

The Project for Human Resource Development Scholarship
by Japanese Grant Aid (JDS)

Basic Mathematics Aptitude Test
2019

Note:

- You have 60 minutes to complete.
- No calculators are allowed.
- Show all your work and write your answers in the designated space.
- Part I and Part II are ‘Basic Math,’ and Part III and Part IV are ‘Applied Math.’

Name : _____

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

[PART I] Calculate the followings.

1. $(1 - 3) \times (-5) \times (2 - (1 - 3))$

Answer : _____

2. $\left(\frac{7}{5} \div \frac{2}{15} - \frac{1}{2}\right) \times \frac{1}{3} - \frac{5}{2}$

Answer : _____

3. $(\sqrt{3} - \sqrt{2})^2 + \sqrt{24}$

Answer : _____

4. $\left(\left(\frac{1}{8}\right)^{-1} \div \left(\frac{1}{16}\right)^{0.5}\right)^{-3} \div \left(\frac{1}{3}\right)^2$

Answer : _____

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

[PART II] Answer the following questions.

1. Solve the following equation for w.

$$\frac{5 - w}{2w} = 3$$

Answer : _____

2. Solve the following simultaneous equations for x and y.

$$\begin{aligned} -x + 3y &= 7 \\ -2x + 2y &= 6 \end{aligned}$$

Answer : _____

3. Consider the straight line in the (x,y)-plane that passes through the points (0,a) and (b,0). Assume $2a = 3b$ and $a \neq 0$. Find the slope of the straight line.

Answer : _____

4. Solve the following equation for x.

$$|x - 5| = 3$$

Answer : _____

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

[PART III] Answer the following questions:

1. Find the region of x satisfying the following inequality.

$$8x^2 - 5x < 9x - 3$$

Answer : _____

2. Solve the following equation for x .

$$\log_2(x) = \log_2(6x - 5)$$

Answer : _____

3. Find the minimum integer x satisfying the following inequality.

$$\sum_{k=1}^x \left(\frac{k}{x}\right) > 100$$

Answer : _____

4. Consider the following five values,
 $\{-10, 25, 30, -25, 0\}$.

Suppose that the average of these five values is $\log_3(x)$. Find the value of x .

Answer : _____

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

[PART IV] Answer the following questions:

1. Determine the first-order derivative of the following. Note that e is a mathematical constant which is the base of the natural logarithm.

$$y = x^3 + e^{3x} + \log_e x$$

Answer : _____

2. Solve the following equation for z .

$$\int_0^{2z} e^x dx = e^{z+5} - 1$$

Answer : _____

3. Let $A = \begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$. Find $A^{-1}B$.

Answer : _____

4. Consider the following function, $F(x, y) = xy$. Assume that $x + y = 10$. Find (x, y) at which the value of the function is maximized.

Answer : _____

[PART V] Fill in the following blanks with correct answers.

1. Find the first derivative of the following.

$$f(x) = 5\sin(5x).$$

Answer : _____

2. Consider a sequence $\{a_k\}_{k=1}^{\infty}$ with $a_k = r^{1-k}$. Find the value r which satisfies

$$\sum_{k=1}^{\infty} a_k = 10$$

Answer : _____

3. Suppose that $\vec{a} = (x, 1)$ and $\vec{b} = (2, y - 2)$ are vertical and that $x + y = 4$. Find x and y .

Answer : _____

4. There are 12 adults and 10 kids in a room. Find the number of ways you can select three persons from them. The choice must contain two kids and one adult.

Answer : _____