

Reference Number: \_\_\_\_\_

Country: \_\_\_\_\_

Name: \_\_\_\_\_

JAPAN-IMF SCHOLARSHIP PROGRAM FOR ASIA 2011

## Basic Mathematics Aptitude Test (Full Score: 25 Points)

Please Note:

- You have 60 minutes to complete.
- No calculators are allowed. No dictionaries are allowed.
- Please show all your work and write your answers in the designated space. No additional papers are allowed.

*Thank you.*

*name :* \_\_\_\_\_

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(Please show all your work here and write your answers in the designated spaces.)

[PART I] (1 point/question) Calculate the following:

1.  $0.1(0.2 - 0.3) - (0.4 - 0.5)$

*Answer :* \_\_\_\_\_

2.  $\left(\frac{1}{2} + \frac{1}{3}\right) \left(\frac{1}{4} + \frac{1}{5}\right)$

*Answer :* \_\_\_\_\_

3.  $(\sqrt{5} + \sqrt{3})(\sqrt{5} - \sqrt{3})$

*Answer :* \_\_\_\_\_

4.  $0.9^2 (0.3^{-2})^2$

*Answer :* \_\_\_\_\_

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(Please show all your work here and write your answers in the designated spaces.)

[PART II] (2 points/question) Answer to the following questions:

1. Solve the following for  $x$ :

$$\frac{1}{2}x - \frac{1}{4} = \frac{1}{8}x - \frac{1}{16}.$$

*Answer :* \_\_\_\_\_

2. Factor  $x^3 + 3x^2 + 2x$ .

*Answer :* \_\_\_\_\_

3. If a quadratic function  $y = ax^2 + bx + c$  goes through points  $(x, y) = (-1, 0), (0, 5)$ , and  $(3, -4)$ , then what is the value for the coefficient  $a$ ?

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[PART III] (2 points/question) Answer to the following questions:

1. Compute  $\lim_{x \rightarrow 1} \frac{\ln x}{x - 1}$

*Answer :* \_\_\_\_\_

2. Let  $\lambda_1$  and  $\lambda_2$  be the two eigen values of a  $2 \times 2$  matrix  $A$ , where  $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ . Then what is  $\lambda_1\lambda_2$ ?

*Answer :* \_\_\_\_\_

3. If  $y = \exp(-\exp(-x))$ , then what is the maximum value of  $dy/dx$ ?

*Answer :* \_\_\_\_\_

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(Please show all your work here and write your answers in the designated spaces.)

[PART IV] (3 points/question) Answer to the following questions:

1. In year 2010, country A's GDP has increased from 2009 by 12%, while Country B's GDP has decreased by 20%. As a result, countries A and B have the same GDP in 2010. What was the ratio of Country A's GDP to that of Country B in year 2009?

*Answer :* \_\_\_\_\_

2. In Figure 1,  $4AB=5CD$ ,  $OB=3BD$ , and  $AB//CD$ . That is, AB is 1.25 times longer than CD; OB is three times longer than BD; and AB and CD are parallel. If the area of a triangle ACE is  $1\text{cm}^2$  then how big is the area of ECDB?

*Answer :* \_\_\_\_\_

3. Suppose you have ten cards, each with a number from 1 to 10 as follows.

1	2	3	4	5	6	7	8	9	10
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Now, you shuffle these cards and place them into your pocket in a random order. With these ten cards in your pocket, we will play the following game.

- (i) *You take out one card blindly from your pocket and place it on a desk.*
- (ii) *You take another card blindly from your pocket again. If the card that you just took out has a larger number than the card on the desk, put it on the desk, too. Otherwise, you throw away the card (that you just took out of your pocket) into a trash.*
- (iii) *You take another card from your pocket, and if it is larger than any cards on the desk, you put it on the desk. Otherwise, you throw it away in the trash.*
- (iv) *You repeat this step (iii) until you do not have any more card in your pocket.*

Then, what is the probability that the card 7 is on the desk, and not in the trash.

*Answer :* \_\_\_\_\_

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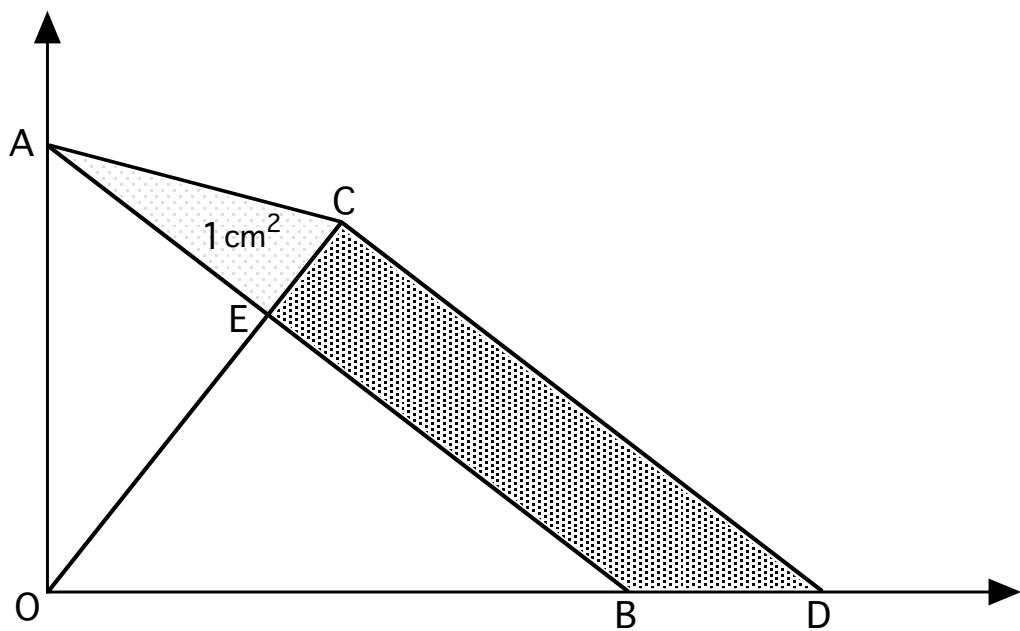


Figure 1