



## 자 연 A

12. When he admitted to ①subordinates that he had made a mistake and then ②had expressed remorse, they not only ③forgave him, but became ④even more loyal.
13. If the congressman hopes to become president, he ①might need to start ②drawing up a bill for ③them who are likely to vote for him ④in the 2024 presidential election as well as people in his election district.
14. According to the recent survey by ①the Seoul Times, the number of citizens who ②are unable to find a book they would like to buy at a bookstore and order it ③at an online bookstore ④are skyrocketing these days.
15. Kepler, ①whose attitude toward astrology ②was remained ambiguous all his life, wondered whether there might be hidden patterns ③underlying the apparent chaos ④of daily life.

### III. Choose the one that is most suitable for the blank. (16-19)

16. A car company has recently been fined \$5 billion by government regulators, and the fine is for past \_\_\_\_\_ that are no longer relevant to how the firm produces cars going forward.
- ① anecdotes                      ② aptitudes  
③ oxymorons                      ④ infractions
17. People in the advertising industry are working to \_\_\_\_\_ the new media channels into the broader world of print and electronic media to maximize the entire system's potential for selling.
- ① integrate                      ② compromise  
③ denominate                      ④ impose
18. Unlike the first stimulus payment which college students can get, adults who are claimed as dependents on another person's tax return (such as a college student) aren't \_\_\_\_\_ for a second stimulus check.
- ① eligible                      ② illegitimate  
③ obligatory                      ④ illegible
19. Scientists strive to develop theories that \_\_\_\_\_ as wide a range of phenomena as possible, and physicists in particular tend to get excited about the prospect of describing everything that can happen in the material world in terms of a small number of rules.
- ① disambiguate                      ② discern  
③ advance                      ④ encompass

### IV. Read the following passage and answer the questions. (20-22)

When in 1997 the United States Congress passed a law requiring that juveniles aged 14 or older charged with federal crimes be tried as adults and incarcerated in adult prisons, they were following the lead of every state in the country.

But despite the tremendous popularity in lowering the age of adulthood by the criminal justice system, there's no evidence that it works to lower crime. In fact, ironically, the evidence shows the opposite.

Certainly, there are juvenile psychopathic murderers from whom, if released, the public could never be assured of protection. But as nightmarish as are those headline cases of brutal murders by juveniles, they make up an infinitesimal fraction of serious youth crimes. Most juveniles who are tried in adult courts and sent to adult prisons are sent there for lesser crimes than homicide and will be released someday.

Every study available so far shows that those juveniles who are sent to adult prison have higher recidivism rates than those who remain in juvenile facilities. That means that juveniles sent to adult prison tend to endanger the public and get rearrested at much higher rates once they've been released.

The reason youths who have served time in adult prison are so much more dangerous when released than their counterparts who have served time in juvenile facilities is that, for those who are capable of having their lives turned around, they stand the best chance of picking up the life skills they need in juvenile facilities. For most — but not all — education and treatment in youth facilities that are set up to try to save kids really does work.

Certainly, rehabilitation doesn't have a 100 percent success rate, particularly in those rare instances when the youngster either is incapable of or not open to it. One teenager I spoke with, whom I'll call [A]esse, had abandoned a fine family with seemingly caring working-class immigrant parents and successful siblings for an essentially homeless life of no school, fighting and crime. He couldn't articulate to me why he preferred his rootless life.

## 자 연 A

20. Which of the following can be inferred from the passage?
- ① Every juvenile crime can be prevented by appropriate parental guidance regardless of each juvenile's personality.
  - ② The portion of brutal murders by juveniles is not small enough to be ignored but has gradually decreased.
  - ③ The juveniles in juvenile facilities are likely to endanger the public less than those in adult prison, once both of them were released.
  - ④ There is no evidence that lowering the age of adulthood by the criminal justice system actually increases crime.
21. What is the main purpose of the passage?
- ① To explain criminal justice system relating to juveniles in America before 1997
  - ② To inform the reader of the negative effect of sending juveniles to adult prison
  - ③ To describe the relation between ages and crime rates
  - ④ To provide examples for juvenile crimes which raise serious issues
22. Why does the author mention a teenager, [A] esse in the passage?
- ① To provide an example of a juvenile who got unsuccessful rehabilitation
  - ② To analyze the difference between adult prisons and juvenile facilities
  - ③ To criticize the complicated situation of American criminal justice system
  - ④ To portray the life of an average adolescent in a juvenile facility

V. Read the following passage and answer the questions. (23-25)

A performance of music contains the following perceptual attributes: pitch, rhythm, tempo, contour, timbre, loudness, and spatial location. Technically speaking, pitch and loudness are psychological constructs that relate to the physical properties of frequency and amplitude. The term contour refers to the shape of a melody when musical interval size is ignored, and only the pattern of "up" and "down" motion is considered. Each one of these attributes can be changed without changing the others. With the exception of contour, and sometimes rhythm, the recognizability of the melody is maintained when each

of these attributes is changed. Of course, extreme changes in any of these dimensions will render the song unrecognizable.

A specific case of transformation invariance for melodies concerns pitch. The identity of a melody is independent of the actual pitches of the tones played. A melody is defined by the pattern of tones, or the relation of pitches to each other. Thus, when we transpose a melody, it is still recognizable as the same melody.

One of the reasons we are able to recognize melodies is that the memory system has formed an abstract representation of the melody that is pitch-invariant, loudness-invariant, and so on. We take for granted that our memory system is able to perform this important function. Recent evidence suggests that memory retains both the [A] "gist" and the actual details of experience. But what about melodies? Do we also retain pitch details, like the absolute pitch information?

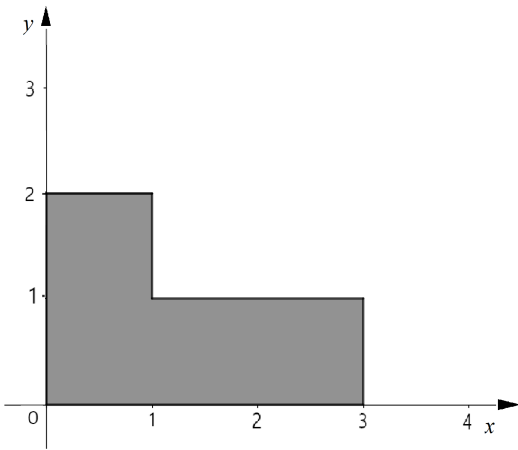
23. Which of the following CANNOT be a good example of "transformation invariance" for melodies?
- ① When you hear a song played louder than you're accustomed to, you can still identify it.
  - ② When you hear a song played at an extremely slow rate, with a tempo of one beat per hour, you can still recognize it.
  - ③ When you hear a song played on a different musical instrument, you can still identify it.
  - ④ When you hear your favorite song played from different directions, you can still recognize it.
24. According to the passage, why can't contour contribute to the identification of melody?
- ① Because contour only refers to the direction of a melody, but not exact intervals.
  - ② Because melody is part of the overall contour of a musical piece.
  - ③ Because it is easier to recognize melody than to recognize contour.
  - ④ Because a change in contour has greater perceptual consequences than a change in the other perceptual attributes.
25. In the passage, what does the underlined word in [A] "gist" refer to?
- ① absolute pitch
  - ② memory system
  - ③ abstract representation
  - ④ perceptual dimensions

수 학 15문항 (26-40)

26. 극한  $\lim_{x \rightarrow 0} (1 - \sin x)^{\frac{1}{x}}$  을 구하시오.

- ① 0      ② 1      ③ e      ④  $\frac{1}{e}$

27. 다음과 같은 밀도가 균일한 얇은 판이 있다. 이 판의 무게중심의  $y$ 좌표를 구하시오.



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

28. 공간곡선  $(x, y, z) = (\cos t, \sin t, t)$ ,  $0 \leq t \leq 2\pi$  는 식 (가)로 주어진 곡면 위의 곡선이며 이 곡선의 길이는 (나)이다. (가), (나)를 구하시오.

- ①  $x^2 + y^2 = z^2$ ,  $2\pi$       ②  $x^2 + y^2 = 1$ ,  $2\pi$   
 ③  $x^2 + y^2 = z^2$ ,  $2\sqrt{2}\pi$       ④  $x^2 + y^2 = 1$ ,  $2\sqrt{2}\pi$

29. 포물선  $y = x^2$ 을  $y$ 축을 중심으로 회전시킨 형태의 용기에  $3\text{cm}^3/\text{sec}$ 로 매초 일정한 양의 물을 채울 때 수면의 상승속도를 생각하자. 용기의 바닥 즉, 원점에서부터 수면의 높이가  $y_0$ ,  $y_1 = 2y_0$ 일 때 수면의 상승속도를 각각  $v_0, v_1$ 이라 하자.  $\frac{v_1}{v_0}$ 을 구하시오. 단,  $y_0 > 0$ 이다.

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

30.  $\int_0^\infty e^{-x^2} dx = \frac{\sqrt{\pi}}{2}$  를 이용하여  $\int_0^\infty x^2 e^{-x^2} dx$  를 구하시오.

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

31. 곡선  $x^2 + 4xy + 5y^2 = 6$  에서 함수  $f(x, y) = x + 3y$  의 최댓값을 구하시오.

- ①  $2\sqrt{2}$       ②  $2\sqrt{3}$       ③  $3 + \sqrt{2}$       ④  $6 - \sqrt{3}$

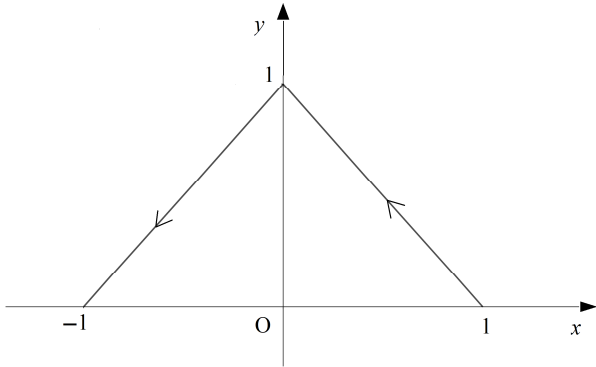
32. 구면  $S = \{(x, y, z) \in \mathbb{R}^3 \mid x^2 + y^2 + z^2 = 1\}$ 의  $z \geq a$ 인 부분의 면적이  $S$ 의 전체 면적의  $\frac{1}{6}$ 이다.  $a$ 를 구하시오.

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

# 자연 A

33. 경로  $C$ 는 점  $(1,0)$ 에서  $(0,1)$ 까지 선분과  $(0,1)$ 에서  $(-1,0)$ 까지 선분이다. 다음 선적분을 구하시오.

$$\int_C (3x^2 + 2xy^5) dx + (5x^2y^4 + \sin y + 6x) dy$$



- ① 4      ② 5      ③ 6      ④ 7

34. 미분방정식  $\frac{dx}{dt} = x^3$ ,  $x(0) = \frac{1}{10}$ 의 해  $x(t)$ 에 대해,  $x(t)$ 의  $t = a$ 에서의 좌극한이 무한대로 발산하는, 즉  $\lim_{t \rightarrow a^-} x(t) = \infty$ 인 상수  $a > 0$ 가 존재한다.  $a$ 를 구하시오.

- ① 10      ② 30      ③ 50      ④ 60

35. 함수  $f(t) = \begin{cases} 1, & 0 \leq t \leq \frac{\pi}{2} \\ 0, & \frac{\pi}{2} < t \end{cases}$ 에 대해 미분방정식

$$x'' + 4x = f(t), \quad x(0) = 0, \quad x'(\frac{\pi}{2}) = 0$$

은 구간  $[0, \infty)$ 에서  $x(t), x'(t)$ 가 연속인 해를 가진다. 이러한 해  $x(t)$ 에 대해  $x(\pi)$ 를 구하시오.

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

36. 다음 연립 선형미분방정식

$$\frac{dx}{dt} = -7x + 2y$$

$$\frac{dy}{dt} = -12x + 7y$$

의 해  $x(t), y(t)$ 에 대해  $\lim_{t \rightarrow \infty} \frac{y(t)}{x(t)}$ 를 구하시오. 단,

$x(0) = 2021, y(0) = 1.08$  이다.

- ① -5      ② 1      ③ 5      ④ 6

37. 다음의 행렬  $A$ 에 대해  $A\mathbf{x} = \mathbf{0}$ 인 영벡터가 아닌  $\mathbf{x} \in \mathbb{R}^3$ 가 존재한다.  $a$ 를 구하시오. 단,  $a > 0$ 이다.

$$A = \begin{pmatrix} 1 & 2 & 0 \\ a & 1 & a \\ 2 & 8a & 7 \end{pmatrix}$$

- ①  $\frac{1}{4}$       ②  $\frac{1}{2}$       ③  $\frac{7}{8}$       ④  $\frac{7}{4}$

38. 점  $P(3,4,1)$ 의 평면  $2x - y + z = 0$  위로의 정사영을  $Q(x_1, x_2, x_3)$ 이라 하자.  $x_1 + x_2 + x_3$ 을 구하시오.

- ① 2      ②  $\frac{8}{3}$       ③ 4      ④ 7

39. 복소수  $z = \cos \frac{2\pi}{13} + i \sin \frac{2\pi}{13}$ 에 대해

$$1 + z + z^2 + z^3 + \dots + z^{39}$$

- 을 구하시오.  
① 0      ② 1      ③  $2\cos \frac{2\pi}{13}$       ④  $2i \sin \frac{2\pi}{13}$

40. 원점을 중심으로 반지름 2인 반시계방향의 원  $C$ 에 대한 다음 복소함수의 경로적분들 중 적분값을 바르게 나타낸 것의 개수를 구하시오.

(a)  $\int_C e^{z^2} dz = 0$       (b)  $\int_C \frac{1}{z^3} dz = 0$

(c)  $\int_C \frac{1}{z^2 + 1} dz = 0$       (d)  $\int_C 1 dz = 4\pi$

- ① 1개      ② 2개      ③ 3개      ④ 4개