

Japanese Grant Aid for Human Resource  
Development Scholarship (JDS)  
Basic Mathematics Aptitude Test  
2021

**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 (total 60 points)

1. Calculate:

$$\frac{3}{2} + 1.5 = 3$$

$$7 - (-12) = 19$$

$$-\frac{1}{7} + \left(\frac{5}{2}\right) = \frac{-2 + 35}{14} = \frac{33}{14}$$

$$\frac{1}{3} - \frac{3}{4} + \frac{5}{12} = \frac{4 - 9 + 5}{12} = \frac{0}{12} = 0$$

$$8.2 + (-3.5) = 4.7$$

$$\frac{1}{5} \div \left( \frac{2}{3} - 2 \right) = \frac{1}{5} \div \left( \frac{2-6}{3} \right) = \frac{1}{5} \times \frac{3}{-4} = -\frac{3}{20}$$

$$(x+2)(x+3) = x^2 + 5x + 6$$

$$5(3a-b) - (4a-7b) = 15a - 5b - 4a + 7b = 11a + 2b$$

$$(-1 + \sqrt{6})^2 = 1 - 2\sqrt{6} + 6 = 7 - 2\sqrt{6}$$

2. Solve:

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

$$4x + 4 = x - 8$$

$$3x = -12$$

$$x = -4$$

$$\frac{4}{x+1} = \frac{1}{7}$$

$$\frac{4}{1} = \frac{x+1}{7}$$

$$x+1 = 4 \times 7$$

$$x = 28 - 1$$

$$x = 27$$

$$\frac{x}{7} = -\frac{x}{7} + 2$$

$$x = -x + 14$$

$$2x = 14$$

$$x = 7$$

$$\begin{cases} x + 3 = 6 \\ 7x - 2y = 9 \end{cases}$$

$$x = 3$$

$$21 - 2y = 9$$

$$-2y = -12$$

$$y = 6$$

$$\begin{cases} 2x + 3y = 5 \\ 7x - 2y = 5 \end{cases}$$

$$\begin{cases} 4x + 6y = 10 \\ 21x - 6y = 15 \end{cases}$$

$$25x = 25$$

$$x = 1$$

$$4 + 6y = 10$$

$$6y = 6$$

$$y = 1$$

$$2x^2 + 7x + 3 = 0$$

$$x = \frac{-7 \pm \sqrt{7 \times 7 - 4 \times 2 \times 3}}{2 \times 2}$$

$$x = \frac{-7 \pm \sqrt{49 - 24}}{4}$$

$$x = \frac{-7 \pm \sqrt{25}}{4}$$

$$x = \frac{-7 \pm 5}{4}$$

$$x = \frac{-2}{4}, \frac{-12}{4}$$

$$x = -\frac{1}{2}, -3$$

$$-3x - 12 < 0$$

$$x > -4$$

$$(x - 6)(x - 2) \geq 0$$

$$x \leq 2, x \geq 6$$

$$\begin{aligned} \left(4 \times \left(\frac{1}{2}\right)^{-2} \times 2^3\right)^{\frac{2}{7}} \times \left(\frac{1}{2}\right)^3 &= (2^2 \times 2^2 \times 2^3)^{\frac{2}{7}} \times 2^{-3} = (2^7)^{\frac{2}{7}} \times 2^{-3} = 2^2 \times 2^{-3} \\ &= 2^{-1} = \frac{1}{2} \end{aligned}$$

3. What is the value of  $-2x + x^2 - x^3 + x^4$  when  $x = 2$  ?

$$-2x + x^2 - x^3 + x^4 = -4 + 4 - 8 + 16 = 8$$

4. What is the value of  $-2ab + a^2 - b^3 + a^4$  when  $a = -1, b = 1$  ?

$$-2ab + a^2 - b^3 + a^4 = 2 + 1 - 1 + 1 = 3$$

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

[PART II]

4 points/each question (total 40 points)

$$\left\{0.5, \quad 0, \quad 1.25, \quad \frac{3}{2}, \quad -\frac{1}{2}, \quad \frac{1}{4}\right\}$$

1. Find the average of the six values above:

$$\left\{\frac{1}{2}, \quad 0, \quad \frac{5}{4}, \quad \frac{3}{2}, \quad -\frac{1}{2}, \quad \frac{1}{4}\right\}$$

$$\frac{1}{2} + 0 + \frac{5}{4} + \frac{3}{2} - \frac{1}{2} + \frac{1}{4} = \frac{2 + 5 + 6 - 2 + 1}{4} = \frac{12}{4} = 3$$

$$3 \div 6 = \frac{1}{2}$$

2. Find the maximum value of the six values above.

$$\frac{3}{2}$$

3. Find the minimum value of the six values above.

$$-\frac{1}{2}$$

4. Find the median of the six values above.

$$\frac{1}{4} + \frac{1}{2} = \frac{3}{4}$$

$$\frac{3}{4} \div 2 = \frac{3}{8} = 0.375$$

5. Round off 4.249 to the first decimal place.

4.2

6. The points on a plane coordinate,  $(1, 3)$ ,  $(-5, -9)$ , and  $(4, \mathbf{a})$ , lie on the same line. Find the value  $\mathbf{a}$ .

$$y = 2x + 1$$

$$a = 9$$

7. Mr. Smith asked 10% discount and bought a smartphone for 540 dollars. What was the original price of it?

$$x - 0.1x = 540$$

$$0.9x = 540$$

$$x = 600 \text{ dollars}$$



8. There are two girls named Kate and Amy. The sum of their ages is 42. The difference between each girl's age is 8. Kate is older than Amy. Find the ages of each girl.

$$\text{Kate} + \text{Amy} = 42$$

$$\text{Kate} - \text{Amy} = 8$$

$$2 \text{ Kate} = 50$$

$$\text{Kate} = 25 \text{ years old}$$

$$\text{Amy} = 42 - 25 = 17 \text{ years old}$$

9. Naomi gathered the data of children's height in a classroom as following table. Find the values of  $a$ ,  $b$ ,  $c$ , and  $d$  on the table. (1 point/each, total 4 points)

Height (cm)	Number of students	Percentage
Below 140	2	5 %
140 to 144	8	<b>c</b>
145 to 149	<b>a</b>	20 %
150 to 154	11	27.5 %
155 to 159	9	<b>d</b>
Above 160	2	5 %
<b>Total</b>	<b>b</b>	<b>100 %</b>

$$b = \frac{2 \times 100}{5} = 40 \text{ people}$$

$$c = \frac{8}{40} \times 100 = 20 \%$$

$$a = 40 \times \frac{20}{100} = 8 \text{ people}$$

$$d = \frac{9}{40} \times 100 = 22.5 \%$$

10. There is a job that takes 20 days to do alone by Tom or 30 days to do alone by Bob. On this job, at first Bob works by himself for 5 days. After that Tom and Bob work together and finish it. All together how many days does it take to complete the job?

Tom:

$$\frac{1}{20} \text{ job/day}$$

Bob

$$\frac{1}{30} \text{ job/day}$$

When Tom and Bob work together,

$$\left(\frac{1}{20} + \frac{1}{30}\right) \text{ job/day}$$

$$\left(\frac{3+2}{60}\right) \text{ job/day}$$

$$\left(\frac{5}{60}\right) \text{ job/day}$$

$$\left(\frac{1}{12}\right) \text{ job/day}$$

Bob works 5 days at first. Then Bob can complete  $\frac{1}{6}$  job by himself.

$$\frac{1}{30} \times 5 \text{ days} = \frac{1}{6}$$

The remaining  $\frac{5}{6}$  is shared by Tom and Bob, which takes 10 days

$$\frac{5}{6} \div \left(\frac{1}{12}\right) = 10 \text{ days}$$

Until the job is completed, it takes

$$5 + 10 = 15 \text{ days}$$