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

Basic Mathematics Aptitude Test
2021

Note:

- The test is a computer-scored multiple-choice test.
- You have 60 minutes to complete.
- No calculators are allowed.
- Part I and 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.

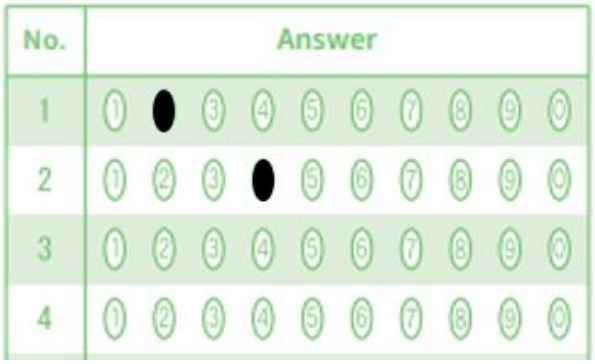
Example:

Please select integer number that correspond to A and B. (A=No.1、B=No.2)

➢ $3 \times 8 =$ | A | B |

(2 digits)

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



Name : _____

[PART I] Calculate the followings.

Please select integer number that correspond to A and B. (A=No.1、B=No.2)

- $(-3) \times (1-3) \times (12-3) = \boxed{A}\boxed{B}$

(2 digits)

Please select integer number that correspond to A and B. (A=No.3、B=No.4)

- $\left(\frac{1}{2} \div \frac{1}{3} - \frac{2}{3}\right) \times \left(\frac{1}{2} \div \frac{1}{3} + \frac{2}{3}\right) = \frac{6\ 5}{\boxed{A}\boxed{B}}$

(2 digits)

Please select integer number that correspond to A and B. (A=No.5、B=No.6)

- $\left(\sqrt{5}+2\right)^2 = \boxed{A} + 4\sqrt{\boxed{B}}$

Please select integer number that correspond to A,B and C.
(A=No.7、B=No.8、C=No.9)

- $\left(\left(\frac{1}{2}\right)^{-2.5} \times \left(\frac{1}{4}\right)^{0.25}\right)^{-4} = \frac{1}{\boxed{A}\boxed{B}\boxed{C}}$

(3 digits)

[PART II] Answer the following questions.

Please select integer number that correspond to $\boxed{\quad}$. (No.10)

- Solve the following equation for x.

$$2 = \frac{5x - 1}{x + 2}$$

Answer : $x = \frac{5}{\boxed{\quad}}$

Please select integer number that correspond to a and b. (a=No.11、b=No.12)

- Solve the following simultaneous equations for a and b.

$$a + b = 16$$
$$ab = 64$$

Answer : $a = \boxed{\quad}, b = \boxed{\quad}$

Please select integer number that correspond to A and B. (A=No.13、B=No.14)

- Find the region of x satisfying the following inequality.

$$|x| \leq x^2$$

Answer : $x \leq -\boxed{A}, \quad \boxed{B} \leq x$

Please select integer number that correspond to a. (No.15)

- Consider the straight line in the (x,y)-plane that passes through the point (a+1, a). Assume that the slope is -1 and the x-intercept is $(5,0)$. Find the value of a.

Answer : $a = \boxed{\quad}$

[PART III] Answer the following questions:

Please select integer number that correspond to A and B. (A=No.16、B=No.17)

- Find the region of x satisfying the following inequality.

  $2^{x^2} < 2^{64}$

Answer : $-$ [A] $< x <$ [B]

Please select integer number that correspond to x. (No.18)

- Solve the following equation for x.

  $\log_{10}(x) - \log_{10}\left(\frac{1}{x}\right) = \log_{10}(10 - 3x)$

Answer : x = [ ]

Please select integer number that correspond to A and B. (A=No.19、B=No.20)

- Consider a sequence series $\{x_k\}_{k=1}^{\infty}$ with $x_k = 2k - 1$. Consider the series $S_n = \sum_{k=1}^{n} x_k$. Find the smallest integer of n satisfying $S_n > 120$.

Answer : n = [A] [B]
(2 digits)

Please select integer number that correspond to [ ]. (No.21)

- Consider the following five values,
  $\{-2,\ 5,\ -1,\ 3,-\ \ 5\}$.

Let x and y be the average and median of these five values, respectively. Find the value of $\log_{10}(x - y)$.

Answer : [ ]

[PART IV] Answer the following questions:

Please select integer number that correspond to A and B. (A=No.22、B=No.23)

- Determine the second-order derivative of the following. Assume $x > 0$. Note that e is a mathematical constant which is the base of the natural logarithm.

$$y = \int_0^x (2z)dz - \log_e(x^3)$$

Answer： $y'' =$ [A] $+ \frac{[B]}{x^2}$

Please select integer number that correspond to A and B. (A=No.24、B=No.25)

- Assume that $b > 1$. Find the following value.

$$\lim_{n\to\infty} \frac{2b^n}{10 + 3b^n}$$

Answer： $\frac{[B]}{[A]}$

Please select integer number that correspond to X and Y.
(X=No.26、Y=No.27、Z=No.28)

- Let $A = \begin{bmatrix} 1 & 1 \\ -2 & a \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$. Assume that the determinant of A is 2. Find $A^{-1}B$.

Answer： $\begin{bmatrix} [X] & -[Y] \\ 2 & [Z] \end{bmatrix}$

Please select integer number that correspond to x and y. (x =No.29 、y =No.30)

- Find the values of x and y that solve the following constrained maximization problem:
  Maximize $\sqrt{xy}$ subject to $x + y = 10$.

Answer： x =[ ], y =[ ]

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

Please select integer number that correspond to ☐. (No.31)

- Find the first derivative of the following.
  $f(x) = \sin(x^2)$.

Answer : ☐ $x\cos(x^2)$

Please select integer number that correspond to ☐. (No. 32)

- A continuous random variable follows the following probability density function f. Find the value of a positive constant b.

$$f(x) = \begin{cases} b & \text{if } 0 \le x \le 0.5 \\ 0 & \text{otherwise} \end{cases}$$

Answer : b = ☐

Please select integer number that correspond to A and B. (A=No.33、B=No.34)

- Suppose that $\vec{a} = (2x, -1)$ and $\vec{b} = (x, 32)$ are vertical. Find the value of x.

Answer： $x = -$ [A] , [B]

Please select integer number that correspond to A,B and C.
(A=No.35、B=No.36、C=No.37)

- A baseball team consisting of 5 boys and 4 girls will be formed from a group of 6 boys and 7 girls. Find how many different teams can be formed from the group.

Answer： [A] [B] [C]

(3 digits)