

FINAL EXAM
FMTH005: PURE MATHEMATICS
Fall-T2 2024 – 25

Points of attention:

- For each question, the maximum earned points are specified in the question.
- Write clearly! Answers that are not readable are not marked and don't earn marks!
- All answers should be written in English using **blue or black pens** only.
- Use the pencil only for diagrams and graphs.
- Show all the calculation steps in the given space.
- When finished, submit and sign the question paper to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration: 2 hours
Instructor's Name: Muhammad Kazam
Exam Date: 09/02/2025
Program: FND

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Student Information

Name: ID:
Signature:

Invigilator

Initials: ☐ Student ID checked
Time received:

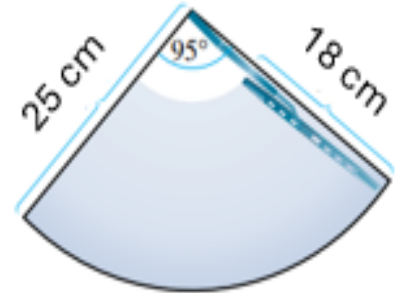
Question 1.**[10 Marks]****Circle the correct option to fill in the blanks.****Example.** 85 is a _____ digit number.

- a. 1 **b. 2** c. 3 d. 4

- The domain of the function $f(x) = \frac{x}{x^2-1}$ is _____.
 a. $\mathbb{R}$ b. $\{x|x \neq 1\}$ c. $\{x|x \neq -1\}$ d. $\{x|x \neq \pm 1\}$
- A central angle subtended by an arc of length 5 m in a circle of radius 3 m is _____.
 a. 1.56° b. 1.56 rad c. 95.5° d. 95.5 rad
- $\cos^2\theta(1 + \tan^2\theta) =$ _____.
 a. $\cot x$ b. $\tan x$ c. $\cos x$ d. 1
- If two dice are rolled once, then the number of elements in the sample space is _____.
 a. 2 b. 4 c. 6 d. 36
- The median of the data 60, 74, 60, 62, 68, 68, 79, 62 is _____.
 a. 60 b. 62 c. 65 d. 60, 62 and 68
- The range of the data 45, 32, 37, 46, 39, 36, 41, 48, 36 is _____.
 a. 16 b. 39 c. 46 d. 48
- $f(x) = 2e^x$ is a _____ function.
 a. linear b. quadratic c. logarithmic d. exponential
- $f(x) = ax^2 + bx + c$ has a maximum value if _____.
 a. $a < 0$ b. $a > 0$ c. $a = 0$ d. $a \neq 0$
- $a^{\log_a x} =$ _____.
 a. 0 b. a c. x d. $\log_a x$
- If $2^{3x-2} = 1$, then $x =$ _____.
 a. 0 b. 1 c. -1 d. $\frac{2}{3}$

Question 2.**[4 Marks]**

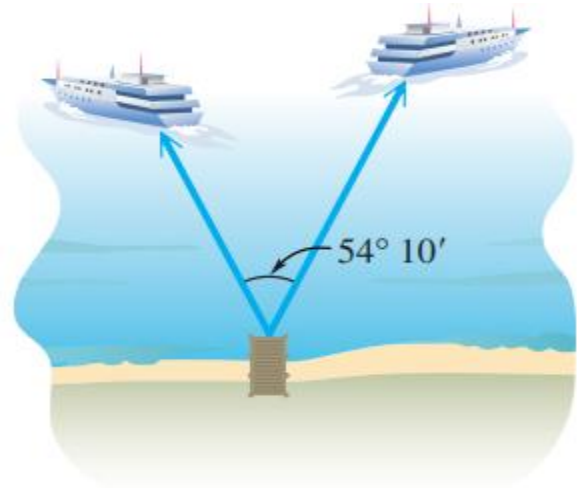
A car has a single windshield wiper on the driver's side. The total arm and blade are 25 cm long and rotated back and forth through an angle of 95° . The shaded region in the figure is the portion of the windshield cleaned by the 18 cm wiper blade. Find the area of the region cleaned by the wiper.



(Lial, Schneider and Daniels, 2017)

Question 3.**[4 Marks]**

Two ships leave a dock together. Each travel in a straight line. The angle between their courses measures $54^\circ 10'$. One ship travels 36.2 km per hr, and the other travels 45.6 km per hr. Calculate the distance between the ships after 3 hours.



(ibid, 2017)

Question 4.**[4 Marks]**

Prove the trigonometric identities given below.

$$\frac{\sin \theta - \csc \theta}{\cos \theta - \cot \theta} = \frac{\cos \theta}{1 - \sin \theta}$$

Question 5.**[3 Marks]**

Use the Laws of Logarithms to expand expression given below.

$$\log \frac{\sqrt{x} \times \sqrt[3]{y}}{w^2 \times \sqrt{z}}$$

Question 6.**[3 Marks]**

Solve the equation given below.

$$\log(3x + 5) - \log(2x + 4) = 0$$

Question 7.**[5 Marks]**

The percent of women employees in an organization can be modeled by the function

$$P = \frac{65.32}{1 + 7.06e^{\frac{-x}{19.4}}}$$

where P is the percent of women employees and x represents the number of years since January 1, 1980.

a. Calculate the percent of women employees in 2015.

(1.5 marks)

b. Determine the year in which the women employees will be 20%.

(3.5 marks)

Question 8.**[4 Marks]**

Calculate the inverse of the function given below.

$$f(x) = \frac{x+2}{x-1}$$

Question 9.**[3 Marks]**

Calculate the maximum or minimum value of the function given below.

$$f(x) = -x^2 - 1.2x + 16$$

Formula Sheet

Quadratic formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Law of Sines	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Law of Cosines	$\begin{aligned}a^2 &= b^2 + c^2 - 2bc \cos A \\b^2 &= a^2 + c^2 - 2ac \cos B \\c^2 &= a^2 + b^2 - 2ab \cos C\end{aligned}$

Reference:

Lial, M.L., Schneider, D.I. and Daniels, C.J. (2017) *College Algebra & Trigonometry*. 6th edn. Harlow: Pearson.