Project for Human Resource Development Scholarship (JDS)
Basic Mathematics Aptitude Test
2019

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 and Part II are 'Basic Math,' and Part III 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]   Answer the following questions.   **Points: 3/each, Total:30**

1. $-10.5 + (-8.3)$

$$= -10.5 - 8.3 = -18.8$$

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

$$= -6 - (-21) = -6 + 21 = 15$$

3. $2^0 \times 3^1 \times 4^2$

$$= 1 \times 3 \times 16 = 48$$

4. $\left(\frac{7}{5} - \frac{1}{3}\right) \div \frac{4}{5}$

$$= \left(\frac{21}{15} - \frac{5}{15}\right) \div \frac{4}{5} = \left(\frac{16}{15}\right) \div \frac{4}{5} = \frac{16}{15} \times \frac{5}{4} = \frac{4}{3}$$

5. $0.5 \times \frac{\frac{4}{2}}{\frac{1}{4}} \div \left(1.25 - \frac{1}{4}\right)$

$$= \frac{1}{2} \times \frac{8}{1} \div (1.25 - 0.25) = 4 \div 1 = 4$$

6. $\left(\frac{1}{5}\right)^{-2} + 100^{\frac{1}{2}}$

$$= 5^2 + \sqrt{100} = 25 + 10 = 35$$

7. $\sqrt{27} \div \sqrt{3}$

$$= \sqrt{\frac{27}{3}} = \sqrt{9} = \pm 3$$

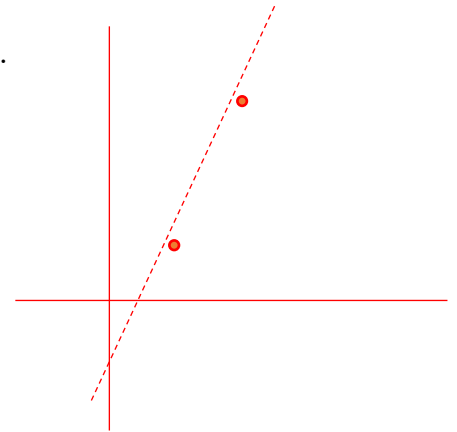8. Find the linear function passing through the following 2 points.
$$(x, \quad y) = (1, \quad 1) \text{ and } (x, \quad y) = (2, \quad 3)$$

Slope 2
$$y = 2x + a$$
$$a = -1$$
$$y = 2x - 1$$

9. Find the solutions.
$$(x - 8)(2x + 1) + 26 = 0$$

$$2x^2 - 16x + x - 8 + 26 = 0$$
$$2x^2 - 15x + 18 = 0$$
$$x = \frac{-(-15) \pm \sqrt{(-15)^2 - 4 \times 2 \times 18}}{2 \times 2}$$
$$x = \frac{15 \pm 9}{4}$$
$$x = 6, \quad \frac{3}{2}$$

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10. Find the solutions.

$$\frac{1}{6}x^2 + \frac{1}{3}x - 1 = 0$$

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

$$x = \frac{-2 \pm \sqrt{2^2 - 4 \times 1 \times (-6)}}{2 \times 1}$$

$$x = \frac{-2 \pm \sqrt{4 + 24}}{2}$$

$$x = -1 \pm \sqrt{7}$$

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

[PART II] Answer the following questions. **Points: 5/each, Total:35**

1. Find the maximum value and the minimum value among the six values below.

$$\left\{\frac{15}{16}, \ -\frac{3}{4}, \ 0.8, \ -1, \ -\frac{15}{16}, \ 0.35\right\}$$

$$\frac{15}{16} = 0.9375, -\frac{3}{4} = -0.75$$

$$\{0.9375, \ -0.75, \ 0.8, \quad -1, \ -0.9375, \ 0.35\}$$
$$\{-1, \ -0.9375, \quad -0.75, \ 0.35, \quad 0.8, \ 0.9375\}$$

$$Max \ value = \frac{15}{16}$$
$$Min \ value = -1$$

※両方正解で 5 点、片方なら 3 点

2. Find the average of the six values above.

$$\frac{(0.9375 - 0.75 + 0.8 - 1 - 0.9375 + 0.35)}{6} = -0.1$$
$$-0.1$$

3. Round off 3.14159265359 to the hundredths digit (the second decimal place).

3.14

4. There are two values. The sum of the values is 9 and the difference of the values is 25. Find these two values.

$$\begin{cases} a + b = 9 \\ a - b = 25 \end{cases}$$
$$a = 17, b = -8$$
$$17, -8$$

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5. There are 2 numbers. Adding twice of the larger number and three times of the smaller number becomes 10. Subtracting 4 times of the smaller number from three times of the larger number becomes 32. Find these 2 numbers.

$$\begin{cases} 2a + 3b = 10 \\ 3a - 4b = 32 \end{cases}$$
$$a = 8, b = -2$$
$$8, -2$$

6. Solve the following inequality for x.

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

$$1 + 5x \leq -2$$
$$5x \leq -3$$
$$x \leq -\frac{3}{5}$$

7. Solve the following inequality for x.
$$3^{3x+2} > 1$$

$$3^{3x+2} > 3^0$$
$$3x + 2 > 0$$
$$3x > -2$$
$$x > -\frac{2}{3}$$

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

[PART III]   Answer the following questions.   **Points: 7/each, Total:35**

1.   Ken heard a sound that fell on water 111/17 seconds later after he dropped a stone from a bridge. The distance of dropping stone t seconds later is expressed *5t²* meters and the speed of sound in the air is 340 m/s. Find the distance from the bridge to the surface of water.

$$\frac{5x^2}{340} + x = \frac{111}{17}$$
$$5x^2 + 340x = 20 \times 111$$
$$5x^2 + 340x - 2220 = 0$$
$$x^2 + 68x - 444 = 0$$
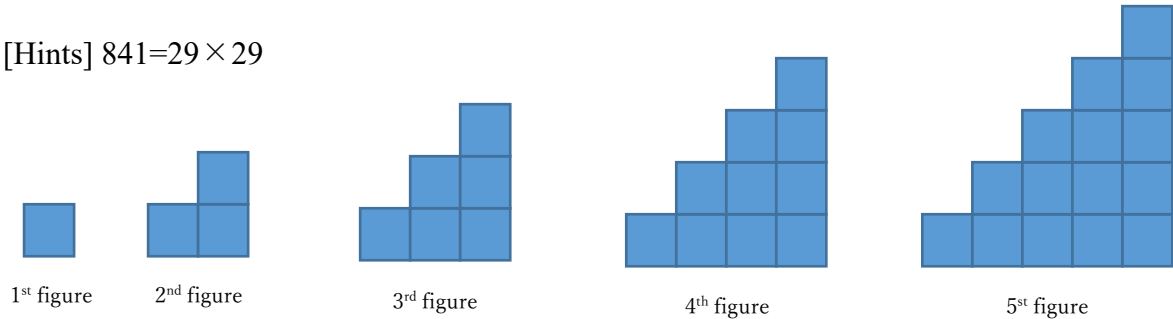$$(x + 74)(x - 6) = 0$$
$$x = 6, -74$$

$$x > 0 \qquad x = 6 \, sec$$

$$distance = 5 \times 6^2$$
$$180 \, m$$

※距離（180m）でなく、時間（6秒）を答えた人には3点。

2. As the figure below, with arranging a 1-cm square, creates 1st figure, 2nd figure, 3rd figure, 4th figure, …… (The same applies to the following.) Which figure will have the area of *105 cm²*?

[Hints] 841=29×29

| 1st figure | 2nd figure | 3rd figure | 4th figure | 5st figure |

$$(x \times x)\frac{1}{2} + x\frac{1}{2} = 105cm^2$$

$$x^2\frac{1}{2} + x\frac{1}{2} = 105$$

$$x^2 + x = 210$$

$$x^2 + x - 210 = 0$$

$$(x + 15)(x - 14) = 0$$

$$x = -15, \quad 14$$

$$x > 0 \quad x = 14$$

$$14th\ figure$$

3. Solve the following equation.

$$\log_{\frac{1}{5}} x = -1$$

$$log_{\frac{1}{5}} x = log_{\frac{1}{5}}(\frac{1}{5})^{-1}, \qquad x = 5$$

4. Determine the first-derivative of the following.

$$f(x) = 3x^3 - 2x^2 + x - 1$$

$$f(x)' = 9x^2 - 4x + 1$$

5. Find the following definite integral.

$$\int_1^2 (6x + 4)\, dx$$

$$[3x^2 + 4x]_1^2 = (12 + 8) - (3 + 4) = 20 - 7 = 13$$