Master’s Degree and Internship Program
of the African Business Education Initiative for Youth (ABE Initiative)
(2nd Batch)

Examination for Mathematics (45 min.)

Note:
1. Rules of Examination
   ● Do not leave the room without proctor’s permission.
   ● Do not take this question booklet out of the room.
   ● No calculators are allowed.
   ● Show all your work in blank spaces and write your answers in the space provided.

2. Instruction for the Question booklet
   ● Do not open this question booklet until instructed.
   ● Do not remove the staples from this booklet.
   ● After being instructed, write your registration number and name in the space provided below.
   ● If your question booklet is missing any pages, raise your hand.
   ● This question booklet consists of 2 parts (Part 1 and Part 2). You are requested to answer all the questions.

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Part 1
Write down your answer for each question.

(1) Calculate $\frac{1}{3} \div \left( \frac{1}{6} - \frac{4}{3} \right) \div \frac{1}{7}$.

Answer:

(2) Calculate $\left( \left( \frac{1}{3} \right)^{-2} \times 9 \right)^{\frac{1}{4}}$.

Answer:

(3) Solve $-x - 5 = -2 - 4x$ for $x$.

Answer:

(4) Solve $x - y = 3$ and $-2x + 6y = -10$ for $x$ and $y$.

Answer:
(5) Find the region of $x$ satisfying $3 \frac{x}{2} \leq x + \frac{3}{2}$.

Answer:

(6) Suppose that the average of the five values, $\{1, -2, x, 1 + x, -3\}$, is equal to $x$. Find the value of $x$.

Answer:

(7) Suppose that the area of the shaded triangle is equal to 25. Find the value of $A$.

Answer:
Part 2
Write down your answer for each question.

(8) Solve \( x^2 - x = -6 + 4x \) for \( x \)

Answer:

(9) Find the region of \( x \) satisfying \( 3^{-x^2} \times \left(\frac{1}{3}\right)^x > 1 \).

Answer:

(10) Find the positive value of \( n \) satisfying

\[
\sum_{k=1}^{n} (2k - 1) - \sum_{k=1}^{n-1} (2k - 1) = 7
\]

Answer:

(11) Find the first-derivative of \( y = x^3 - x + 101 \).

Answer:
(12) Find the definite integral:
\[ \int_{e}^{e^2} \frac{1}{x} \, dx. \]
Note that \( e \) is a mathematical constant which is the base of the natural logarithm.

Answer:

(13) Let \( A = \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix} \) and \( B = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \). Find the inverse matrix of \( AB \).

Answer:

(14) The profit \( \pi \) is described by the following function:
\[ \pi(q) = \left( 50 - \frac{1}{2}q \right)q - \frac{1}{2}q^2 - 25, \]
where \( q \) is the output. Find the output \( q \) at which the profit is maximized.

Answer:
(15) Suppose that $\tan \theta = 1$. Find the value of $\cos^2 \theta$.

Answer:

(16) Suppose that $\tan \theta = -\frac{3}{4}$ with $0 \leq \theta \leq \pi$. Find the value of $\cos \theta$.

Answer: