

編入学試験問題集

令和7年度

■令和7年度編入学試験（一般学力）

数学	1
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金沢工業大学

数学 問題

問題 1 行列式 $\begin{vmatrix} a+1 & a & a-1 \\ a & a-1 & a+1 \\ a-1 & a+1 & a \end{vmatrix}$ を計算せよ.

問題 2 行列 $A = \begin{pmatrix} 1 & 2 \\ 3 & -4 \end{pmatrix}$ について

- (1) 行列 A の固有値を求めよ.
- (2) (1) で求めた固有値に対応する固有ベクトルを求めよ.

問題 3 次の関数を微分せよ.

- (1) $y = \log(x^2 + 1)$
- (2) $y = \sin^{-1} \sqrt{x}$ [ここで $\sin^{-1} t$ は $\sin t$ の逆関数である]
- (3) $y = \frac{e^x - 1}{e^x + 1}$

問題 4 次の定積分を求めよ.

- (1) $\int_0^1 x^2 e^x dx$
- (2) $\int_0^{\frac{\pi}{2}} \frac{\sin x}{1 + \cos x} dx$

問題 5 次の各問いに答えよ.

- (1) 微分方程式 $\frac{dy}{dx} + 2xy = 0$ の一般解を求めよ.
- (2) 微分方程式 $\frac{dy}{dx} + 2xy = xe^{-x^2}$ の一般解を求めよ.

問題 6 2重積分 $I = \iint_D xy dx dy$ ($D: 0 \leq x \leq 1, x \leq y \leq 2-x$) について

- (1) 領域 D を図示せよ.
- (2) 2重積分 I の値を求めよ.

問題 7 2変数関数 $f(x, y) = x \log x + y \log y$ について, 次の問いに答えよ.

- (1) 第1次偏導関数および第2次偏導関数を求めよ.
- (2) $f(x, y)$ の極値を求めよ.

外国語(英語) 問題

A. 空所に適切な単語を以下の選択肢 A.~T.から一つ選び、書き入れなさい。各選択肢は一回のみ使うことができます。文頭にくるものも小文字で書いてあります。

空所 1~10 :

- | | | | |
|-------------|-------------|--------------|---------------|
| A. affected | B. approach | C. depend on | D. focused on |
| E. largest | F. like | G. more | H. nearly |
| I. problems | J. ranks | | |

空所 11~20 :

- | | | | |
|---------------|-------------|------------------|--------------|
| K. assistance | L. budget | M. characterized | N. different |
| O. frequently | P. goal | Q. popular | R. reduces |
| S. something | T. suggests | | |

As one of the world's major industrialized countries, Japan consumes a lot of energy. In fact, Japan 1[] fifth in the world when it comes to energy consumption, behind the United States, China, Russia, and India. And 2[] many industrialized countries, Japan relies on fossil fuels for most of this energy. 3[] 90% of Japan's energy comes from oil, natural gas, and coal, with just over 10% coming from nuclear, hydroelectric power, and other renewable energy sources. There are two big 4[] with Japan's energy supply. First, its reliance on fossil fuels is bad for the environment. On top of that, Japan imports over 90% of its oil from other countries, and it is the 5[] importer of liquid natural gas in the world. This means that Japan must 6[] other countries for its energy supply. However, a recent trend around the country is solving both of these problems by creating small, local power supplies that also use 7[] renewable energy sources.

The 2011 Tohoku earthquake and tsunami 8[] many towns in northern Japan, and many lost their ability to generate electricity for an extended period of time. In one such town, Higashi-Matsushima, Miyagi, 75% of the houses were destroyed by the disaster. When it came time to rebuild its electricity system, the town decided to take a new 9[]. Rather than relying only on the region's large electricity provider, Higashi-Matsushima 10[] creating "micro-grids."

Most modern energy systems are built around a central power plant that provides electricity for a large area. If **11**[] happens to the central power plant, the entire area can lose electricity. Micro-grids, as their name **12**[], are smaller energy systems that provide electricity for a more limited area.

Micro-grids are **13**[] by three features. First, they are local, meaning that they create energy for people who live nearby. A micro-grid could generate electricity for a college campus, a neighborhood, or even a hospital. Second, they are independent. Even though many micro-grids are connected to a larger electricity grid, they can operate on their own if there is a problem with the larger grid. What's more, they **14**[] generate electricity from several sources, such as solar panels, wind turbines, batteries, and generators. If there is a problem with one energy source, the micro-grid can use a **15**[] one. Finally, micro-grids are intelligent. They use the internet to control appliances and electricity meters so that power can be sent to different parts of the grid at different times, better meeting the needs of its users.

In Higashi-Matsushima, the **16**[] of the micro-grid is not to be the main power source. Instead, it acts as a backup in case another natural disaster occurs while providing 25% of the town's normal energy needs. If Higashi-Matsushima experiences another extended power outage, its micro-grid can provide electricity to the town for three days.

The success of Higashi-Matsushima's micro-grid has made the concept more **17**[] across Japan, and it even caught the eye of the Japanese government. The government's National Resilience Program provides financial **18**[] to towns that have to rebuild after natural disasters. After observing how effective Higashi-Matsushima's micro-grid was, the government decided to increase the program's **19**[] by 24% and encourage other towns to create micro-grids.

While Japan will never stop experiencing natural disasters, it is finding ways to be more prepared for them in the future. At the same time, the country is creating an energy system that is better for the environment and **20**[] the need to rely on other countries for its energy needs.

B. 次の日本語の意味を表す英文になるように、1.~8.の英単語を全て使って最も適切な順番に並べ、空所に書きなさい。文頭にくるものも小文字で書いてあります。また、必要なコンマが省略されている場合もあります。

(ア) 明日は一日中雨が降りそうだ。

_____ tomorrow.

- | | | | |
|-------------|---------|---------|---------|
| 1. all | 2. day | 3. it | 4. it's |
| 5. possible | 6. rain | 7. that | 8. will |

(イ) 弟は昨夜23時まで映画を見続けた。

My _____ night.

- | | | | |
|-----------|------------|-------------|------------|
| 1. 23:00 | 2. brother | 3. kept | 4. last |
| 5. movies | 6. until | 7. watching | 8. younger |

(ウ) 先生は今日機嫌が悪そうだ。

_____ today.

- | | | | |
|---------|----------|----------------|-------|
| 1. a | 2. bad | 3. be | 4. in |
| 5. mood | 6. seems | 7. the teacher | 8. to |

(エ) 自分たちの仕事がAIに取って代わられると心配する人たちもいる。

Some people worry _____.

- | | | | |
|-------------|---------|----------|---------|
| 1. AI | 2. be | 3. by | 4. jobs |
| 5. replaced | 6. that | 7. their | 8. will |

(オ) 学生全員が授業に来たわけではない。

_____.

- | | | | |
|--------|-------------|----------|--------|
| 1. all | 2. came | 3. class | 4. not |
| 5. of | 6. students | 7. the | 8. to |

[以上、試験問題終了]

■ 解答

問題 1
$$\begin{vmatrix} a+1 & a & a-1 \\ a & a-1 & a+1 \\ a-1 & a+1 & a \end{vmatrix} = \begin{vmatrix} 3a & a & a-1 \\ 3a & a-1 & a+1 \\ 3a & a+1 & a \end{vmatrix} = 3a \begin{vmatrix} 1 & a & a-1 \\ 1 & a-1 & a+1 \\ 1 & a+1 & a \end{vmatrix} = 3a \begin{vmatrix} 1 & a & a-1 \\ 0 & -1 & 2 \\ 0 & 1 & 1 \end{vmatrix} = 3a \begin{vmatrix} -1 & 2 \\ 1 & 1 \end{vmatrix} = -9a$$

問題 2 (1)
$$\begin{vmatrix} 1-\lambda & 2 \\ 3 & -4-\lambda \end{vmatrix} = 0, (1-\lambda)(-4-\lambda) - 6 = 0, \lambda^2 + 3\lambda - 10 = 0, (\lambda+5)(\lambda-2) = 0, \lambda = -5, 2$$

よって、 A の固有値は $-5, 2$ である。

(2) $\lambda = -5$ のとき、 $\begin{pmatrix} 6 & 2 \\ 3 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ より $3x + y = 0$ であるから、
 -5 の固有ベクトルは、 $x = t_1 (t_1 \neq 0)$ とおけば $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} t_1 \\ -3t_1 \end{pmatrix} = t_1 \begin{pmatrix} 1 \\ -3 \end{pmatrix} (t_1 \neq 0)$

$\lambda = 2$ のとき、 $\begin{pmatrix} -1 & 2 \\ 3 & -6 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ より $-x + 2y = 0$ であるから、

2 の固有ベクトルは、 $y = t_2 (t_2 \neq 0)$ とおけば $\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2t_2 \\ t_2 \end{pmatrix} = t_2 \begin{pmatrix} 2 \\ 1 \end{pmatrix} (t_2 \neq 0)$

問題 3 (1) $y' = \frac{2x}{x^2 + 1}$

(2) $y' = \frac{1}{\sqrt{1-(\sqrt{x})^2}} \left(\frac{1}{2\sqrt{x}}\right) = \frac{1}{2\sqrt{x(1-x)}}$

(3) $y' = \frac{e^x(e^x+1) - (e^x-1)e^x}{(e^x+1)^2} = \frac{2e^x}{(e^x+1)^2}$

問題 4 (1) $\int_0^1 x^2 e^x dx = [x^2 e^x]_0^1 - 2 \int_0^1 x e^x dx = e - 2 \left\{ [x e^x]_0^1 - \int_0^1 e^x dx \right\} = e - 2 \left\{ e - [e^x]_0^1 \right\} = e - 2$

(2) $1 + \cos x = t$ とおくと、 $\sin x dx = -dt, \frac{x}{t} \Big|_{0 \rightarrow \pi/2}^{2 \rightarrow 1}, \int_0^{\pi/2} \frac{\sin x}{1 + \cos x} dx = - \int_2^1 \frac{1}{t} dt = [\log t]_1^2 = \log 2$

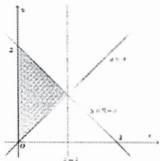
問題 5 (1) $\int \frac{1}{y} dy = -2 \int x dx, \log|y| = -x^2 + C, y = \pm e^C e^{-x^2} (C \text{ は積分定数}).$

$\pm e^C$ を C に置きなおして $y = C e^{-x^2} (C \text{ は積分定数})$

(2) (1) に対し定数変化法を用いる。 $C = u(x)$ とおいて微分方程式に代入すると、

$$\left\{ u(x)e^{-x^2} \right\}' + 2x(u(x)e^{-x^2}) = xe^{-x^2}, u'(x)e^{-x^2} + u(x) \cdot (-2xe^{-x^2}) + u(x)2xe^{-x^2} = xe^{-x^2}, u'(x)e^{-x^2} = xe^{-x^2}, u'(x) = x.$$

任意定数を C とすれば $u(x) = \frac{1}{2}x^2 + C$. よって、求める一般解は $y = \left(\frac{1}{2}x^2 + C\right)e^{-x^2}$

問題 6 (1)  (2)
$$\begin{aligned} \int_0^1 x \int_x^{2-x} y dy dx &= \int_0^1 x \left[\frac{1}{2} y^2 \right]_x^{2-x} dx = \frac{1}{2} \int_0^1 x \{ (2-x)^2 - x^2 \} dx \\ &= 2 \int_0^1 (-x^2 + x) dx = 2 \left[-\frac{1}{3} x^3 + \frac{1}{2} x^2 \right]_0^1 = 2 \left(-\frac{1}{3} + \frac{1}{2} \right) = \frac{1}{3} \end{aligned}$$

問題 7 (1) 第 1 次偏導関数は $f_x(x, y) = \log x + 1, f_y(x, y) = \log y + 1$

第 2 次偏導関数は $f_{xx}(x, y) = \frac{1}{x}, f_{xy}(x, y) = f_{yx}(x, y) = 0, f_{yy}(x, y) = \frac{1}{y}$

(2) $f_x = 0, f_y = 0$ より $\log x + 1 = 0, \log y + 1 = 0, x = e^{-1}, y = e^{-1}$. よって、臨界点は $(x, y) = (e^{-1}, e^{-1})$ である。

$f_{xx}(e^{-1}, e^{-1}) = e, f_{yy}(e^{-1}, e^{-1}) = e, f_{xy}(e^{-1}, e^{-1}) = 0$ であるから

$H(e^{-1}, e^{-1}) = \begin{vmatrix} e & 0 \\ 0 & e \end{vmatrix} = e^2 > 0, f_{xx} = e > 0$ であるので、 $f(x, y)$ は (e^{-1}, e^{-1}) で極小となる。

$f(e^{-1}, e^{-1}) = e^{-1} \log e^{-1} + e^{-1} \log e^{-1} = -\frac{2}{e}$ であるから、 $f(x, y)$ は $(x, y) = (e^{-1}, e^{-1})$ のとき極小値 $-\frac{2}{e}$ をとる。

■解答

A.

- | | | | | |
|-------|-------|-------|-------|-------|
| 1. J | 2. F | 3. H | 4. I | 5. E |
| 6. C | 7. G | 8. A | 9. B | 10. D |
| 11. S | 12. T | 13. M | 14. O | 15. N |
| 16. P | 17. Q | 18. K | 19. L | 20. R |

B.

ア. 4 5 7 3 8 6 1 2

It's possible that it will rain all day tomorrow.

イ. 8 2 3 7 5 6 1 4

My younger brother kept watching movies until 23:00 last night.

ウ. 7 6 8 3 4 1 2 5

The teacher seems to be in a bad mood today.

エ. 6 7 4 8 2 5 3 1

Some people worry that their jobs will be replaced by AI.

オ. 4 1 5 7 6 2 8 3

Not all of the students came to class.