

# The Project for Human Resource Development Scholarship (JDS)

## Basic Mathematics Aptitude Test 2024

Note:

- The test is a computer-scored multiple-choice test.
- You have 60 minutes to complete.
- No calculators are allowed.
- Part I and Part II are 'Basic Math,' and Part III, IV and V are 'Applied Math.'
- Select one(1) integer 0 to 9 for each square.
- Each square correspond to each answer number of computer-scored answer sheet.

**Example:**

Please select integer number that correspond to .

➤  $3 \times 8 =$    (2digits)

                                    ↓                                    ↓

                                    No.1                                    No.2

Fill the oval shape completely with a pencil that you think it is the appropriate answer as shown in the picture below.

No.	Answer
1	① ● ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
2	① ② ③ ● ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
3	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
4	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

Application Number:

Name:

(Please show all your work here and write your answers in the designated space)  
**[PART I] Calculate the followings.**

1.  $2 - (2 - 4 \times (3 + (4 - 7)))$

Answer :

No.1

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

Answer :

No.2

3.  $(\sqrt{48} - \sqrt{75}) \times \sqrt{3}$

Answer :

→ No.3

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

Answer :

1

(2digits)

→ No.4

→ No.5

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

**[PART II] Answer the following questions.**

1. Solve the following equations:  $4x+2=6x-6$

Answer :  $x =$

→ No.6

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

$$3x + 2y - 1 = 7$$

$$-x + 5y = 3$$

Answer :  $x =$   ,  $y =$

→ No.7

→ No.8

3. Find the region  $x$  satisfying the following inequality, where  $| |$  indicates the absolute value.

$$\left| \frac{2x+3}{4} \right| < 2$$

Answer :  $-\frac{\boxed{\phantom{00}}\boxed{\phantom{00}}}{2} < x < \frac{\boxed{\phantom{00}}}{2}$

(2digits)

No.9      No.10      No.11

4. Find the difference between the arithmetic mean and median values in the following observations  $x_i$ :  $Mean(x_i) - Median(x_i)$  where  $x_i = \{22, 4, 8, 5, 11, 10\}$ .

Answer :  $\boxed{\phantom{00}}$

No.12

(Please show all your work here and write your answers in the designated space)  
[PART III] Answer the following questions:

1. Solve the following equation for  $x$ . Consider only real number solutions.

$$\frac{5x^3}{2} - 7 = 13$$

Answer :  $x =$

 No.13

2. Find the region of  $x$  satisfying the following inequality.

$$x^2 - 4x < x - 6$$

Answer :   $< x <$

 No.14

 No.15

3. Solve the following equation for  $x$ .

$$2\log_3(x) = \log_3(2) + \log_3(3x - 4)$$

Answer :  $x =$   ,   
→ No.16 → No.17

4. Consider the following six values, [6, 4, 12, 8, 10, 14]. Suppose that the median of six values is  $3^{2x}$ . Find the value of  $x$ .

Answer :  $x =$    
→ No.18

(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 log is the natural logarithm.

$$y = \log(x^2 + 4)$$

Answer :

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$$\frac{\boxed{\phantom{00}}x}{(x^2 + \boxed{\phantom{00}})}$$

No.19  
No.20

2. Find the following definite integral.

$$\int_1^2 (2x + 3x^2) dx$$

Answer :

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$$\boxed{\phantom{00}} \boxed{\phantom{00}} \text{ (2digits)}$$

No.21  
No.22



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

Assume determinant of the matrix A is 5. Find  $A^{-1} \times B$ .

Answer :

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$$\begin{bmatrix} \boxed{\phantom{00}}/5 & 1/5 \\ 4/5 & \boxed{\phantom{00}}/5 \end{bmatrix}$$

No.23  
No.24

4. Find the maximum total revenue (TR) for a firm, given the flowing functions:  $TR = P \times Q$  and  $P = 16 - 2Q$ , where P and Q are the price and quantity of goods, respectively.

Answer :

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$\boxed{\phantom{00}} \quad \boxed{\phantom{00}}$  (2digits)

No.25  
No.26

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

**[PART V] Answer the following questions:**

1. Find the following trigonometric function value:  $\sin\left(\pi - \frac{5\pi}{6}\right) + \cos\left(\frac{\pi}{3}\right)$  where  $\pi$  represents the mathematical constant and the angles are in radians.

Answer :

→ No.27

2. Given a sequence  $\left(\frac{1}{3}\right)^{n-1}$ , find  $\sum_{n=1}^{\infty} \left(\frac{1}{3}\right)^{n-1}$  where  $n$  is an integer.

Answer :

  

→ No.28

→ No.29

3. Suppose that  $\vec{a} = (4x - 5, 2)$  and  $\vec{b} = (3, y)$  are vertical and that  $x - y = 3$ . Find  $x$  and  $y$ .

Answer :  $x = \frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$ ,  $y = -\frac{\boxed{\phantom{00}}}{\boxed{\phantom{00}}}$

No.30

No.32

No.31

No.33

4. In the Econometrics course, there are 5 Japanese students and 7 non-Japanese students. The professor plans to form a group for assignment, by selecting two members from each group. Find the total number of different teams that can be formed.

Answer :  $\boxed{\phantom{00}} \boxed{\phantom{00}} \boxed{\phantom{00}}$  (3digits)

No.34

No.35

No.36