

Japanese Grant Aid for Human Resource
Development Scholarship (JDS)
Basic Mathematics Aptitude Test
2024

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.

$$-2 + 5 - 9 = -6$$

$$-4.7 + 8.5 = 3.8$$

$$5 - 9 \div \frac{1}{3} = 5 - 27 = -22$$

$$0.6 + \frac{1}{4} - 1 = \frac{3}{5} + \frac{1}{4} - 1 = \frac{12+5-20}{20} = -\frac{3}{20} \quad \text{or} \quad -0.15$$

$$\frac{7}{2} \times -\frac{3}{7} \div \frac{3}{4} = \frac{7 \times -3 \times 4}{2 \times 7 \times 3} = -2$$

$$(3 - \sqrt{7})(2 + \sqrt{7}) = 6 + 3\sqrt{7} - 2\sqrt{7} - 7 = \sqrt{7} - 1 \text{ or } -1 + \sqrt{7}$$

$$(\sqrt{5} - 2)^2 = 5 - 6\sqrt{5} + 4 = 9 - 4\sqrt{5}$$

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

$$\left(3^5 \times \left(\frac{1}{3}\right)^3 \times 3^3\right)^{\frac{2}{5}} \div \frac{1}{3^2} = (3^5 \times 3^{-3} \times 3^3)^{\frac{2}{5}} \div 3^{-2} = 3^2 \times 3^2 = \mathbf{3^4 \text{ or } 81}$$

2. Solve the following equations or inequality.

$$x + 5 = \frac{x}{3} + 3$$

$$x - \frac{x}{3} = -5 + 3$$

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

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

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

$$\mathbf{x = -3}$$

$$\begin{cases} 5x + 3y = 4 \\ x - y = 4 \end{cases}$$

$$\begin{cases} 5x + 3y = 4 \\ 5x - 5y = 20 \end{cases}$$

$$8y = -16$$

$$\mathbf{x = 2}$$

$$\mathbf{y = -2}$$

$$-4x + 16 > 0$$

$$-4x > -16$$

$$x < \frac{-16}{-4}$$

$$\mathbf{x < 4}$$

3. Factorize the following quadratic equation. If not possible, use the solution formula to solve it.

$$x^2 - 5x + 6 = 0$$

$$(x - 3)(x - 2) = 0$$

$$x = 3, 2$$

$$x^2 - 8x = -3$$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 1 \times 3}}{2 \times 1}$$

$$x = \frac{8 \pm \sqrt{52}}{2}$$

$$x = 4 \pm \sqrt{13}$$

or-----

$$(x - 4)^2 - 16 = -3$$

$$(x - 4)^2 = 13$$

$$x - 4 = \pm \sqrt{13}$$

$$x = 4 \pm \sqrt{13}$$

Expand the following formula.

$$(2x + 3)(3x - 4)$$

$$= 6x^2 - 8x + 9x - 12$$

$$= 6x^2 + x - 12$$

4. When $a = 3$ and $b = -\frac{1}{4}$, what is the value of

$$a^2 + \frac{2}{b} - \frac{4}{3}ab - 4b^2$$

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

$$= 9 - 8 + 1 - \frac{1}{4}$$

$$= \frac{7}{4} \quad \text{or} \quad 1.75$$

5. Determine the first derivative of

$$f(x) = -3x^3 - 4x^2 + 6x + 35$$

$$f(x)' = -9x^2 - 8x + 6$$

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

$$f(x) = 4x^3 - 3x$$

$$f(x)' = 12x^2 - 3$$

$$f(a)' = 12a^2 - 3$$

7. Find definite integral of

$$\begin{aligned} \int_0^2 (4x^2 - 2x + 5) dx \\ &= \left[\frac{4}{3}x^3 - \frac{2}{2}x^2 + 5x \right]_0^2 \\ &= \left\{ \frac{4}{3}(2)^3 - 2^2 + 5 \cdot 2 \right\} - 0 \\ &= \frac{4 \times 8}{3} - 4 + 10 = \frac{32}{3} + 6 \\ &= \frac{32+18}{3} = \frac{50}{3} \end{aligned}$$

8. Find definite integral of

$$\begin{aligned} \int_1^3 (4x - 5) dx \\ &= [2x^2 - 5x]_1^3 \\ &= (18 - 15) - (2 - 5) \\ &= 3 + 3 \\ &= 6 \end{aligned}$$

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

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

1. The points on a plane coordinate, $(-6, 2)$, $(4, -3)$, and $(6, a)$, lie on the same line.
Find the value a .

This straight line is expressed as follows:

$$y = bx + c \text{ ---①}$$

Substitute points $(-6, 2)$, $(4, -3)$ into ①

$$\begin{cases} 2 = -6b + c \\ -3 = 4b + c \end{cases}$$

$$-5 = 10b \quad b = -\frac{1}{2}$$

$$-3 = 4 \times \left(-\frac{1}{2}\right) + c \quad -3 = -2 + c \quad c = -1$$

This straight line is $y = -\frac{1}{2}x - 1$ ---②

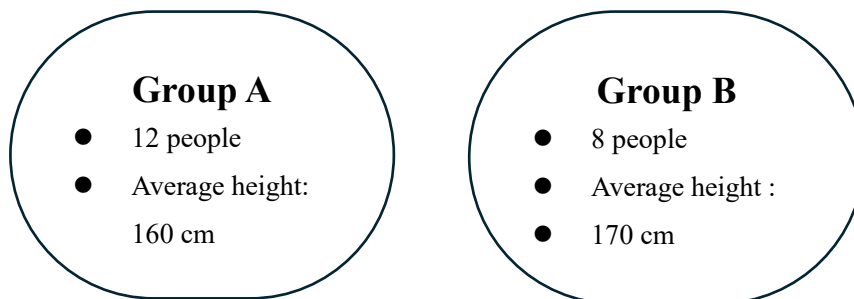
Substitute point $(6, a)$ into ②

$$a = -\frac{1}{2} \times (6) - 1 \quad \mathbf{a = -4}$$

2. Round off 53.89 AT the first decimal place.

54

3. Calculate the average height of the WHOLE people.



$$\begin{aligned} (12 \times 160\text{cm} + 8 \times 170\text{cm}) \div 20 \\ &= (1920 + 1360) \div 20 \\ &= 3280 \div 20 \\ &= \mathbf{164\text{cm}} \end{aligned}$$

4. There are 6 values below.

$$\left\{-\frac{4}{5}, \quad 0, \quad -\frac{3}{4}, \quad \frac{5}{4}, \quad \sqrt{2}, \quad -0.70\right\}$$

(1) Find the maximum value.

$$\sqrt{2}$$

(2) Find the minimum value.

$$-\frac{4}{5}$$

(3) Calculate the average of the six values.

$$\begin{aligned} & \left(-\frac{4}{5} + 0 - \frac{3}{4} + \frac{5}{4} + \sqrt{2} - 0.70\right) \div 6 \\ &= \left(-\frac{16}{20} - \frac{15}{20} + \frac{25}{20} + \sqrt{2} - \frac{14}{20}\right) \div 6 \\ &= \left(-\frac{16}{20} - \frac{15}{20} + \frac{25}{20} + \sqrt{2} - \frac{14}{20}\right) \div 6 \\ &= (-1 + \sqrt{2}) \div 6 \\ &= -\frac{1 - \sqrt{2}}{6} = \frac{\sqrt{2} - 1}{6} \end{aligned}$$

or

$$\begin{aligned} & \left(-\frac{4}{5} + 0 - \frac{3}{4} + \frac{5}{4} + \sqrt{2} - 0.70\right) \div 6 \\ &= (-0.8 - 0.75 + 1.25 + 1.414 - 0.7) \div 6 \\ &= \mathbf{0.069} \end{aligned}$$

5. The table below shows a survey result of spending time for voluntary activity each week.

Answer the following questions.

<i>Spending time (hours)</i>	<i>Number of People</i>
0 to less than 1	7
1 to less than 2	1
2 to less than 3	3
3 to less than 4	5
4 to less than 5	3
5 to less than 6	0
6 to less than 7	1

- (1) How many people are in the group 1 ~ 3 hours?

$$1 + 3 = 4 \text{ people}$$

- (2) How many people spent 4 hours or more?

$$3 + 0 + 1 = 4 \text{ people}$$

- (3) What percentage of the people spent less than 3 hours ?

$$7 + 1 + 3 = 11$$

$$11 / 20 = 55 \%$$

- (4) Find the average amount of time spent on voluntary activities.

$$\begin{aligned}
 \text{Average} &= (0.5 \times 7 + 1.5 \times 1 + 2.5 \times 3 + 3.5 \times 5 + 4.5 \times 3 + 5.5 \times 0 + 6.5 \times 1) / 20 \\
 &= (3.5 + 1.5 + 7.5 + 17.5 + 13.5 + 0 + 6.5) / 20 \\
 &= 50 / 20 \\
 &= \mathbf{2.5 \text{ hours}}
 \end{aligned}$$