Japanese Grant Aid for Human Resource Development Scholarship (JDS)

Basic Mathematics Aptitude Test

2023

Solution

Prepared by Japanese Development Service Co., Ltd.

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 is 'Basic Math' and Part II is 'Applied Math.'
- The test result is only for the reference purpose and basically does not affect the selection procedure. However, some accepting universities may require the candidates who apply for the economics-related fields of study to have analytical and numerical skills.

Registration No.: _____

Name: _____

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

[PART I] **3 points/each * 20 questions (total 60 points)**

1. Calculate.

$-9 + 2 - 6 = -13$

$-3.5 + 9.2 = 5.7$

$7 - 8 \div \frac{1}{2} = 7 - 16 = -9$

$2.5 + \frac{1}{5} = 2.5 + 0.2 = 2.7$ *or* $\frac{27}{10}$

$$-\frac{1}{4}+\frac{2}{3}=\frac{-3+8}{12}=\frac{5}{12}$$

$$0.2-\frac{1}{3}+1=\frac{1}{5}-\frac{1}{3}+1=\frac{3-5+15}{15}=\frac{13}{15}$$

$$\frac{5}{2}\times-\frac{3}{5}\div\frac{3}{5}=\frac{5\times-3\times5}{2\times5\times3}=-\frac{5}{2}$$

$$(2-\sqrt{6})(1+\sqrt{6})=2+2\sqrt{6}-\sqrt{6}-6=\sqrt{6}-4$$

$(\sqrt{3}-2)^2 = 3 - 4\sqrt{3} + 4 = 7 - 4\sqrt{3}$

$2^2 \div 2^{-4} \div 2^3 = 2^2 \times \frac{1}{2^{-4}} \times \frac{1}{2^3} = 2^{2+4-3} = 2^3 = 8$

$\left(2^2 \times \left(\frac{1}{2}\right)^2 \times 2^3\right)^{\frac{2}{3}} \div \frac{1}{2^3} = (2^2 \times 2^{-2} \times 2^3)^{\frac{2}{3}} \div 2^{-3} = 2^2 \times 2^3 = 2^5$

2. Solve the following equations or inequality.

$2x + 3 = \frac{x}{2} - 3$

$2x - \frac{x}{2} = -3 - 3$

$\frac{4x - x}{2} = -6$

$\frac{3}{2}x = -6$

$x = -6 \times \frac{2}{3}$

$x = -4$

$\begin{cases} 7x - 3y = 6 \\ x + y = 8 \end{cases}$

$\begin{cases} 7x - 3y = 6 \\ 7x + 7y = 56 \end{cases}$

$10y = 50$

$y = 5$

$x = 3$

$-5x + 25 > 0$

$-5x > -25$

$x < \frac{-25}{-5}$

$x < 5$

3. When $a = 2$ and $b = -\frac{1}{2}$, what is the value of

$$a^2 - 2ab - b^2 + \frac{1}{b}$$

$= 2^2 - 2 \times 2 \times \left(-\frac{1}{2}\right) - \left(-\frac{1}{2}\right)^2 + \frac{1}{-\frac{1}{2}}$

$= 4 + 2 - \frac{1}{4} - 2$

$= \frac{15}{4}$ *or* 3.75

4. Determine the first derivative of

$$f(x) = -2x^3 - 3x^2 + 12x + 20$$

$f(x)' = -6x^2 - 6x + 12$

5. When $x = 2$, calculate the first derivative of

$$f(x) = x^2 - x$$

$f(x)' = 2x - 1$
$f(x)' = 4 - 1$
$f(x)' = 3$

6. When $x = a$, find the first derivative of

$$f(x) = x^3 + x$$

$$f(x)' = 3x^2 + 1$$
$$f(x)' = 3a^2 + 1$$

7. Find definite integral of

$$\int_0^3 (x^2 - 2x + 1)\, dx$$

$$= \left[\frac{1}{3}x^3 - x^2 + x\right]_0^3$$

$$= \frac{27}{3} - 9 + 3$$

$$= 3$$

8. Find definite integral of

$$\int_1^2 (6x + 3)\, dx$$

$$= [3x^2 + 3x]_1^2$$
$$= (12 + 6) - (3 + 3)$$
$$= 18 - 6$$
$$= 12$$

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

[PART II] **4 point/each * 10 questions (total 40 points)**

9. The points on a plane coordinate, $(6, -2)$, $(-2, 2)$, and $(2, \boldsymbol{a})$, lie on the same line. Find the value $\boldsymbol{a}$.

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

$a = 0$

10. Round off 43.67 **AT** the first decimal place.

44

11. Calculate the average salary of the **WHOLE** people.

Group A
- 8 people
- Average salary: $1000/month

Group B
- 12 people
- Average salary: $800/month

$(8 \times \$1000 + 12 \times \$800) \div 20$
$= (\$8000 + \$9600) \div 20$
$= \$17600 \div 20$
$= \$880$

12. There are 6 values below.

$$\left\{-\frac{3}{4},\quad 0,\quad -\frac{1}{2},\quad \frac{3}{2},\quad \sqrt{2},\quad -0.25\right\}$$

(1) Find the maximum value.

$\frac{3}{2}$

(2) Find the minimum value.

$-\frac{3}{4}$

(3) Calculate the average of the six values.

$$\left(-\frac{3}{4}+0-\frac{1}{2}+\frac{3}{2}+\sqrt{2}-0.25\right)\div 6$$
$$=\left(-\frac{3}{4}-\frac{2}{4}+\frac{6}{4}+\sqrt{2}-\frac{1}{4}\right)\div 6$$
$$=\sqrt{2}\div 6$$
$$=\frac{\sqrt{2}}{6}$$

13. The table below shows a survey result of spending time on social media every day. Answer the following questions.

Spending Time (hours)	Number of People
0 to less than 1	1
1 to less than 2	3
2 to less than 3	4
3 to less than 4	5
4 to less than 5	3
5 to less than 6	2
6 to less than 7	2

(1) How many people are in the group 4 ~ 5 hours?

3 people

(2) How many people spent less than 3 hours?

1 + 3 + 4 = 8 people

(3) What percentage of the people spent 4 hours or more?

3 + 2 + 2 = 7
7 / 20 = 35 %

(4) Find the average amount of time spent on social media.

Average = (0.5 × 1 + 1.5 × 3 + 2.5 × 4 + 3.5 × 5 + 4.5 × 3 + 5.5 × 2 + 6.5 × 2) / 20
= 70 / 20
= 3.5 hours