ for\ this)$ $\left\lceil \frac{75}{16} \right\rceil = 5\ additional\ bus$	5 5
3.2	Two neon lights are switched on at the same time. One flashes every 60 seconds and the other one every 140 seconds. After how many seconds will they flash together again? **Solution:** 2 | 60 2 | 30 3 | 15 5 | 5 1 ✓ 2 | 140 2 | 70 5 | 35 7 | 7 1 ✓ $60 = 2^2 \times 3 \times 5$ ✓ $140 = 2^2 \times 5 \times 7$ ✓ $LCM = 2^2 \times 3 \times 5 \times 7 = 420\ seconds$ ✓	(3)

3.3	Lerato is a final year student in Computer Science. She is also a tutor for ICT first years and foundation unit. She has **40** hours per week, and it is spent on the time she attends her final year classes, her tutoring job time, and her study time. She spent one-third of the total time attending her final year classes, and one-third of the remaining time on her tutoring job and the rest on her study time. **Answer the following questions:**	(6)

3.3.1	What fraction of the hours did Lerato spent on her tutoring job? **Solution:** $1-\frac{1}{3}$ $\frac{2}{3}\ remaining$ ✓ $Tutoring\ job\ fraction: \frac{2}{3}\times\frac{1}{3}$ ✓ $Tutoring\ job\ fraction: \frac{2}{9}$ ✓	**(3)**
3.3.2	What fraction of the hours did Lerato spent on her study time? **Solution:** $Study\ time\ fraction: \frac{2}{3}-\frac{2}{9}$ ✓ $Study\ time\ fraction: \frac{6}{9}-\frac{2}{9}$ ✓ $Study\ time\ fraction: \frac{4}{9}$ ✓	**(2)**
3.3.3	How many hours were spent on her final year classes? **Solution:** $\frac{1}{3}\times 40 = 13.33\ hours$ ✓	**(1)**

3.4	Thato made a **10%** profit by selling a book to Lesedi for **R1560**. Lesedi sold the same book to Omphile at a profit of **16.5%**. Calculate Thato's cost price and Omphile's cost price. **Solution:** $$Thato's\ cost\ price = \frac{1560}{1+0.1}$$ $$R1418.18$$ $$Omphile's\ cost\ price = 1560 * 1.165$$ $$Omphile's\ cost\ price = R1817.40$$	(2)
3.5	In Tom's bakery, one employee makes **40** pies in one hour. How long will it take if Tom hired six people to make 40 pies? **Solution:** $$\begin{matrix} employees : hours \\ 1 : 1 \\ 6 : x \end{matrix}$$ $$x = \frac{1}{6}\ hours$$	(2)
Space for rough work:		

Question 4: Show your calculations. [21]

4.1	**Factorise:** $8(a+b)^2 - 50c^2$ **Solution:** $2(4(a+b)^2 - 25c^2)$ ✓ $2(2(a+b) - 5c)(2(a+b) + 5c)$ ✓ ✓	(3)
4.2	**Solve for x:** $5x^2 + 15x + 10 = 0$ **Solution:** $5(x^2 + 3x + 2) = 0$ ✓ $x^2 + 3x + 2 = 0$ $(x+2)(x+1) = 0$ ✓ $x + 2 = 0 \ or \ x + 1 = 0$ $x = -2 \ or \ x = -1$ ✓	(3)
4.3	**Solve for x:** $3^{\frac{x}{3}} + 7 = 34$ (Please note: On the left of the equation the **power of 3 is** $\frac{x}{3}$) **Solution:** $3^{\frac{x}{3}} = 34 - 7$ $3^{\frac{x}{3}} = 27$ ✓ $3^{\frac{x}{3}} = 3^3$ ✓ $\frac{x}{3} = 3$ $x = 9$ ✓	(3)

4.4	Simplify the following expression: $\frac{6x^2y}{4y^3z} \times \frac{4z}{6x^3} - \frac{1}{2xy}$ **Solution:** $= \frac{1}{xy^2} - \frac{1}{2xy}$ $= \frac{1}{xy^2} \times \frac{2}{2} - \frac{1}{2xy} \times \frac{y}{y}$ $= \frac{2}{2xy^2} - \frac{y}{2xy^2}$ $= \frac{2-y}{2xy^2}$	(4)

4.5	The length of a rectangle is **3 m** longer than the breadth. If the length is increased by **3 m** and the breadth is decreased by **2 m**, the area remains unaltered. Calculate the breadth of the rectangle. **Solution:** $let\ x\ be\ the\ breath$ ✓ $length = x + 3$ ✓ $x(x+3) = (x-2)(x+6)$ ✓ $x^2 + 3x = x^2 + 6x - 2x - 12$ ✓ $-x = -12$ $x = 12\ m$ ✓	(4)

4.6	The ages of two brothers differ by **20** years. If **5** years ago, the elder one be **5** times as old as the younger one, their present ages (in years) are respectively?	(4)

Let the younger brother be x years old

Fill in the table below:

	Now	5 years ago (-5 years)
Younger	x	$x-5$
Elder	$x+20$	$x+15$

Write the equation and solve:

$$x+15=5(x-5)$$

$$x+15=5x-25$$

$$-4x=-40$$

$$x=10$$

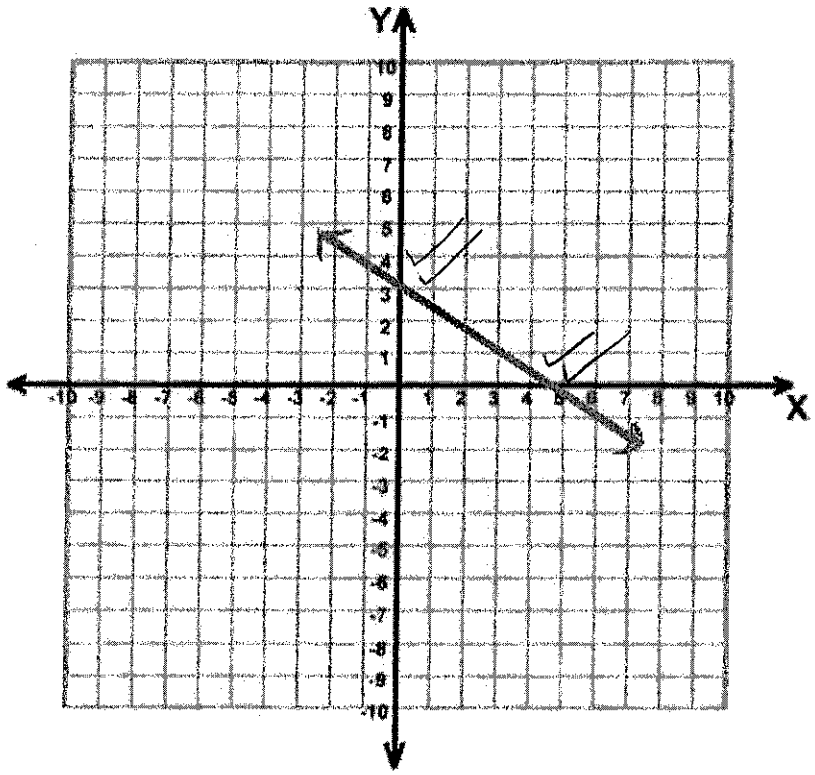
The younger brother is 10 years old

The elder brother is 30 years old

Question 5: Show your calculations. [12]

5.1 Draw a straight-line graph for a line that has a gradient of $m = -\frac{2}{3}$ and y-intercept of $c = 3$. (4)

Your straight-line must intercept both the x and y axes.



5.2 Determine the equation of a straight-line graph given the following table that show relationship between the x-value and the y-value: (2)

x	-2	-1	0	1	2
y	9	5	1	-3	-7

Solution:

$$y = -4x + 1$$

5.3	Find the value of k if the following straight lines are perpendicular: $2y + kx = 4$ and $y = 4x - 2$ **Solution:** $$2y + kx = 4$$ $$y = -\frac{kx}{2} + 2$$ $$\textit{The product of perpendicular lines is} -1$$ $$-\frac{k}{2} \times 4 = -1$$ $$-2k = -1$$ $$k = \frac{1}{2}$$	(3)
5.4	What is the gradient of the line joining the two points **(3, 3)** and **(-1, -5)**? **Solution:** $$gradient = \frac{3 - (-5)}{3 - (-1)}$$ $$gradient = \frac{3 + 5}{3 + 1}$$ $$gradient = \frac{8}{4}$$ $$gradient = \frac{2}{1}$$	(3)

Space for rough work

Space for rough work