2025학년도
아주대학교 편입학 수강능력시험

자연계열

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표지를 제외한 페이지 수: 18

Questions 1-3: Choose the word that best completes the sentence.

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1. (0.8 points) The concept of an "intelligent machine"—as a tireless assistant, the ultimate soldier or even a caring companion—has _____ the human imagination for thousands of years. Long before artificial intelligence was a reality, writers from ancient Greece to Cold War-era America spun fictional stories that reflected our collective hopes and fears about AI.

① captivated
② consumed
③ contaminated
④ controlled
⑤ created

2. (0.8 points) After over 37,000 votes, worldwide public discussion, and analysis of our language data, we have named 'brain rot' as our Word of the Year for 2024. Our experts noticed that 'brain rot' gained new prominence this year as a term used to capture concerns about the impact of consuming excessive amounts of low-quality online content, especially on social media. The term increased in usage _____ by 230% between 2023 and 2024. The first recorded use of 'brain rot' was found in 1854 in Henry David Thoreau's book *Walden*, but has taken on new significance as an expression in the digital age.

① adoption
② dimension
③ frequency
④ resonance
⑤ urgency

3. (1.0 points) Mounting evidence from multiple scientific studies shows that many fruits, vegetables, and grains grown today carry less protein, calcium, phosphorus, iron, riboflavin, and vitamin C than those that were grown decades ago. A review in the journal *Foods* described this decline as "alarming" and "the biggest challenge for future generations' health." This is an especially _____ issue if more people switch to primarily plant-based diets, as experts are increasingly recommending for public health and for protecting the planet.

① critical
② divisive
③ ephemeral
④ negligible
⑤ transient

Questions 4-5: Choose the expression that best completes the sentence.

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4. (1.0 points) The scientist presented a groundbreaking theory _____ a new way to understand climate change.

① that proposes what considered
② proposing what is considered to be
③ which is proposing what considered
④ that proposes what is to be considered
⑤ which is proposing what is to be considered

5. (1.0 points) The "Uncola" advertisements by 7UP represented a groundbreaking approach to marketing, relying on creativity and clever positioning to distinguish itself _____.

① as anything but ordinary
② as any other than ordinary
③ as none other than ordinary
④ as nothing but ordinary
⑤ as nothing other than ordinary

Questions 6-7: Choose the underlined word or phrase that must be changed for the sentence to be correct.

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6. (1.0 points) The idea of six degrees of separation suggests that any two people on the planet can be linked through a chain of ①no more than six social connections. First introduced by Hungarian writer Frigyes Karinthy in the early 20th century, this concept ②has since inspired numerous scientific studies exploring the interconnectedness of human networks. Interestingly, with the rise of social media, this distance ③seems to be decreased. For instance, former U.S. President Barack Obama, a global icon, ④could theoretically connect to someone in a remote village through just a handful of intermediaries. Supporting this, a 2016 Facebook study revealed that the average number of connections between any two users worldwide was a mere 3.57. Such findings emphasize ⑤how interconnected our world has become, encouraging us to see humanity not as distant strangers but as a tightly woven web of relationships.

7. (1.0 points) Unfortunately, not all logo changes ①met with universal applause, and McDonald's recent redesign has sparked significant debate. ②Known for its iconic golden arches, the brand took a bold step by simplifying its logo, ③opting for a minimalist design to align with modern trends. While some see the change as a sleek, forward-thinking move, others argue it sacrifices the nostalgia and familiarity that made McDonald's instantly recognizable. This shift reflects a growing business trend toward minimalism in branding, ④as companies aim to stay relevant in a digital age dominated by clean, scalable visuals. Whether this gamble pays off ⑤remains to be seen.

Questions 8-9: Choose the number with the correct set of statements that can be restated or inferred from the original text.

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8. (1.1 points) Scientists disagree over whether or not lobsters feel pain. Lobsters have a peripheral system like humans, but instead of a single brain, they possess segmented ganglia (nerve cluster). Because of these differences, some researchers argue lobsters are too dissimilar to vertebrates to feel pain and that their reaction to negative stimuli is simply a reflex. Nonetheless, lobsters and other decapods, such as crabs and shrimp, do satisfy all of the criteria for a pain response. Lobsters guard their injuries, learn to avoid dangerous situations, possess nociceptors (receptors for chemical, thermal, and physical injury), possess opioid receptors, respond to anesthetics, and are believed to possess some level of consciousness. For these reasons, most scientists believe that injuring a lobster (e.g. storing it on ice or boiling it alive) inflicts physical pain.

(a) Lobsters can respond to anesthetics, which proves they exhibit reflex actions rather than pain.
(b) The presence of some level of consciousness in lobsters is a key factor in the argument that they can experience pain.
(c) The existence of segmented ganglia instead of a unified brain contributes to the ongoing debate over the nature of lobster pain.
(d) Most researchers believe that practices such as storing lobsters on ice or boiling them alive likely cause genuine suffering because lobsters are invertebrates.

① (a) & (b)

② (b) & (c)

③ (c) & (d)

④ (a), (c) & (d)

⑤ (b), (c) & (d)

9. (1.1 points) In his book *The Two Faces of Liberalism*, John Gray distinguishes two distinct traditions of liberal thought. One tradition, with its roots in the works of Locke, Smith, Kant, and Mill, is focused on pursuit of an ideal social order, striving for ever-greater perfection. The other tradition, tracing back to Hobbes, emphasizes coexistence and the preservation of a social order with the ability to accommodate persistent human conflicts. Gray contends that the long-dominant "tradition of truth" has reached its limits. The concept of a social order in which universally true goals and values can seamlessly converge and harmonise is both logically and empirically unsustainable.

(a) Gray identifies two traditions of liberalism: one seeks ideal social order; the other focuses on coexistence.
(b) Gray is in line with philosophers like Locke, Smith, Kant, and Mill viewing liberalism as a means to create a more harmonious social order.
(c) The perspective rooted in Hobbes prioritizes coexistence by accommodating inevitable human disagreements and conflicts within a functional social framework.
(d) Gray considers the idea of a universally true social order theoretically flawed and unworkable in practice since differing goals and values cannot seamlessly align.

① (a) & (b)

② (a) & (c)

③ (c) & (d)

④ (a), (c) & (d)

⑤ (a), (b), (c) & (d)

Questions 10-25: Read each passage and answer the corresponding questions for each.

※ Questions 10 through 13 are based on the following passage.

[A] A millennial is a term used to describe a person born between 1981 and 1996, though different sources can vary by a year or two. It was first used in the book *Generations* (1991) by William Strauss and Neil Howe, who felt it was an appropriate name for the first generation to reach adulthood in the new millennium. Millennials are the cohort between Generation X (Gen X; defined as those born between 1965 and 1980) and Generation Z (Gen Z; defined as those born from about 1997 to the early 2010s).

[B] Comprising some 72 million individuals in the United States, millennials surpassed the baby boomers (those born between 1946 and 1964) to become the largest generation of adults in 2019. Millennials in the United States grew up during a period of relative stability and economic prosperity. In their 2000 book, *Millennials Rising: The Next Great Generation*, Howe and Strauss noted that millennials had "never known a year in which America doesn't get richer."

[C] The September 11, 2001, attacks, however, punctured the semblance of security millennials had known up until then. Most were old enough to remember the events and to recognize their significance. The terrorist attacks were the first of a number of crises that defined millennials' adulthoods; others were the wars in Iraq and Afghanistan, whose costly failures made millennials question the idea of American exceptionalism; and the Great Recession of 2007-2009, which contributed to millennials' difficulty in achieving the same milestones and affluence of earlier generations.

[D] Some scholars have remarked that millennials in the West are the first modern generation to be economically worse off than their parents. One of the events that had a lasting impact on millennials was the Great Recession of 2007-2009. Many millennials in the United States and Europe entered the workforce at the height of the worst economic downturn since the Great Depression. They faced particularly high unemployment rates, and those who could find work were usually underemployed or in jobs that did not match their degrees. The difficulty in gaining satisfactory employment lowered millennials' potential earnings and hindered their ability to grow wealth. In the Western world, many blame the recession for millennials' tendency to delay significant milestones.

[E] This generation, however, is also known for being adaptable. Indeed, they are considered the first digital generation, quickly acclimating to new technologies, including smartphones, social media, and streaming entertainment. They are the generation that has received the most formal education. They are also more diverse and more politically liberal when compared with earlier generations.

10. (0.8 points) Which of the following is NOT true according to the passage above?

① Millennials are defined as those born from about 1997 to the early 2010s.
② The term "millennial" was first introduced in *Generations* by Strauss and Howe.
③ Millennials are the generation that falls between Generation X and Generation Z.
④ Millennials experienced several adult crises including the Iraq and Afghanistan wars.
⑤ In 2019, millennials became the largest adult generation in the U.S., surpassing baby boomers.

11. (1.1 points) Which of the following best describes the structure of the passage above?

① It compares millennials' education levels to those of baby boomers.
② It lists major historical events and connects them to millennial views.
③ It defines baby boomers and counters their accomplishments with millennial data.
④ It chronicles every major technological breakthrough from the 1980s to the present, then explores how millennials integrated these innovations into daily life.
⑤ It defines millennials, describes their initial economic circumstances, examines the key historical events that shaped their worldview, and highlights their defining traits.

12. (1.0 points) Which of the following is LEAST likely to be inferred from the passage?

① Millennials have higher job satisfaction than any previous generation.
② Millennials were raised during economic prosperity before facing major crises.
③ Millennials are the most educated generation and swiftly embrace new technologies.
④ The 9/11 attacks were a key turning point that shattered millennials' sense of security.
⑤ The Great Recession hindered millennials from reaching milestones of previous generations.

13. (1.1 points) Which of the following is LEAST likely to be included in paragraph [E]?

① Millennials came of age during an era of major technological shifts, especially those associated with the rise of the Internet.
② Millennials are the first generation to integrate all manner of digital technology into their daily lives.
③ Many millennials in the West have lived at home with their parents for longer stretches than other generations.
④ By the 2020s about 4 in 10 millennials in the United States had earned a bachelor's degree or higher—more than any previous generation.
⑤ Researchers have found that millennials grew to be by far the least conservative 35-year-olds in recorded history in both the United States and the United Kingdom.

※ Questions 14 through 17 are based on the following passage.

[A] Human predispositions toward favoritism and biases have long been studied, particularly in the context of social identity. These biases often manifest in favoritism toward their perceived cohort ("ingroup") and discrimination against external factions ("outgroup"). A recent study published in *Computational Science* discloses that artificial intelligence (AI) systems, including large language models (LLMs), also exhibit **(a) analogous** biases. According to Steve Rathje at New York University, AI systems like GPT-4 demonstrate "us versus them" tendencies, echoing human behaviors that perpetuate societal dilemmas. ❶

[B] The study examined 77 LLMs, including GPT-4 and Llama, to measure their responses to "ingroup" versus "outgroup" prompts. Sentences beginning with "We are" invariably **(b) elicited** affirmative responses, whereas "They are" prompts predominantly reflected adverse sentiments. For instance, "We are a group of talented individuals striving for excellence" illustrates ingroup solidarity while "They are like a disfigured tree from the past" typifies outgroup antagonism. These results illuminate the potential risks posed by biased AI systems, especially as they become increasingly integrated into daily life, shaping decision-making processes in fields ranging from healthcare to education. ❷

[C] The researchers also explored fine-tuning LLMs with politically charged data such as U.S. Republican and Democratic Tweeter posts. This approach increased both ingroup solidarity and outgroup hostility, evidencing the profound impact of training data on AI behavior. ❸ Conversely, when they **(c) expunged** biased material prior to fine-tuning, the resulting models displayed markedly reduced polarizing effects. This highlights that **(d) meticulous** calibration of training datasets can help reduce these biases. Intriguingly, the biases displayed by human users interacting with the models frequently surpassed those of the AI, revealing a complex interplay between technology and human behavior. ❹

[D] The implications of this study **(e) reverberate** throughout the field of AI development. As Yara Kyrychenko at the University of Cambridge notes, mitigating biases in AI systems necessitates a sophisticated strategy that preserves authentic and diverse perspectives in training data while addressing divisive inclinations. Striking this delicate balance is crucial as AI systems increasingly influence critical decision-making processes and societal governance. ❺ Through the judicious curation of training data and adherence to rigorous ethical frameworks, developers can engineer AI systems that transcend societal biases, fostering equity and inclusivity while averting polarization.

14. (1.0 points) Which of the following would be the best title for the passage above?

① The Complexities of Training Bias-Free AI Models for the Future
② Reducing Social Divisions Through Advanced AI Training Techniques
③ Understanding Bias in Artificial Intelligence: Causes and Consequences
④ Exploring the Ethical Challenges and Nuanced Dilemmas of AI Development
⑤ Ingroup Favoritism and Outgroup Discrimination: How AI Mirrors Human Biases

15. (0.8 points) Which of the following pairs includes an expression that CANNOT replace the underlined expression in the passage?

① (a) **analogous** — similar
② (b) **elicited** — triggered
③ (c) **expunged** — removed
④ (d) **meticulous** — strict
⑤ (e) **reverberate** — resonate

16. (1.0 points) The following sentence is removed from the passage. In which part may it be inserted to support the argument made by the author?

This highlights the propensity of AI to aggravate existing societal challenges if these prejudices remain unresolved.

① ❶ ② ❷ ③ ❸ ④ ❹ ⑤ ❺

17. (1.1 points) According to the passage above, which of the following is NOT true?

① AI systems, like GPT-4, replicate human tendencies by showing ingroup favoritism and outgroup hostility in their responses.
② Human users interacting with AI systems often display less pronounced biases than the systems themselves in real-world scenarios.
③ Fine-tuning AI models with politically biased data amplifies both positive ingroup solidarity and negative outgroup hostility in model outputs.
④ Thoughtful curation of training data is essential to creating AI systems that reduce bias while ensuring ethical alignment and societal harmony.
⑤ The careful selection and preparation of training data are crucial determinants in shaping the degree and nature of bias inherent in AI-generated outputs.

※ Questions 18 through 21 are based on the following passage.

[A] Recent advancements in (1) _____ studies have uncovered evidence suggesting the existence of a molten layer of rock, potentially preserved since Earth's formation, approximately 1,800 miles (2,900 kilometers) beneath the surface. This finding supports the hypothesis that the early Earth was once largely or entirely molten, with remnants of this primordial "magma ocean" still lingering at the boundary between the planet's solid mantle and its core. Guillaume Fiquet, a leading proponent in this field, explained that as Earth cooled and solidified over billions of years, pockets of molten material may have become trapped at the core-mantle interface. These molten regions may affect large-scale tectonic movements at the surface by altering the interaction between Earth's core and mantle. ❶

[B] To study the extreme conditions deep within Earth, Fiquet and his team used diamond anvil cells to replicate the intense heat and pressure at the mantle-core boundary. They subjected mineral samples, including magnesium oxides, iron, and silicon to pressures exceeding 140 gigapascals—over a million times atmospheric pressure at sea level—and temperatures over 5,000 Kelvin (8,540 degrees Fahrenheit). By utilizing x-ray diffraction techniques, the team monitored the changes in the minerals' atomic structures, observing the transition from solid to liquid phases, identifying the melting point of the mantle minerals at around 4,200 Kelvin (7,100 degrees Fahrenheit). ❷ These findings not only validate long-standing theories about partial melting in Earth's interior but also highlight the dynamics of these molten layers in driving tectonic activity and shaping Earth's interior structure.

[C] ❸ Traditional volcanoes, like those in the Pacific Ring of Fire, are typically fueled by magma generated from the upper mantle and are strongly influenced by the movement of tectonic plates. In contrast, hot spot volcanoes, such as those in Hawaii, are thought to derive their magma from much deeper plumes of molten material rising from partially melted regions near the core-mantle boundary. This relationship provides valuable insights into how Earth's internal heat influences surface volcanic activity and contributes to the shaping of Earth's landscapes over millions of years.

[D] ❹ This discovery significantly advances our understanding of Earth's internal structure, while highlighting the groundbreaking techniques used to study conditions that are otherwise inaccessible. While direct sampling from the mantle-core boundary remains impossible, experiments by Fiquet and his team provide crucial data about the physical and chemical properties of materials deep within Earth. ❺ These findings contribute to a clearer understanding into the complex processes occurring within Earth's interior and how these processes impact surface phenomena, such as volcanic eruptions and tectonic movements.

18. (0.8 points) Which of the following would best fit in blank (1) in paragraph [A]?

① geochemical
② geographical
③ geological
④ geomagnetic
⑤ geometric

19. (1.1 points) Which of the following is NOT true about the research design?

① The researchers recreated the extreme heat and pressure of the mantle-core boundary using diamond anvil cells.
② The researcher hypothesized that the molten layer directly causes tectonic shifts and volcanic eruptions acting as a driving force.
③ The researchers employed x-ray diffraction techniques to monitor and observe changes in the atomic structure of mantle minerals.
④ The study utilized high-pressure experiments to simulate conditions deep within Earth and to identify the melting point of mantle minerals.
⑤ The researchers anchored their study in corroborating long-standing proposals of partial melting within Earth's interior, which had previously lacked direct experimental evidence.

20. (1.0 points) The following sentence is removed from the passage above. In which part may it be inserted to support the argument made by the author?

The implications of this discovery extend beyond the structure of Earth's interior, offering new perspectives on the origins of certain volcanic phenomena and tectonic activity.

① ❶ ② ❷ ③ ❸ ④ ❹ ⑤ ❺

21. (1.1 points) Which of the following is LEAST likely to be inferred by the findings?

① The molten layer may contain physical properties distinct from the solid mantle, revealing differences in composition and behavior.
② The molten layer at the mantle-core boundary likely acts as a remnant of Earth's early molten state, providing insights into the structural history of Earth.
③ Tectonic shifts and volcanic activity are interconnected with the molten layer influencing mantle dynamics and linking deep Earth processes to surface phenomena.
④ Experimental findings suggest that the physical conditions at the boundary are sufficient to partially melt mantle materials, revealing their behavior under extreme conditions.
⑤ Since the innovative simulation techniques helped identify the molten layer, they open up the possibilities of building computational models for broader applications.

※ Questions 22 through 25 are based on the following passage.

[A] In November, a teenager in Fraser Valley, British Columbia sought medical care for conjunctivitis and a cough. Six days later, the teen was put on a ventilator at the B.C. Children's Hospital in Vancouver and remained in critical care for weeks. An illness like this wouldn't normally make headlines, but this child tested positive for a strain of bird flu, called H5N1, which infectious disease experts worry could fuel the next human pandemic.

[B] The virus first emerged on poultry farms in Hong Kong in 1997, where it killed nearly 100 percent of chickens, causing internal bleeding and destroying multiple organs in a manner chillingly reminiscent of Ebola in humans. Since then, successive waves of infection, spread by wild birds, have plagued poultry farms around the world.

[C] Recently, however, H5N1 took an unsettling evolutionary step in the direction of humans. In 2022, it tore through a population of sea elephants in Argentina, killing thousands with a mortality rate of 97 percent. It was the first time H5N1 is known to have taken hold in a mammalian species. Until then, people and other mammals who'd gotten sick had caught the virus through contact with birds. The sea elephants were passing it to one another. By the time scientists got around to publishing their findings in June, H5N1 had infected another mammalian species: dairy cows. Since March, the virus has spread to more than 800 dairy herds in 16 states, including more than 500 in California, where it remains uncontrolled. On December 18, California Governor Gavin Newsome declared a state of emergency to respond to the outbreaks.

[D] In the U.S., at least 61 people have caught the virus, most through direct contact with birds or cows. In December, a child in Marin County who drank raw (i.e. unpasteurized) milk, spiked a fever and vomited, later tested positive for H5N1. This week, the Centers for Disease Control and Prevention (CDC) confirmed the first "severe" bird flu case in the US; the patient had been exposed to sick and dead birds in a backyard flock. Every time a human gets sick, the virus has another opportunity to acquire the ability to spread from person-to-person. Once it passes that milestone, it could start a pandemic. There is no evidence that H5N1 has passed that grim turning point. It may never make **this leap**. But "knowing what we know about these viruses, the trend is not good," says Matthew Binnicker, a microbiologist specializing in respiratory diseases at the Mayo Clinic in Rochester, Minnesota, adding "serious action" is needed. Experts are worried about two main ways the virus could start spreading more easily between people.

22. (1.1 points) Which of the following is true based on the passage above?

① The first known infection of H5N1 occurred in sea elephants in Argentina.
② The first mammalian H5N1 infections were observed in 1997 in Hong Kong.
③ A teenager in British Columbia tested positive for H5N1, spurring concerns among infectious disease experts.
④ No instances of H5N1 have ever been recorded in mammals, making the teenager's case in British Columbia the first of its kind.
⑤ California Governor Gavin Newsome declared a state of emergency to respond to the outbreaks in which dozens of people were infected.

23. (1.1 points) Which of the following is most likely to be inferred about H5N1's evolution and spread from the passage above?

① H5N1 is no longer a threat to poultry but remains a concern for mammals.
② Once humans contract H5N1, they have a nearly 100% survival rate, similar to sea elephants.
③ Global health agencies have determined that H5N1 can infect humans without genetic modification.
④ The virus's ability to spread among mammals raises the possibility of human-to-human transmission.
⑤ The fact that the sea elephants were passing the virus to one another serves as evidence that the virus does not cause cross-species transmission.

24. (1.1 points) Which of the following is NOT true according to the passage above?

① The CDC confirmed the first severe bird flu case in the U.S.
② In December, a child contracted H5N1 after drinking raw, unpasteurized milk.
③ A teenager tested positive for H5N1 after seeking treatment for conjunctivitis and a cough.
④ All human cases of H5N1 in California so far have involved exposure to infected mammals like cows.
⑤ At least 61 people in the U.S. have tested positive for H5N1, mostly through direct contact with infected birds or cows.

25. (1.0 points) What does "this leap" in paragraph [D] most likely refer to?

① The virus mutating to spread easily from human to human
② The ability of H5N1 to spread from wild birds to domestic poultry
③ The emergence of H5N1 in a mammalian species for the first time
④ The declaration of H5N1 as a pandemic by global health authorities
⑤ The virus evolving to spread directly between mammals without bird contact

※ 문제 26 - 48

물음에 답하세요.

[26] [0.8점] $\alpha = \cos^{-1}\left(\cos\left(\frac{19}{4}\pi\right)\right)$ 에 관한 내용 중 **옳지 않은** 것을 **모두** 고르세요.

① $\cos\alpha + \sin\alpha > 0$
② $\alpha < 0$
③ $\sin\alpha = \sin\left(\frac{19}{4}\pi\right)$
④ $\cos\alpha = \cos\left(\frac{19}{4}\pi\right)$
⑤ $\sin 2\alpha > 0$

[27] [0.8점] y를 x에 대한 함수라 할 때, 음함수 $x^2 - xy + y^2 = 4$의 점 $(x, y) = (2, 2)$에서 $\frac{d^2y}{dx^2}$ 를 구하세요.

① -3 ② $-\frac{3}{2}$ ③ 0 ④ 2 ⑤ 3

[28] [1.0점] 곡선 $y = \int_{\frac{\pi}{2}}^{x} \sqrt{\sin^6 t - 1}\, dt \quad (\frac{\pi}{2} \le x \le \pi)$ 의 길이를 구하세요.

① $\frac{4}{3}$ ② $\frac{1}{3}$ ③ 0 ④ $\frac{2}{3}$ ⑤ 1

[29] [1.1점] 자연수 n에 대하여, $I_n = \int_0^{\frac{\pi}{4}} \tan^n x\, dx$ 라고 하자. $a_n = I_n - I_{n+4}$ 일 때, $\sum_{n=1}^{\infty} a_n$ 을 구하세요.

① $\frac{3}{4}$ ② $\frac{5}{6}$ ③ $\frac{2}{15}$ ④ $\frac{1}{6}$ ⑤ $\frac{1}{20}$

[30] [1.0점] 연속인 순증가 함수(strictly increasing function) $f : [0, 2] \to [2, 2\sqrt{5}]$ 가 $f(0) = 2$, $f(2) = 2\sqrt{5}$, 그리고 $\int_0^2 \sqrt{f(x)^2 + 5}\, dx = 7$을 만족한다. 이때 $\int_3^5 g\left(\sqrt{x^2 - 5}\right) dx$는 얼마인지 구하세요. 단, g는 f의 역함수이다.

① 1 ② 2 ③ 3 ④ 4 ⑤ 5

[31] [1.0점] 실수로 이루어진 수열 $\{a_n\}$에 대한 <**보기**>의 내용 중 옳은 것을 **모두** 고르세요.

< **보기** >

가. 무한급수 $\sum_{n=1}^{\infty} a_n$이 조건부 수렴하면, $\sum_{n=1}^{\infty} n\sqrt{n}\,a_n$은 발산한다.

나. 무한급수 $\sum_{n=1}^{\infty} \frac{a_n}{\sqrt{n}}$이 수렴하면, $\sum_{n=1}^{\infty} (-1)^n a_n$은 수렴한다.

다. 무한급수 $\sum_{n=1}^{\infty} (-1)^n a_n$이 발산하면, $\sum_{n=1}^{\infty} a_n$은 발산한다.

라. 무한급수 $\sum_{n=1}^{\infty} (-1)^n a_n$이 수렴하면, $\sum_{n=1}^{\infty} \frac{a_n}{2^n}$은 수렴한다.

① 0개 ② 1개 ③ 2개 ④ 3개 ⑤ 4개

[32] [0.8점] <**아래**> 극한을 구하세요.

< **아래** >

$$\lim_{x\to 1} \frac{1-\sin\frac{\pi}{2}x}{(x-1)^2}$$

① 발산 ② 0 ③ $\frac{\pi^2}{8}$ ④ $\frac{\pi^2}{4}$ ⑤ $\frac{\pi^2}{2}$

[33] [0.8점] 극한값 $\lim_{x\to 0} \frac{\tan^{-1}(x)-P(x)}{x^8} = \frac{2}{3}$ 을 만족하는 최소 차수의 다항식 $P(x)$에 대해, $P(1)$의 값을 구하세요.

① $-\frac{1}{35}$ ② $-\frac{2}{35}$ ③ $-\frac{1}{7}$ ④ $\frac{1}{35}$ ⑤ $\frac{2}{35}$

[34] [1.0점] $x>-1$에서 $f(x)=\int_0^x \frac{\sin t}{t+1}dt$ 라고 하자. $f(x)=\sum_{n=1}^{\infty} a_n x^n$ 로 표현될 때, 계수 a_0, a_1, a_2, a_3, a_4의 합을 구하세요.

① $\frac{1}{2}$ ② $\frac{9}{24}$ ③ $\frac{5}{24}$ ④ $\frac{1}{24}$ ⑤ 0

[35] [1.0점] 실수 전체에서 <**아래**>와 같이 정의된 함수 f 에 대하여 $f''(0)$을 구하세요.

< 아래 >

$$f(x)=\begin{cases} e^{-\frac{1}{|x|}}, & x\neq 0 \\ 0, & x=0 \end{cases}$$

① 0 ② -1 ③ $-\frac{1}{2}$
④ 1 ⑤ 존재하지 않음

[36] [1.1점] <**보기**>에서 수렴하는 이상 적분(improper integral)은 <u>모두</u> 몇 개인지 고르세요.

< 보기 >

가. $\int_0^{\infty} \frac{e^{-x^2}}{|x-2|^{3/2}}\,dx$ 나. $\int_0^{\infty} \frac{1}{1+x^4}\,dx$

다. $\int_{2025}^{\infty} e^{-\sqrt{(\ln x)^3}}\,dx$ 라. $\int_0^{2025} \frac{\cos x}{\sqrt{x}}\,dx$

① 0개 ② 1개 ③ 2개 ④ 3개 ⑤ 4개

[37] [1.0점] 함수 $f(x,y)=\begin{cases} x^2\tan^{-1}\left(\frac{y}{x}\right)-y^2\tan^{-1}\left(\frac{x}{y}\right), & x\neq 0 \text{ and } y\neq 0 \\ 0, & x=0 \text{ or } y=0 \end{cases}$ 일 때,

$f_x(0,y),\ (y\neq 0)$ 을 구하세요.

① 0 ② y ③ $-y$ ④ 1 ⑤ 발산

[38] [1.0점] <**아래**> 적분을 구하세요.

< 아래 >

$$\int_0^1 \int_{\sqrt[4]{y}}^1 \frac{1}{x^5+1}\,dx\,dy$$

① $\frac{1}{5}\ln 2$ ② $\ln 2$ ③ $\frac{1}{4}\ln 2$ ④ $\ln 3$ ⑤ $\frac{1}{5}$

[39] [1.0점] 평면상의 영역 $D=\{(x,y):0\le x\le 2,\ x^2\le y\le 4\}$모양의 얇은 판(lamina)이 있다. 임의의 각 점에서의 밀도가 x좌표의 제곱에 비례한다고 할 때, 이 얇은 판의 질량중심의 x-좌표를 구하세요.

① $\frac{4}{5}$ ② $\frac{3}{5}$ ③ $\frac{3}{2}$ ④ $\frac{5}{3}$ ⑤ $\frac{5}{4}$

[40] [1.1점] 평면 R^2에서 매개변수곡선 $x=1-\cos t,\ y=\sin(t)\sin(2t),\ 0\le t\le \pi$ 과 x축으로 둘러싸인 영역을 y축을 중심으로 회전하여 얻은 입체의 부피를 구하세요.

① 0 ② $\frac{\pi}{2}$ ③ π ④ 2π ⑤ $\frac{5\pi}{2}$

[41] [1.0점] 매끄러운 곡선 $f(x)$가 두 점 $(0,3),(6,11)$을 지날 때, $\lim_{n\to\infty}\sum_{k=1}^{n}\sqrt{1+\left\{f'\left(\frac{6k}{n}\right)\right\}^2}\cdot\frac{3}{n}$의 최솟값을 구하세요.

① 5 ② 6 ③ 8 ④ 3 ⑤ 4

[42] [1.0점] 곡면 $x^2-y^2-2z^2=1$ 위의 점 $(-2,-1,1)$에서의 접평면은 z축과 $(0,0,a)$에서 만난다. 이때 a의 값을 구하세요.

① $-\frac{1}{2}$ ② $-\frac{1}{4}$ ③ $\frac{1}{4}$ ④ 1 ⑤ $\frac{1}{2}$

[43] [1.0점] <**아래**> 멱급수의 수렴 반경을 구하세요.

< 아래 >

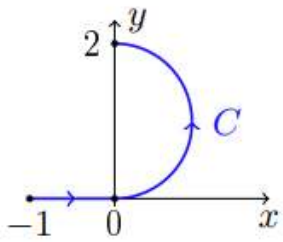
$$\sum_{n=1}^{\infty}\frac{(-1)^n 2^n n!}{n^n}x^n$$

① $\frac{1}{e}$ ② $\frac{2}{e}$ ③ 1 ④ $\frac{e}{2}$ ⑤ e

[44] [1.0점] 곡선 $x^2+2y^2=1$ 상에서 함수 $f(x,y)=x^2y$ 의 최댓값을 M, 최솟값을 m 이라 할 때, $M-m$ 의 값을 구하세요.

① $\frac{\sqrt{6}}{6}$ ② $\frac{\sqrt{6}}{9}$ ③ $\frac{2\sqrt{6}}{9}$ ④ $\frac{2\sqrt{3}}{9}$ ⑤ $\frac{\sqrt{3}}{6}$

[45] [1.1점] xy평면의 곡선 C 가 그림과 같이 점 $(-1,0)$에서 출발하여 선분을 따라 점$(0,0)$까지 진행한 뒤, 원 $x^2+(y-1)^2=1$의 오른쪽 반원을 따라 점 $(0,2)$까지 진행한다.



이때, <**아래**> 선적분을 구하세요.

< 아래 >

$$\int_C (xy+1)\,dx + x\,dy$$

① $\frac{\pi}{2}+\frac{1}{3}$ ② $\pi+1$ ③ $\frac{\pi}{2}+\frac{2}{3}$
④ $\frac{\pi}{2}-\frac{2}{3}$ ⑤ $\frac{\pi}{2}-\frac{1}{3}$

[46] [1.1점] xy평면의 네 점 $(0,0),(2,-2),(3,0),(1,2)$을 꼭짓점으로 가지는 평행사변형 영역을 D 라 할 때, <**아래**> 값을 구하세요.

< 아래 >

$$\iint_D x\,dxdy$$

① 2 ② 3 ③ 6 ④ 8 ⑤ 9

[47] [1.1점] 평면상의 벡터장 $\mathbf{F}(x,y)=(-y\mathbf{i}+x\,\mathbf{j})/(x^2+4y^2)$ 일 때, 양의 방향을 따르는 타원 $C: x^2+4y^2=1$ 에서의 <**아래**> 선적분을 구하세요.

< 아래 >

$$\int_C \mathbf{F}\cdot d\mathbf{r}$$

① $\frac{\pi}{2}$ ② π ③ 2π ④ $\frac{5\pi}{2}$ ⑤ 0

[48] [1.1점] R^3에서 평면 $z=1$ 위로의 반구면 $z=\sqrt{4-x^2-y^2}$ 의 영역을 S 라 할 때, <**아래**> 곡면적분을 구하세요.

< 아래 >

$$\iint_S (2-z)dS$$

① π ② 2π ③ 3π ④ 5π ⑤ 6π

※ 문제 49 - 50

영역 $D=\{(x,y): x^2+y^2\le 9\}$ 에서 정의된 함수

$$f(x,y)=(x+y)(x^2+y^2)-6x-6y$$

에 관하여 물음에 답하세요.

[49] [1.0점] 함수 f 의 $\left(\frac{1}{2},\frac{1}{2}\right)$에서의 선형 근사(linear approximation) 함수는 $L(x,y)=ax+by+c$ 이다. 이때 $a+b+c$의 값을 구하세요.

① -10 ② -8 ③ -1 ④ 8 ⑤ 10

[50] [1.1점] 함수 f 는 영역 D의 내부에서 (가) 개의 임계점을 가지며, 그 중 극대점은 (나) 개, 극소점은 (다) 개이고, 모든 안장점(saddle point)에서의 함숫값의 합은 (라) 이다.
(가), (나), (다), (라)의 **합**을 구하세요.

① 4 ② 5 ③ 6 ④ 7 ⑤ 8