# The Open University of Sri Lanka
## Faculty of Engineering Technology
### Department of Mathematics and Philosophy of Engineering

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|---|---|---|
| Study Programme | : | Bachelor of Industrial Studies Honours |
| Name of the Examination | : | Final Examination |
| **Course Code and Title** | : | **MHZ3458 Mathematics for Agriculture** |
| Academic Year | : | 2024/25 |
| Date | : | 26th January 2026(Monday) |
| Time | : | 0930-1230h |
| Duration | : | 3 hours |

**General instructions**

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Eight (8)** questions in **Four (4)** pages.
3. Answer **Five (5)** questions only.
4. Nonprogrammable calculators are allowed.
5. All questions carry equal marks.
6. Answer for each question should commence from a new page.
7. This is a Closed Book Test (CBT).

**Question 01**

Out of a group of 58 farmers, 25 cultivate coconut, 37 cultivate vegetables and 41 cultivate paddy. Among them, 17 farmers cultivate both coconut and vegetables, 26 cultivate both vegetables and paddy, 12 cultivate both coconut and paddy.

a. Draw a Venn diagram to represent the given information. (40 %)

b. How many farmers cultivate all three types of crops? (30 %)

c. How many farmers cultivate only one type of crop? (20 %)

d. How many farmers cultivate exactly two types of crops? (10 %)

**Question 02**

a. Simplify the following expressions. (40 %)

i. $(3xy - y)(-5x - 2y) + (2y - 3x)(-4xy)$

ii. $(25x^2y^6)^{1/2} \div 5^2(x^3y)^{-2}$

b. Find the value of $x$ by solving the following equation. (20 %)

$$\log\frac{1}{2} - \log 5 - \log x = \log 5 + \log 2$$

c. Solve the following system of simultaneous equations. (40 %)

$$5x + 3y = 2$$
$$-3x - 9y = 6$$

**Question 03**

a. The first three terms of an *arithmetic series* are $17, 23$ and $29$ respectively. If the number of terms in the series is 16, then find the last term and the sum of the series. (50 %)

b. The first three terms of a *geometric series* are 5,15 and 45, respectively. Find the common ratio of the series. Hence, find the number of terms required for the sum of the series to be 5465. (50 %)

(For your calculations, you may make use of the following formulas:

$T_n = a + (n-1)d$, $S_n = \frac{n}{2}[2a + (n-1)d]$, $T_n = ar^{n-1}$, $S_n = \frac{a(r^n-1)}{r-1}\Big\}\ r \neq 1)$

**Question 04**

Let function $y = x^2 - 5x + 4$, where $-1 \leq x \leq 6$.

a. By calculating the corresponding $y$ values for the integer values of $x$, draw the graph of the function in the interval $-1 \leq x \leq 6$. (70 %)

8 Determine the *minimum or maximum* value of the function and the $x-$ value at which it occurs. (20 %)

c. Determine the range of values of $x$,where $y \leq 4$. (10 %)

**Question 05**

a. Evaluate the limit, $\lim_{x \to 1} \frac{x-1}{x^2-1}$. (25 %)

b. Let $y = 2x^3 + 15x^2 + 36x + 17$, for $x \in \mathbb{R}$. Find the local *minimum* and local *maximum* values of $y$. Justify your answer. (75 %)

**Question 06**

a. Convert the angle $58° \; 30' \; 24''$ to decimal degrees form. (20 %)

b. From the top of a lighthouse which is $60\,m$ above sea level, a man observes a ship at an angle of depression of $16°42'$ and, in the same line a boat at an angle of depression of $39° \; 21'$. Assuming all three lie in the same vertical plane, (80 %)

i. Draw a sketch of the above description marking relevant data.

ii. Find the distance between the ship and the boat.

**Question 07**

a. Find the determinant of the following matrix $D$. Hence, find the inverse of matrix $D$. (25 %)

$$D = \begin{bmatrix} 4 & 5 \\ -7 & -3 \end{bmatrix}$$

b. Solve the following systems of equations by using *Cramer's Rule*. (75 %)

$$2x + 3y - 5z = 3$$
$$4x - y - 7z = -7$$
$$2x + 5y - 6z = 5$$

**Question 08**

a. Let $f(x) = \frac{x-5}{(x^2 - 7x + 12)}$.

i. Find the partial fractions of $f(x)$. (50 %)

ii. Using the above partial fractions find $\int \frac{x-5}{(x^2 - 7x + 12)} dx$.

b. Find the area enclosed by the curve $y = -x^2 + 9, y - axis, x - axis$ and $x = 2$. (50 %)

## ප්‍රකෘති වැංජන
## இயற்கைத் தான்கன்கள்
## NATURAL TANGENTS

| | 0′ | 10′ | 20′ | 30′ | 40′ | 50′ | 60′ | | මධ්‍යන්‍ය අන්තරය<br>இடை வித்தியாசங்கள்<br>Mean Differences | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 1′ | 2′ | 3′ | 4′ | 5′ | 6′ | 7′ | 8′ | 9′ |
| 0 | 0.0000 | 0.0029 | 0.0058 | 0.0087 | 0.0116 | 0.0145 | 0.0175 | 89° | 3 | 6 | 9 | 12 | 15 | 17 | 20 | 23 | 26 |
| 1 | .0175 | .0204 | .0233 | .0262 | .0291 | .0320 | .0349 | 88 | 3 | 6 | 9 | 12 | 15 | 17 | 20 | 23 | 26 |
| 2 | .0349 | .0378 | .0407 | .0437 | .0466 | .0495 | .0524 | 87 | 3 | 6 | 9 | 12 | 15 | 18 | 20 | 23 | 26 |
| 3 | .0524 | .0553 | .0582 | .0612 | .0641 | .0670 | .0699 | 86 | 3 | 6 | 9 | 12 | 15 | 18 | 20 | 23 | 26 |
| 4 | .0699 | .0729 | .0758 | .0787 | .0816 | .0846 | .0875 | 85 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 23 | 26 |
| 5 | 0.0875 | 0.0904 | 0.0934 | 0.0963 | 0.0992 | 0.1022 | 0.1051 | 84 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 26 |
| 6 | .1051 | .1080 | .1110 | .1139 | .1169 | .1198 | .1228 | 83 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 7 | .1228 | .1257 | .1287 | .1317 | .1346 | .1376 | .1405 | 82 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 8 | .1405 | .1435 | .1465 | .1495 | .1524 | .1554 | .1584 | 81 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 9 | .1584 | .1614 | .1644 | .1673 | .1703 | .1733 | .1763 | 80° | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 10° | 0.1763 | 0.1793 | 0.1823 | 0.1853 | 0.1883 | 0.1914 | 0.1944 | 79 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 11 | .1944 | .1974 | .2004 | .2035 | .2065 | 0.2095 | 0.2126 | 78 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 12 | .2126 | .2156 | .2186 | .2217 | .2247 | .2278 | .2309 | 77 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 |
| 13 | .2309 | .2339 | .2370 | .2401 | .2432 | .2462 | .2493 | 76 | 3 | 6 | 9 | 12 | 15 | 18 | 22 | 25 | 28 |
| 14 | .2493 | .2524 | .2555 | .2586 | .2617 | .2648 | .2679 | 75 | 3 | 6 | 9 | 12 | 16 | 19 | 22 | 25 | 28 |
| 15 | 0.2679 | 0.2711 | 0.2742 | 0.2773 | 0.2805 | 0.2836 | 0.2867 | 74 | 3 | 6 | 9 | 13 | 16 | 19 | 22 | 25 | 28 |
| 16 | .2867 | .2899 | .2931 | .2962 | .2994 | .3026 | .3057 | 73 | 3 | 6 | 9 | 13 | 16 | 19 | 22 | 25 | 28 |
| 17 | .3057 | .3089 | .3121 | .3153 | .3185 | .3217 | .3249 | 72 | 3 | 6 | 10 | 13 | 16 | 19 | 22 | 26 | 29 |
| 18 | .3249 | .3281 | .3314 | .3346 | .3378 | .3411 | .3443 | 71 | 3 | 6 | 10 | 13 | 16 | 19 | 23 | 26 | 29 |
| 19 | .3443 | .3476 | .3508 | .3541 | .3574 | .3607 | .3640 | 70° | 3 | 7 | 10 | 13 | 16 | 20 | 23 | 26 | 29 |
| 20° | 0.3640 | 0.3673 | 0.3706 | 0.3739 | 0.3772 | 0.3805 | 0.3839 | 69 | 3 | 7 | 10 | 13 | 17 | 20 | 23 | 27 | 30 |
| 21 | .3839 | .3872 | .3906 | .3939 | .3973 | .4006 | .4040 | 68 | 3 | 7 | 10 | 13 | 17 | 20 | 24 | 27 | 30 |
| 22 | .4040 | .4074 | .4108 | .4142 | .4176 | .4210 | .4245 | 67 | 3 | 7 | 10 | 14 | 17 | 20 | 24 | 27 | 31 |
| 23 | .4245 | .4279 | .4314 | .4348 | .4383 | .4417 | .4452 | 66 | 3 | 7 | 10 | 14 | 17 | 21 | 24 | 28 | 31 |
| 24 | .4452 | .4487 | .4522 | .4557 | .4592 | .4628 | .4663 | 65 | 4 | 7 | 11 | 14 | 18 | 21 | 25 | 28 | 32 |
| 25 | 0.4663 | 0.4699 | 0.4734 | 0.4770 | 0.4806 | 0.4841 | 0.4877 | 64 | 4 | 7 | 11 | 14 | 18 | 21 | 25 | 29 | 32 |
| 26 | .4877 | .4913 | .4950 | .4986 | .5022 | .5059 | .5095 | 63 | 4 | 7 | 11 | 15 | 18 | 22 | 25 | 29 | 33 |
| 27 | .5095 | .5132 | .5169 | .5206 | .5243 | .5280 | .5317 | 62 | 4 | 7 | 11 | 15 | 18 | 22 | 26 | 30 | 33 |
| 28 | .5317 | .5354 | .5392 | .5430 | .5467 | .5505 | .5543 | 61 | 4 | 8 | 11 | 15 | 19 | 23 | 26 | 30 | 34 |
| 29 | .5543 | .5581 | .5619 | .5658 | .5696 | .5735 | .5774 | 60° | 4 | 8 | 12 | 15 | 19 | 23 | 27 | 31 | 35 |
| 30° | 0.5774 | 0.5812 | 0.5851 | 0.5890 | 0.5930 | 0.5969 | 0.6009 | 59 | 4 | 8 | 12 | 16 | 20 | 24 | 27 | 31 | 35 |
| 31 | .6009 | .6048 | .6088 | .6128 | .6168 | .6208 | .6249 | 58 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 |
| 32 | .6249 | .6289 | .6330 | .6371 | .6412 | .6453 | .6494 | 57 | 4 | 8 | 12 | 16 | 20 | 25 | 29 | 33 | 37 |
| 33 | .6494 | .6536 | .6577 | .6619 | .6661 | .6703 | .6745 | 56 | 4 | 8 | 13 | 17 | 21 | 25 | 29 | 33 | 38 |
| 34 | .6745 | .6787 | .6830 | .6873 | .6916 | .6959 | .7002 | 55 | 4 | 9 | 13 | 17 | 21 | 26 | 30 | 34 | 39 |
| 35 | 0.7002 | 0.7046 | 0.7089 | 0.7133 | 0.7177 | 0.7221 | 0.7265 | 54 | 4 | 9 | 13 | 18 | 22 | 26 | 31 | 35 | 40 |
| 36 | .7265 | .7310 | .7355 | .7400 | .7445 | .7490 | .7536 | 53 | 5 | 9 | 14 | 18 | 23 | 27 | 32 | 36 | 41 |
| 37 | .7536 | .7581 | .7627 | .7673 | .7720 | .7766 | .7813 | 52 | 5 | 9 | 14 | 19 | 23 | 28 | 32 | 37 | 42 |
| 38 | .7813 | .7860 | .7907 | .7954 | .8002 | .8050 | .8098 | 51 | 5 | 10 | 14 | 19 | 24 | 29 | 33 | 38 | 43 |
| 39 | .8098 | .8146 | .8195 | .8243 | .8292 | .8342 | .8391 | 50° | 5 | 10 | 15 | 20 | 24 | 29 | 34 | 39 | 44 |
| 40° | 0.8391 | 0.8441 | 0.8491 | 0.8541 | 0.8591 | 0.8642 | 0.8693 | 49 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| 41 | .8693 | .8744 | .8796 | .8847 | .8899 | .8952 | .9004 | 48 | 5 | 10 | 16 | 21 | 26 | 31 | 36 | 41 | 47 |
| 42 | .9004 | .9057 | .9110 | .9163 | .9217 | .9271 | .9325 | 47 | 5 | 11 | 16 | 21 | 27 | 32 | 37 | 43 | 48 |
| 43 | .9325 | .9380 | .9435 | .9490 | .9545 | .9601 | .9657 | 46 | 6 | 11 | 17 | 22 | 28 | 33 | 39 | 44 | 50 |
| 44 | .9657 | .9731 | .9770 | .9827 | .9884 | .9942 | 1.0000 | 45 | 6 | 11 | 17 | 23 | 29 | 34 | 40 | 46 | 51 |
| | 60′ | 50′ | 40′ | 30′ | 20′ | 10′ | 0′ | | 1′ | 2′ | 3′ | 4′ | 5′ | 6′ | 7′ | 8′ | 9′ |

## ප්‍රකෘති කෝටැංජන
## இயற்கைக் கோதான்சன்கள்
## NATURAL COTANGENTS

- The End -

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