Japan-IMF Scholarship Program for Asia 2026-2027

Basic Mathematics Aptitude Test

Test A (Answer sheet)

Please Note:

- You have 60 minutes to complete
- Calculators are not allowed

Thank you

Country:_____

Reference Number:_____

Name:_____

Problem 1. Compute the following

$$\frac{100}{4} + 5$$

Answer:

Problem 2. Suppose that

$$Y = K^{\alpha} L^{1-\alpha}$$

Answer:

Problem 3. Suppose that

$$y = x^2 + ax$$

Answer:

Problem 4. Solve for x:

$$\frac{x^{n-1}}{x^n} = \frac{2}{1-x}$$

Answer:

Problem 5. Note that e is Euler's constant. Solve for x:

$$e^{5x-10} = 1$$

Answer:

Problem 6. Solve for x:

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

Answer:

Problem 7. Solve for x:

$$2\ln(1+x) - \ln(1+x) = \ln(2x)$$

Answer:

Problem 8. Find a first order Taylor expansion (nearby $x = 36$) for the function

$$f(x) = 6\sqrt{x}$$

Using this, approximate $6\sqrt{38}$

Answer:

Problem 9. Suppose that two cyclist are biking towards each other. Both cyclists maintain a constant and equal speed of 10 kilometers per hour. The cyclists begin 100 kilometers apart. An insect flies between the cyclists at a constant speed of 40 kilometers per hour. Assume that as the insect reaches one of the cyclist, it immediately turns around (with no change in speed). It keeps flying until the cyclists meet. How far does the insect fly?

Answer:

Problem 10. Suppose that we have the set of numbers:

$$X = [87, 63, 40, 76, 2, 28, 6, 30, 25, 49]$$

The average value of this set of numbers is $\bar{x} = 40.6$. Compute the following

$$\sum_{i=1}^{10} 2x_i, \quad x_i \in X$$

Answer:

Problem 11. Suppose that we have the set of numbers:

$$X = [87, 63, 40, 76, 2, 28, 6, 30, 25, 49]$$

The average value of this set of numbers is $\bar{x} = 40.6$. Compute the following

$$\sum_{i=1}^{10} \left(2x_i - \bar{x}\right), \quad x_i \in X$$

Answer:

Problem 12. Compute the derivative of the function

$$f\left(x\right) = x\ln\left(x\right) + x$$

Answer:

Problem 13. Suppose that

$$y(t) = (x(t))^2$$

where

$$x(t) = x_0 e^{g_x t}$$

Compute

$$g_y \equiv \frac{d \ln y(t)}{dt}$$

Answer:

Problem 14. Assume that a, b, c are positive constants. Evaluate $f'(0)$ where,

$$f(x) = c \ln \ ax^2 + bx + c$$

Answer:

Problem 15. Assume that $\kappa > 1$ and $b > 0$. Define and solve for

$$F(x) = \int_{x_B}^{x} \frac{\kappa x_B^{\kappa}}{x^{\kappa+1}} dx$$

Answer:

Problem 16. Assume that $\kappa > 1$ and $b > 0$. Define,

$$F(x) = \int_{x_B}^{x} \frac{\kappa x_B^{\kappa}}{x^{\kappa+1}} dx.$$

Answer:

Problem 17. Suppose that $A = \begin{bmatrix} 0 & 2 & 3 \end{bmatrix}$. Compute AA^T:

Answer:

Problem 18. Suppose that matrix A is

$$A = \begin{bmatrix} a - \lambda & b \\ c & d - \lambda \end{bmatrix}$$

Answer:

Problem 19. If possible, solve for the values of x_1, x_2, and x_3 in which

$$\begin{bmatrix} 1 & 5 & 10 \\ 1 & 5 & 10 \\ 3 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 5 \end{bmatrix}$$

Answer:

Problem 20. Evaluate the limit (use L'Hôpital's rule)

$$\lim_{x\to\infty} \frac{x}{\ln(x)}$$

Answer: