

한양대학교 2025학년도 편입학전형 필기고사

서울캠퍼스 자연(영어, 수학) A



자 연

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영 어

A

① dietary ② geological ③ demographic
④ seismic ⑤ ecological

10. The criticality in culturally relevant pedagogy seeks to interrogate and disrupt the status quo. That is, the social structures and conscious and unconscious procedures and protocols involved in the reproduction of the status quo—the _____ of it through the distribution of human, material, and symbolic capital—are exposed, examined, and altered. [3점]

- ① extension and altercation
- ② eradication and manipulation
- ③ intensification and termination
- ④ substantiation and fortification
- ⑤ escalation and discombobulation

11. For the surfing sub-culture, one of the unique characteristics of that community is that they go into the sea and ride waves—they surf. There is also an _____ nature to sub-cultures which means that without possessing the unique characteristics one could never join the sub-culture. [2점]

- ① indulgent ② inordinate ③ expansive
- ④ acquiescent ⑤ exclusionary

12. Affirmative action or positive discrimination is a policy or a program providing access to systems for people of a minority group who have traditionally been discriminated against, with the aim of creating a more _____ society. [2점]

- ① agrarian ② legitimate ③ egalitarian
- ④ cosmopolitan ⑤ industrialized

13. The global explosion of symbolic forms makes patterns of cultural thought and behavior much more _____ than integrated and limiting, and the role of individual persons in shaping cultural styles and patterns more original and labor-intensive than ever before. [3점]

- ① unified and inventive
- ② obsolete and dispersed
- ③ ostentatious and creative
- ④ fragmented and generative
- ⑤ homogeneous and reductive

14. Interaction is the elemental feature of interdependence. By interaction, we refer to the fact that people engage in behaviors that affect both their own well-being and the well-being of others. Specifically, actors simultaneously or sequentially enact behaviors with implications for their own and their partners' immediate behavioral options and outcomes, as well as for the future situations, options, and outcomes that are made available (or eliminated) as a consequence of their actions. Thus, the options that are available to us and the outcomes that we experience are not a sole function of our own actions. John's decision to quit his job has implications for Mary; Mary's decision to train for a marathon has implications for John. In short, and to state the obvious: _____. [3점]

- ① Partnerships last a lifetime
- ② No person is an island
- ③ No pressure, no diamonds
- ④ You are your home
- ⑤ Be a voice, not an echo

15. Historians have challenged the assumption that early modern philosophy can be adequately comprehended in terms of the major published works of its most famous figures. It is now a commonplace that to understand a philosopher's views—expressed in the well-honed sentences of a book such as Descartes's *Meditations* or Kant's *Critique of Pure Reason*—requires understanding them in relation to the entire corpus of the philosopher's writings, published and unpublished. Correspondences, preliminary drafts, and subsequent revisions of published texts are all seen as important sources of evidence. In addition, it is increasingly acknowledged that our understanding of a canonical text can be deepened by reading it in conjunction with the works of a philosopher's immediate predecessors and contemporaries—works that often supply an illuminating background for its interpretation. In short, even if a published treatise carries an imprimatur as the authoritative expression of a philosopher's position on a given topic, understanding that position often is facilitated, and sometimes is only possible by _____. [3점]

- ① probing its reception among critics
- ② scrutinizing its political context
- ③ analyzing its logical flow and writing style
- ④ relating it to other pieces of textual evidence
- ⑤ predicting its influence on subsequent philosophical inquiries

16. The Internet is celebrated for disseminating knowledge and supporting conversation, dialogue, and debate. Its decentralization allows anyone to post opinions online or link to other pages. Yet this happy characterization has been challenged by the counter-argument that the Internet and the Web are also tools for _____, which will tend to magnify and reinforce their prejudices. [3점]

- ① negating eccentric opinions for the public
- ② circulating disparate ideas of diverse people
- ③ undermining diverse ethnic groups' cultural heritage
- ④ excising dissenting voices from an individual's purview
- ⑤ introducing opposing voices to broaden an individual's perspective

17. 빈칸 (A), (B)에 들어갈 가장 적절한 것은? [3점]

Progress in AI and in its introduction into neurotechnology has complicated the interaction between humans and machines, mainly with respect to (A)_____ and (B)_____. With respect to the former, AI systems may enable some degree of human-independent cognitive functioning. In particular, systems with self-learning mechanisms might be capable of making decisions or generating outputs that were not previously programmed or intended by humans. As for the latter concern, machine-learning enables devices to make better predictions by learning through trial, error, and feedback loops to decode brain signals more accurately. But conversely, the users of a brain-computer interface may inadvertently learn to change their brain signals to be better decoded by the machine.

- | (A) | (B) |
|---------------|----------------|
| ① autonomy | adaptivity |
| ② accuracy | authenticity |
| ③ uniformity | dichotomy |
| ④ adversity | heterogeneity |
| ⑤ consistency | accountability |

[18-19] 다음 글을 읽고 물음에 답하십시오.

Many Cuban songs, such as guarachas and later boleros, were adopted by the romantic rhetoric of poets and singers in Yucatan. When the Cuban rhythms arrived in the peninsula, they were smothered by this romanticism. The boleros and the Colombian bambuco became part of the regional tradition of Yucatan. The bolero was still performed in a two-beat pattern, but the tempo slowed down and the rhythmical accents were not strongly stressed in order to underline the romantic quality of the lyrics. This is the case of "Presentimiento" by Emilio Pacheco, which is said to be one of the first popular boleros in Mexico City during the twenties. The melodic cinquillo rhythm was still present, but the romantic text by the Spanish poet Pedro Mata was not as heavily stressed by the musical rhythm. The romanticism of Yucatan had a bucolic tendency foreign to any urban tradition; these boleros were the popular version of a naive romanticism. The poet Luis Rosado Vega defined the Yucatan bolero as a delicate genre deprived of any sort of obscenity. Consequently, Cuban boleros were softened in order to conform to middle-class conceptions of propriety and taste. These boleros were spread, transformed, and urbanized during the late twenties in the underground places in Mexico City by composers like Agustin Lara. After the revolution, the new political groups in power were looking for social, political, and economic stability through a new cultural project: the construction of a Mexican identity. The official history glorified Mexico's past with romantic, epic figures, and at the same time, nineteenth-century romanticism was acquiring a popular version.

18. 윗글의 내용과 가장 거리가 먼 것은? [4점]

- ① Singers and poets in Yucatan were influenced by romanticism introduced through Cuban songs.
- ② The rhythmical accents were not strongly emphasized in "Presentimiento."
- ③ Cuban boleros were softened in order to conform to the taste of middle-class people in Mexico.
- ④ Artists such as Agustin Lara advocated a vision of arts as cultural objects for the elite society of Mexico City.
- ⑤ Following the revolution, the emerging political group pursued social, political, and economic stability by introducing a new cultural initiative: the creation of a Mexican identity.

19. 밑줄 친 "bucolic"의 의미와 가장 가까운 것은? [3점]

- ① pastoral ② tangential ③ incessant
- ④ ebullient ⑤ circuitous

[20-21] 다음 글을 읽고 물음에 답하십시오.

Cotton farmers have economic, environmental and agricultural reasons to want a better option for harvesting. Traditional mechanical harvesters can be up to 14 feet long and weigh more than 30 tons. They remove cotton effectively without damaging the plants but also can cause problems. One issue is prolonged fiber exposure. Cotton bolls don't all mature at the same time; the first open bolls in a field may wait for up to 50 days to be picked, until more bolls around them ripen. Another challenge is that harvesting machines compact the soil as they roll over it. This makes it harder for water and fertilizer to penetrate down to plant roots. And the machines cost roughly US\$1 million apiece but are used for only two to three months each year. Robotics is a potential solution that farmers are already using for other crops, such as fruits and vegetables. Harvesting robots use cameras and sensors to detect when crops are ready to pick and can remove them without damaging the plant. For cotton, robotics offers more targeted picking of bolls that are ready to harvest. It produces better-quality cotton fiber by picking seed cotton as soon as the bolls open, without leaving it exposed to the weather. The robot targets the seed cotton and avoids touching other parts of the plant. With robotic picking, cotton farmers don't need to use defoliants to remove leaves from the plants prior to harvesting, which is a common practice now. And small, nimble robots do not compress the soil as they move over it, so they help maintain soil health.

20. 밑글의 내용과 가장 가까운 것은? [3점]

- ① Cotton bolls all mature at the same time, allowing farmers to harvest the entire crop at once.
- ② Although robotic harvesters are not yet in use, they remain a potential solution for future generations.
- ③ Traditional cotton harvesters help maintain soil health by preventing soil compaction.
- ④ Robotic cotton harvesters cause significant damage to the plants, reducing the quality of the cotton fibers.
- ⑤ Robotics in cotton harvesting can help reduce the need for defoliants, as the robots can pick cotton without needing to remove leaves from the plants.

21. 밑줄 친 “nimble”의 뜻과 가장 가까운 것은? [3점]

- ① agile ② minuscule ③ slow-moving
- ④ rigid ⑤ clumsy

[22-23] 다음 글을 읽고 물음에 답하십시오.

The implications of early educational failure are broad and profound. School difficulties are associated with significantly higher expenses for extra help, special education, and grade retention. The added costs are not limited to those incurred at the school level. Children who experience school failure are more likely to be (A)_____, and when they are not in school, they may engage in unhealthy or delinquent behaviors. These students are more likely to drop out of school or to be pushed out through expulsion. This obviously makes them less likely to receive the post-secondary education that is increasingly required for gainful employment in an American work environment that demands specialized skills. When they reach adulthood, the societal costs continue to mount because of higher reliance on welfare and other social supports, increased crime and incarceration, and underemployment with the resultant loss of tax revenue. Due to the intergenerational nature of poverty, the costs of school failure at the individual child level tend to (B)_____ successive generations.

22. 빈칸 (A), (B)에 들어갈 가장 적절한 것은? [3점]

- | (A) | (B) |
|-----------------|------------------|
| ① enthusiastic | pass over |
| ② truant | compound over |
| ③ assiduous | complicate over |
| ④ compassionate | evolve over |
| ⑤ nonchalant | synchronize over |

23. 밑글의 제목으로 가장 적절한 것은? [3점]

- ① The Method of Early Education
- ② The Process of Early Education
- ③ The Cost of Early Education Failure
- ④ The Cause of Early Education Failure
- ⑤ The Range of Early Education Failure

24. 다음 글의 요지로 가장 적절한 것은? [3점]

The conceptualization of an exhibition, whether temporary or permanent, actual or virtual, is of prime importance, for it impacts upon education, public perception, and, on occasion, political will. Museums, libraries, and galleries and their displays, publications, and outreach programs have been known to both reflect and help direct the way in which a given subject area is studied. They can be fruitful meeting grounds for a wide range of disciplines and outlooks and a testing place for matching aspiration and resource. In short, they help us to write history, to record it, and to direct its future. They are powerful social mechanisms, capable of misrepresenting as well as mirroring our identities. As the repositories of our collective memory, they are the stuff of which civilizations are formed—the way in which we shape them, use them, and invest in them in the future will help to serve as an indication of the extent to which we value, or merely pay lip service to, the very concept of civilization.

- ① Exhibitions are often used for political and economic agendas.
- ② Museum exhibits are now often driven by digital media and technology.
- ③ Virtual exhibitions are more effective in displaying exhibits and attracting more people than regular museums.
- ④ Museums can provide a business model by focusing not only public engagement but also profitable programs.
- ⑤ Museums and exhibitions play a key role in constructing and reflecting the collective memory of society.

[25-26] 다음 글을 읽고 물음에 답하십시오.

Seattle recycles and composts more material than almost any other American city, but recycling is not necessarily a signal of success. Critics note, for example, that recycling actually encourages consumption by easing the consciences of consumers, and that it addresses waste only at the very end of the production chain, ignoring the whole system of waste-making from resource extraction through manufacturing and transport. Moreover, processing recycled materials requires huge amounts of energy and degrades material quality. Recycling, argue critics, is a (A)_____ used by industry to displace the responsibility for environmental action on to individuals and municipal governments and to deflect regulatory attention from the corporate machinery of consumption and waste-making. Finally, municipal programs emphasize materials for which recycling provides minimal environmental benefit, ignoring other materials that could be more efficiently recycled. And these are just a few of the many arguments (B)_____. Seattle's success may be notable, but its recycling rate hardly represents a solution to the many socio-environmental crises we face.

25. 빈칸 (A)에 들어갈 가장 적절한 것은? [3점]

- ① ploy ② bonus ③ refuse
- ④ demand ⑤ sentiment

26. 빈칸 (B)에 들어갈 가장 적절한 것은? [3점]

- ① against a whole-scale redefinition of recycling
- ② against the improvement in the material quality of recyclables
- ③ against the efficacy of recycling as a solution to the problems of garbage
- ④ for the investment of an increased amount of effort and money in recycling education
- ⑤ against waste prevention that emphasizes structural changes, such as product stewardship and extended producer responsibility

27. 밑줄 친 (A) ~ (E) 중에서 문맥상 낱말의 쓰임이 적절하지 않은 것은? [3점]

Twice in history, the human race has fundamentally transformed its source of (A)sustenance, and hence its place in the world. Thousands of years ago, the invention of agriculture (B)paradoxically narrowed dietary options from the ever-changing bounty of the hunter-gatherer to the repetitive harvest of the sedentary farmer. Nevertheless, food surpluses also led to the formation of (C)complex societies by supporting kings, priests, merchants, and artists—including culinary artists, who devised novel ways of preparing otherwise monotonous grains. In the nineteenth century, industrialization initiated equally significant changes in food habits and social relations. Once again, humanity learned to make more from less, producing greater quantities from (D)fewer varieties of food stuffs. Yet in contrast to agrarian societies, contemporary surpluses have been achieved by radically separating production from consumption, thereby (E)retaining the social connections between cooks and eaters.

- ① (A) ② (B) ③ (C)
④ (D) ⑤ (E)

[28-29] 다음 글을 읽고 물음에 답하십시오.

In order to support a logically untenable position, in which both parties in all wars attribute themselves total correctness and the Other total error, we use the device of claiming superiority for ourselves and inferiority for the Other. This inferiority and superiority needs to be objectified somehow—the more visibly the better. Ultimately, it is force that provides the justification, and winners usually claim that God or truth was on their side. As we become more civilized, we need more rational reinforcements that will _____ the guilt derived from the use of brute force. Our human differences, whether real or imaginary, provide us with an ideal device. Among the imaginary ones, European aristocrats came up with the easily dismissible notion of blue blood. Racism, invented later, was a product of the same kind of imagination. It is the unfounded expression of prejudice, oppression and injustice based on the myth of “race classification,” which nonetheless has had destructive physical, health, socio-economic-political, and criminal justice effects on those deemed lesser-humans by the classification, which have been very real. Racism has provided, especially since the period of colonization and slavery, a nearly flawless and guilt-freeing excuse for the exploitation of large portions of humanity on the basis of the color of their skin, as well as other physical traits being defined as determinants of their lesser humanity.

28. 빈칸에 들어갈 가장 적절한 것은? [3점]

- ① allay ② elicit ③ incite
④ augment ⑤ coagulate

29. 밑글의 내용과 가장 가까운 것은? [3점]

- ① Racism and its historical consequences are purely imaginary and thus dismissible.
② Racism served as a nearly perfect justification of slavery and colonial exploitation.
③ Race classification is grounded on scientifically proven differences in human physiognomy.
④ The arguments for blue blood and racism use the same kind of verifiable evidence to identify the Other.
⑤ We feel less guilty when the differences that divide us from the Other are intricate and ambiguous.

[30-31] 다음 글을 읽고 물음에 답하십시오.

Climate change is not simply an environmental issue that can be managed through behavioral changes, sectoral interventions or new regulations. It is not a problem that can be addressed single-handedly by environmental ministries, by international institutions and non-governmental organizations or by development aid and adaptation funds. Finally, it is not a problem that can be solved by ecological modernization, ecosystem stewardship or sustainable development. It is, instead, a problem that can only be _____ by focusing on climate change as an issue of human security, which includes a thorough investigation of what it means for humans to be 'secure.' This demands, first and foremost, a change in the way that we think about change. It requires a shift away from the dominant framing that focuses on responding to change through a utilitarian, problem-solving approach or cost-benefit analyses, and towards a framing that recognizes and prioritizes the capacity of individuals and communities to both respond to and create change, including envisioning and pursuing alternative futures.

30. 빈칸에 들어갈 가장 적절한 것은? [3점]

- ① exacerbated ② resolved ③ amplified
- ④ distended ⑤ expounded

31. 밑줄의 내용과 거리가 가장 먼 것은? [4점]

- ① In order to tackle the climate change problem, we should change the way we conceptualize change.
- ② In order to understand climate change as an issue of human security, we need to examine what it means to be secure.
- ③ In order to address climate change, we need to focus on the capacity of individuals and communities to envision alternative futures.
- ④ Environmental ministries, international institutions, and non-governmental organizations can solve the climate change problem.
- ⑤ Ecological modernization, ecosystem stewardship, or sustainable development are not effective means to address the problem of climate change.

[32-33] 다음 글을 읽고 물음에 답하십시오.

What causes excessive manganese exposure during pregnancy? A deficiency in iron—the micronutrient that when low is associated with high antisocial behavior—enhances manganese absorption. Women with low iron levels absorb about four times more manganese than women with high iron levels. An early postnatal source of manganese is soy infant formula, which has eighty times the amount of manganese that natural breast milk has. It is possible that the higher IQs found in breast-fed babies may be due to formula-fed babies' being exposed to high manganese, because manganese excretion is controlled by the liver. The livers of babies are underdeveloped, and consequently they are less able to excrete manganese. The excessive manganese could then result in poorest brain functioning and lower IQs.

32. 밑글의 제목으로 적절한 것은? [3점]

- ① Why Iron Deficiency Improves Brain Development in Infants
- ② Breastfeeding vs. Formula Feeding: The Manganese Advantage
- ③ Iron Deficiency and Soy Formula's Role in Manganese Exposure in Infants
- ④ Manganese Deficiency and Its Role in Infant Cognitive Development
- ⑤ The Benefits of Soy Formula in Promoting Infant Brain Function

33. 밑글의 내용과 거리가 가장 먼 것은? [3점]

- ① Iron deficiency increases manganese absorption.
- ② Underdeveloped livers in babies reduce manganese excretion.
- ③ Soy infant formula contains significantly more manganese than breast milk.
- ④ Low iron levels are linked to higher antisocial behavior.
- ⑤ Breast-fed babies are exposed to more manganese than formula-fed babies.

34. 다음 글의 내용과 가장 거리가 먼 것은? [4점]

Writing systems around the world differ in several ways, from the alphabets of languages like English, where letters stand for individual sounds, to the 'syllabaries' used by Japanese, where a symbol refers to a syllable, to the 'logograms' of Chinese, where a character represents a whole word. Nonetheless, there is little difference in the brain areas involved in reading across individuals and cultures. Near the underside of the temporal region in the left hemisphere sits a brain area known as the visual word form area (VWFA), which is consistently activated no matter the writing system. The existence of the VWFA is important for two reasons. First, it shows that a cultural invention (i.e., literacy) can recruit quite similar neural substrates no matter who is doing the reading or what script is being read, suggesting that the brain deals with all written languages in the same way. Second, the VWFA becomes increasingly dedicated to recognizing words as the reader becomes more proficient in reading. Given that language is also a product of cultural evolution, the fact that the same seemingly specialized language areas are activated in different individuals, no matter which language they speak, does not mean that these areas have evolved as biological adaptations for language. Rather, like the VWFA, they emerge through experience with language, in some cases resulting in neural circuits that are mostly, and perhaps sometimes even completely, dedicated to language.

- ① Writing systems differ in structure, ranging from alphabets to syllabaries to logograms, but the brain processes all written languages in a similar way.
- ② The VWFA in the brain is consistently activated when reading, regardless of the writing system used.
- ③ The VWFA becomes more specialized with increased reading proficiency and reading experience.
- ④ The same brain areas are activated in different individuals when processing language, regardless of the language spoken, indicating that these areas develop through experience with language.
- ⑤ The VWFA evolved specifically for reading and is a biological adaptation to the act of decoding written language.

35. 다음 글의 내용과 가장 거리가 먼 것은? [4점]

Myopia is a condition in which near objects appear clear while distance vision is blurred, with practically no other symptom except perhaps the discomfort of squeezing the eyelids, which does improve vision. From the optical point of view, the image of a distant object is formed not on the retina but in front of it. In other words, the power of the eye is either too strong or the eye is too long; the latter is usually the case. In some cases, the amount of myopia does not stop at maturity but continues to progress. This is a pathological condition in which degenerative changes in the retina and other tissues occur, and eventually vision is impaired even when corrected. It is important for these people not to engage in vigorous sports or activity as the retina is liable to detachment with this condition. Myopia usually develops in the early teens. However, an increasing number of people have been noted to acquire it in the late teens and early twenties, commonly in association with a great deal of visual stimulation, such as reading or working at a visual display unit. Hereditary influence as well as environmental factors both contribute to its development. In the general population, approximately one person in five is myopic, although that figure varies with age, race, and geography and this figure doubles among Chinese and Japanese.

- ① A person with myopia has sharp vision at close range and blurred vision at a distance.
- ② More than half of Chinese and Japanese people are myopic.
- ③ Myopia can continue to progress after maturity, causing changes in the retina.
- ④ Both hereditary and environmental factors can cause the development of myopia.
- ⑤ Myopia occurs when the image of an object is formed in front of the retina instead of on it.

36. 다음 글의 내용과 가장 거리가 먼 것은? [4점]

The reasons why time can speed up and slow down are a bit of a mystery. Some researchers think that mild variations in time perception are linked to information processing. As a general rule, the more information—such as perceptions, sensations, and thoughts—that our minds process, the slower time seems to pass. Time passes slowly to children because they live in a world of newness. New environments stretch time because of their unfamiliarity. Absorption contracts time because our attention becomes narrow, and our minds become quiet, with few thoughts passing through. In contrast, boredom stretches time because our unfocused minds fill with a massive amount of thought-chatter. Time expansion experiences (Tees) can occur in an accident or emergency situation, such as a car crash, a fall or an attack. In time expansion experiences, time appears to expand by many orders of magnitude.

Around a half of Tees occur in accident and emergency situations. In such situations, people are often surprised by the amount of time they have to think and act. In fact, many people are convinced that time expansion saved them from their serious injury, or even saved their lives because it allowed them to take preventative action that would normally be impossible. For example, a woman who reported a Tee in which she avoided a metal barrier falling on to her car told me how a “slowing down of the moment” allowed her to “decide how to escape the falling metal on us.”

- ① Time perception tends to slow down when more information is processed.
- ② The perception of time can be contracted when our attention narrows, as seen in moments of deep absorption.
- ③ In states of intense concentration, individuals may experience time expansion where they perceive time as stretching beyond its actual duration.
- ④ Time expansion occurs more frequently in routine activities because the mind is less occupied with new stimuli, leading to a sense of time moving slowly.
- ⑤ Time expansion often occurs in accidents or emergencies where people perceive a significant lengthening of time that enables them to think and act with clarity.

한양대학교 2025학년도 편입학전형 문제지 수 학	문제 유형
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37. 좌표평면 위에 두 점 $F(a, 0)$, $F'(-a, 0)$ ($a > 0$)을
초점으로 하는 타원 $\frac{x^2}{25} + \frac{y^2}{9} = 1$ 이 있다. 점 $A(-8, 9)$ 와
타원 위의 점 P 에 대하여 $\overline{AP} - \overline{PF'}$ 의 최솟값은? [3점]

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

38. $x = 0$ 에서 함수 $f(x) = \frac{1}{\sqrt{4+3x}}$ 의 테일러 급수가
 $\sum_{n=0}^{\infty} a_n x^n$ 이다. $\frac{a_{11}}{a_{10}}$ 의 값은? [4점]

① $-\frac{3}{4}$ ② $-\frac{129}{176}$ ③ $-\frac{63}{88}$ ④ $-\frac{123}{176}$ ⑤ $-\frac{15}{22}$

39. 점 $(1, 2)$ 에서 미분가능한 함수 $f(x, y)$ 의 두 단위벡터
 $\boldsymbol{u} = \left(\frac{3}{5}, -\frac{4}{5}\right)$, $\boldsymbol{v} = \left(-\frac{12}{13}, \frac{5}{13}\right)$ 에 대한
방향도함수(directional derivative)의 값이
각각 $D_{\boldsymbol{u}}f(1, 2) = \frac{26}{5}$, $D_{\boldsymbol{v}}f(1, 2) = -\frac{82}{13}$ 이다.
곡면 $z = f(x, y)$ 위의 점 $(1, 2, f(1, 2))$ 에서의 접평면이
점 $(3, 5, 3)$ 을 지날 때, $\|\nabla f(1, 2)\|^2 + f(1, 2)$ 의 값은? [4점]

① 34 ② 37 ③ 40 ④ 43 ⑤ 46

40. 연속 함수 $f(x)$ 가 모든 실수 x 에 대하여

$$f(x) \times \int_0^x f(t)dt = e^x + 3x - 1$$

을 만족시킬 때, $f(0)^2 + \left(\int_0^2 f(x)dx\right)^2$ 의 값은? [4점]

- ① $2e^2 + 6$ ② $2e^2 + 8$ ③ $2e^2 + 10$
 ④ $2e^2 + 12$ ⑤ $2e^2 + 14$

41. $\int_0^1 \int_{y^{1/3}}^1 \cos(\pi x^2) dx dy$ 의 값은? [3점]

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

42. <보기>에서 수렴하는 급수를 모두 고른 것은? [5점]

< 보 기 >

ㄱ. $\sum_{n=1}^{\infty} \frac{n^2 + n + 3}{n^3 \{\ln(n+2)\}^2}$

ㄴ. $\sum_{n=1}^{\infty} \frac{2^n n!}{(n+1)^n}$

ㄷ. $\sum_{n=1}^{\infty} \left(2 - n \sin \frac{2}{n}\right)$

- ① ㄱ ② ㄷ ③ ㄱ, ㄴ
 ④ ㄴ, ㄷ ⑤ ㄱ, ㄴ, ㄷ

43. $\mathbf{r}(t) = \langle 3\cos t, \sin t \rangle$ ($0 \leq t \leq 2\pi$)로 나타내어지는

곡선 C 와 벡터장 $F(x, y) = \langle e^x + xy, \sin y + x \rangle$ 에

대하여 선적분 $\int_C F \cdot d\mathbf{r}$ 의 값은? [4점]

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

44. 3×3 행렬 A 와 B 에 대하여 $A^3 = B^2$ 이고

$\det(B) = 27$ 일 때, $\det(2A^T B A^{-1} B^{-1} A)$ 의 값은?

(단, A^T 는 A 의 전치 행렬이다.) [3점]

- ① 18 ② 24 ③ 54 ④ 72 ⑤ 96

45. <보기>에서 옳은 것을 모두 고른 것은? [4점]

< 보 기 >

ㄱ. 행렬 $A = \begin{pmatrix} 0 & a+b & c+2 \\ a & 2 & c \\ 4 & a+b & 4 \end{pmatrix}$ 가 대칭행렬일 때,

행렬 $B = \begin{pmatrix} b & a & -2 \\ b-a & 0 & 1 \\ c & -1 & b \end{pmatrix}$ 는

반대칭 행렬(skew symmetric matrix)이다.

ㄴ. 벡터 $\begin{pmatrix} 5 \\ 1 \\ 1 \end{pmatrix}$ 은 행렬 $\begin{pmatrix} 1 & 2 & 3 \\ 0 & -1 & 3 \\ 0 & 0 & 2 \end{pmatrix}$ 의 가장 큰 고유값에

대응하는 고유벡터이다.

ㄷ. $\lambda = 1$ 이 행렬 $A = \begin{pmatrix} 3 & a \\ b & -5 \end{pmatrix}$ 의 고유값이면,

$\lambda = -3$ 도 A 의 고유값이다.

ㄹ. 두 행렬 $\begin{pmatrix} 1 & 0 & -2 \\ 0 & 5 & 0 \\ -2 & 0 & 4 \end{pmatrix}$ 와 $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{pmatrix}$ 는 닮은 행렬이다.

- ① ㄱ, ㄴ, ㄷ ② ㄱ, ㄴ, ㄹ ③ ㄱ, ㄷ, ㄹ
④ ㄴ, ㄷ, ㄹ ⑤ ㄱ, ㄴ, ㄷ, ㄹ

46. 벡터 $\mathbf{u}_1 = (2, 1, 1)$ 과 $\mathbf{u}_2 = (-1, 2, 3)$ 으로 생성되는

$\mathbb{R}^3$ 의 부분 공간 U 에 대하여 $\{\mathbf{v}_1, \mathbf{v}_2\}$ 는 U 의 직교 기저

(orthogonal basis)이다. $\|\mathbf{v}_1\| = \frac{5}{3}$, $\|\mathbf{v}_2\| = \frac{1}{3}$ 이고

$\mathbf{u}_1 = a_1\mathbf{v}_1 + a_2\mathbf{v}_2$, $\mathbf{u}_2 = b_1\mathbf{v}_1 + b_2\mathbf{v}_2$ 일 때,

$|a_1b_2 - a_2b_1|$ 의 값은? [4점]

- ① $3\sqrt{3}$ ② $3\sqrt{5}$ ③ $5\sqrt{3}$ ④ $5\sqrt{5}$ ⑤ $9\sqrt{3}$

47. 행렬 $A = \begin{pmatrix} 2 & 1 & 0 & 4 \\ 2 & 1 & 1 & 2 \\ 4 & 2 & 3 & 2 \end{pmatrix}$ 에 대하여 $A\mathbf{v} = \begin{pmatrix} 2 \\ 3 \\ r \end{pmatrix}$ 을 만족하는

벡터 $\mathbf{v}$ 가 존재할 때, $\text{rank}(A) \times r$ 의 값은? [4점]

- ① 6 ② 8 ③ 10 ④ 12 ⑤ 14

48. 행렬 $A = \begin{pmatrix} 1 & 1 \\ 0 & -1 \\ 2 & 0 \\ 1 & 1 \end{pmatrix}$ 의 열공간을 V 라 할 때,

벡터 $\mathbf{a} = \begin{pmatrix} 1 \\ 2 \\ -1 \\ 0 \end{pmatrix}$ 의 V 로의 정사영 $\text{proj}_V \mathbf{a}$ 는? [4점]

① $\left(-\frac{5}{14}, \frac{2}{7}, -\frac{1}{7}, -\frac{5}{14}\right)^T$

② $\left(\frac{5}{14}, -\frac{2}{7}, -\frac{1}{7}, \frac{5}{14}\right)^T$

③ $\left(-\frac{5}{14}, -\frac{2}{7}, \frac{1}{7}, -\frac{5}{14}\right)^T$

④ $\left(\frac{5}{14}, \frac{2}{7}, -\frac{1}{7}, \frac{5}{14}\right)^T$

⑤ $\left(\frac{5}{14}, -\frac{2}{7}, \frac{1}{7}, \frac{5}{14}\right)^T$

49. 고윳값이 $1, -1, 2$ 인 3×3 행렬 A 에 대하여

$B = A^3 - 5A^2$ 일 때, $\det(B)$ 의 값은? [3점]

- ① -288 ② -144 ③ -72 ④ -48 ⑤ -24

50. 행렬 $A = \begin{pmatrix} 1 & 1 & -1 \\ 1 & 1 & -1 \end{pmatrix}$ 의

특이값 분해(singular value decomposition)가

$$A = \begin{pmatrix} u_{11} & u_{12} \\ u_{21} & -\frac{1}{\sqrt{2}} \end{pmatrix} \begin{pmatrix} \sqrt{6} & \sigma_{12} & \sigma_{13} \\ \sigma_{21} & 0 & \sigma_{23} \end{pmatrix} \begin{pmatrix} \frac{1}{\sqrt{3}} & v_{12} & v_{13} \\ v_{21} & -\frac{1}{\sqrt{2}} & v_{23} \\ v_{31} & 0 & \frac{2}{\sqrt{6}} \end{pmatrix}^T$$

일 때, $u_{11}^2 + (\sigma_{12}^2 + \sigma_{13}^2 + \sigma_{21}^2 + \sigma_{23}^2) + (v_{12}^2 + v_{23}^2 + v_{31}^2)$ 의

값은? [5점]

- ① $\frac{7}{6}$ ② $\frac{4}{3}$ ③ $\frac{3}{2}$ ④ $\frac{5}{3}$ ⑤ $\frac{11}{6}$

51. $F(s) = \frac{s-1}{s^2+4s+4}$ 의 라플라스 역변환을 $f(t)$ 라 할 때,

$f(1)$ 의 값은? [3점]

- ① $-2e^{-2}$ ② $-e^{-2}$ ③ e^{-2} ④ $2e^{-2}$ ⑤ $3e^{-2}$

52. 미분방정식 $\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 4y = 6e^{-t}$ 의 해 $y(t)$ 가

$y(0) = 2, y'(0) = 3$ 을 만족할 때, $y(1)$ 의 값은? [3점]

- ① $3e^{-1} - e^{-4}$ ② $5e^{-1} - e^{-4}$ ③ $3e^{-1} - 2e^{-4}$
 ④ $-3e^{-1} + e^{-4}$ ⑤ $-5e^{-1} + e^{-4}$

53. 미분방정식 $x^2y'' - 15xy' + 68y = 0, x > 0$ 의 해 $y(x)$ 가

$y(1) = 3, y'(1) = 30$ 을 만족할 때, $y(e^{\frac{\pi}{8}})$ 의 값은? [4점]

- ① $\sqrt{2}e^{\pi}$ ② $2\sqrt{2}e^{\pi}$ ③ $3\sqrt{2}e^{\pi}$ ④ $4\sqrt{2}e^{\pi}$ ⑤ $5\sqrt{2}e^{\pi}$

54. 연립미분방정식 $\begin{cases} x'(t) = x(t) + y(t) \\ y'(t) = -x(t) + y(t) \end{cases}$ 의 해 $\begin{pmatrix} x(t) \\ y(t) \end{pmatrix}$ 가

$\begin{pmatrix} x(0) \\ y(0) \end{pmatrix} = \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ 를 만족할 때, $x(\pi)$ 의 값은? [4점]

- ① $2e^{\pi}$ ② e^{π} ③ $-e^{\pi}$ ④ $-2e^{\pi}$ ⑤ $-3e^{\pi}$

55. 미분방정식 $y'' + y = \sec x$, $-\frac{\pi}{2} < x < \frac{\pi}{2}$ 의 해 $y(x)$ 가 $y(0) = \ln 2$, $y\left(\frac{\pi}{3}\right) = \frac{\sqrt{3}}{6}\pi$ 를 만족할 때, $y\left(\frac{\pi}{4}\right)$ 의 값은? [5점]

- ① $\frac{\sqrt{2}}{4}\ln 2 + \frac{\sqrt{2}}{8}\pi$ ② $\frac{\sqrt{2}}{4}\ln 2 + \frac{\sqrt{2}}{6}\pi$
 ③ $\frac{\sqrt{2}}{2}\ln 2 + \frac{\sqrt{2}}{8}\pi$ ④ $\frac{\sqrt{2}}{2}\ln 2 + \frac{\sqrt{2}}{6}\pi$
 ⑤ $\frac{\sqrt{2}}{6}\ln 2 + \frac{\sqrt{2}}{8}\pi$

56. 미분방정식 $(x^2 - x)y'' + (3x - 1)y' + y = 0$, $0 < x < 1$ 의 해 $y(x)$ 가 $y\left(\frac{1}{2}\right) = 0$, $y'\left(\frac{1}{2}\right) = -12$ 를 만족할 때,

$y\left(\frac{1}{4}\right)$ 의 값은? [5점]

- ① $\ln 2$ ② $2\ln 2$ ③ $3\ln 2$ ④ $4\ln 2$ ⑤ $5\ln 2$

※ 아래 주관식 문제 [57-61]의 정답 표기는 답안지의
「주관식 답란 표기방법」을 참조하시오.

57. 제1팔분공간(first octant)에서 곡면 $xy = 1$, $xy = 4$,
 $yz = 4$, $yz = 16$, $zx = 1$, $zx = 9$ 로 둘러싸인
입체의 부피를 구하시오. [4점]

58. 좌표평면에서 극방정식으로 주어진 곡선 $r = 6 - 6\sin\theta$ 의
내부와 곡선 $r = 6 - 2\sin\theta$ 의 내부에 공통으로 포함되는
부분의 넓이는 $a\pi - b$ 이다. $a + b$ 의 값을 구하시오.
(단, a 와 b 는 유리수이다.) [4점]

59. 미분방정식 $y' + \frac{4y}{x} = 3y^2$, $x > 0$ 의 해 $y(x)$ 가
 $y(1) = \frac{1}{3}$ 을 만족할 때, $y(2) = \frac{q}{p}$ 이다. $p + q$ 의 값을
구하시오. (단, p 와 q 는 서로소인 자연수이다.) [4점]

60. 행렬 $A = \begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$ 에 대하여 선형변환 ϕ_A 를

$$\phi_A(v) = Av, v \in \mathbb{R}^2$$

이라 하자. 합성변환

$$\phi_A^{25} = \underbrace{\phi_A \circ \phi_A \circ \cdots \circ \phi_A}_{25 \text{ times}}$$

가 x 축 위의 모든 점을 x 축 위의 점으로 보낼 때,
 양수 θ 의 최솟값은 $\frac{q}{p}\pi$ 이다. $p+q$ 의 값을 구하시오.
 (단, p 와 q 는 서로소인 자연수이다.) [5점]

61. 30L의 수조 안에 소금 2kg이 녹아있는 10L의 물이

들어있다. 소금의 농도가 0.1kg/L인 물이 3L/min의

비율로 수조 안으로 들어오고, 동시에 잘 섞여진 물이

2L/min의 비율로 수조 밖으로 나간다. 수조의 물이 20L가

되는 순간, 수조 안에 있는 소금의 양이 $\frac{q}{p}$ kg이다.

$p+q$ 의 값을 구하시오. (단, p 와 q 는 서로소인 자연수이고,

수조 안으로 들어오는 물의 속도는 일정하고 수조 밖으로

나가는 물의 속도도 일정하다.) [5점]