英語 I（選択）

次の文章に関して、空欄補充問題と読解問題の二つがあります。まず、[31]から[40]の空所を埋めるのに、文脈的に最も適切な語を 1 から 3 の中から選び、その番号を解答欄（31）から（40）にマークしなさい。次に、内容に関する[41]から[45]の設問には、1 から 4 の選択肢が付されています。そのうち、文章の内容からみて最も適切なものを選び、その番号を解答欄（41）から（45）にマークしなさい。

1　　Here is an example of extreme cognitive dissonance. Teachers are striking across the United States. Thousands of educators have been walking off the job in protest at radical public budget cuts over the past several years. These cuts have left them under-paid, overworked, and using their own money to supplement [31](1. extravagant 2. minuscule 3. balanced) budgets that result in books held together with duct tape and rain pouring into classrooms through ceiling holes.

2　　At the same time, business leaders, who have spent the past year successfully lobbying for tax "reform," are complaining that politicians have to do something about the [32](1. bitter taste 2. happy medium 3. sad state) of American schools. They complain that the failing American education system has made it impossible to find the workers needed to maintain their competitiveness on the international stage.

3　　**They** are right about that. While the US will probably have created about 15 million new jobs in the decade leading up to 2020, 65% will require post-secondary education and training beyond high school. Meanwhile, only 54% of Americans who enter tertiary education receive a degree within six years, a rate that reflects both cost inflation and the lack of preparedness with which many of them enter degree programs.

4　　Yet there is a huge irony here: Businesses want both tax cuts and educational reform. But they refuse to acknowledge the [33](1. elephant in the room 2. snake in the grass 3. wolf in sheep's clothing): the incompatibility between those two things. Recent tax cuts did not cause the state teacher strikes. Education is mainly funded by state and local governments. However, they are part of a decades-long pattern of cuts in the public sector, made mainly at the [34](1. upheaval 2. behest 3. perusal) of business lobbyists, that has battered public education, which is and always has been the great equalizer in American society.

5　　State funding for education hit a peak in the 1980s and has been falling ever since, a decline that has [35](1. nevertheless 2. of course 3. inexplicably) created a huge class and skills gap. While the cost of a degree has risen for everyone, it has hit families in the lowest quartile of the socio-economic [36](1. spectrum 2. prism 3. continuity) the hardest. They paid 44.6% of their income for a degree in 1990, compared with 84% today. No wonder so many drop out with no diploma but huge amounts of

debt—a situation that has become a "headwind" to economic growth, according to the US Federal Reserve.

6   This, combined with the fact that US education has not been retooled in decades and does not churn out graduates equipped to compete in the digital economy, means that there is a large class of under-employed and under-skilled American workers. According to many chief executives, economists and civil society leaders, this has become the most pressing single problem for business.

7   "There are a lot of individual efforts on the part of business to address the skills gap," says Darren Walker, the president of Ford Foundation. "And yet we must acknowledge that, when we prioritize tax cuts above all other policy, we risk [37](1. spiking 2. starving 3. stimulating) the public sector, and that ultimately leads to lower educational outcomes, higher inequality, and more polarized politics."

8   Changing this is [38](1. something other than 2. anything other than 3. nothing short of) a national security issue. Economic research shows that only when education stays ahead of technology can countries prosper. Yet in the US, the system is so broken that the quest for education is itself leading to rising inequality and a $1.3 trillion student debt pile. This is terrible for business in a number of ways—from the fact that unskilled, low-paid workers cannot [39](1. drive 2. lift 3. stretch) growth in an economy dominated by consumer spending, to the reality that less educated people vote for populist politicians.

9   Business must acknowledge this cognitive dissonance. America's major corporate lobbying groups should take on educational reform as a national competitiveness issue, just as they did tax reform. Members should create a task force to [40](1. lay low 2. roll out 3. draw in) their own best practices at a national level and declare that they will not support tax cuts that strip education of funding. It would be good for business—and society.

—Based on Faroohar, R. (2018). "Business must step up and help fix American education," *The Financial Times*.

[41] In the 3ʳᵈ paragraph, who does "**they**" refer to?

1. Teachers on strike

2. Business leaders

3. Politicians

4. American schools

[42] Which of the following is **_NOT_** given as a consequence of cuts to public education?

1. Large gaps are forming between skilled and unskilled workers.

2. Populist politicians are being elected into power.

3. The cost of a college degree is continuing to rise for everyone.

4. Businesses are unable to compete internationally.

[43] In the 5ᵗʰ paragraph, what is meant by "headwind"?

1. An advantage

2. A penalty

3. A guide

4. An obstacle

[44] Which of the following best expresses the overall meaning of the 6ᵗʰ paragraph?

1. The American college system is more concerned with giving people degrees than educating them.

2. American education is falling behind when it comes to preparing students to work in technology.

3. Graduates from American colleges make less money than skilled workers in other countries.

4. Businesses are taking issue with the abundance of executives, economists, and society leaders.

[45] What is the cognitive dissonance that the article is referring to?

1. Teacher strikes in the United States are not the result of tax reform.

2. American businesses seeking tax cuts make it impossible for education to improve.

3. Education should be prioritized over technology for the US to compete internationally.

4. America has both one of the strongest economies and weakest education systems in the world.

英語 II

次の文章に関して、空欄補充問題と読解問題の二つがあります。まず、[46]から[55]の空所を埋めるのに、文脈的に最も適切な語を 1 から 3 の中から選び、その番号を解答欄（46）から（55）にマークしなさい。次に、内容に関する[56]から[60]の設問には、1 から 4 の選択肢が付されています。そのうち、文章の内容からみて最も適切なものを選び、その番号を解答欄（56）から（60）にマークしなさい。

1   "Techlash" is the rising animosity toward large technology companies and their impacts on society. Government leaders are becoming exasperated at the inability of traditional policymaking to keep up with the speed and scale of change. In that governance [46](1. direction 2. bubble 3. vacuum), corporate leaders are recognizing a growing crisis of trust with the public that requires more aggressive self-regulation.

2   In response, some companies are creating new executive positions, such as a chief ethics officer, to ensure that ethical considerations are integrated across product development and deployment. These executives are working through some of the most [47](1. disingenuous 2. contentious 3. innocuous) issues in the public eye, and the ways to drive cultural change within organizations that pride themselves on their willingness to "move fast and break things."

3   While accountability for harmful products often happens at the executive level, decisions that lead to them are often made by engineers and developers on product teams. If you look at the recent tech scandals, most did not involve a moment when someone decided to proceed with a product despite knowing how it could be abused. Rather, they usually emanate from a design decision that had unintended impacts.

4   Most tech developers have a natural bias toward imagining the ways their products can benefit society. To [48](1. counteract 2. normalize 3. conceal) this, employees need tools to help them predict a range of harms, from discrimination to tech addiction, and develop strategies to mitigate those outcomes.

5   Identifying red flags is just the first step. A process is necessary to ensure that they are raised to an appropriate level of seniority and [49](1. judged 2. implemented 3. embraced) transparently and consistently. Some ethics executives experimented with creating a new process for these "ethics checkpoints," but quickly realized that this burdened the tight product development cycle, or was ignored altogether.

6   What's proven to be more effective is piggy-backing on processes that are already [50](1. irrelevant to 2. ingrained in 3. independent of) the product development road map, such as those created in recent years related to cybersecurity, environmental sustainability, and accessibility. This

allows straightforward concerns to be addressed quickly, while more complex or sensitive ones can be escalated for deeper review.

7   As tempting as it may be to see a new "ethics office" as the [51](1. placebo 2. panacea 3. pacifier) for a company's problems, ethics executives realized that they could not keep up with the demands for support from across the company, no matter how big their new department grew. Devoting your whole ethics teams to a few controversial topics or complex new products for a few months is useful to initially [52](1. refute 2. refine 3. retire) a methodology. But that approach doesn't scale when there is a need for attention and consideration across all products and features.

8   [53](1. Instead 2. Otherwise 3. Nevertheless), companies like Microsoft are now finding success with training "ambassadors" or "champions" embedded in teams to heighten sensitivity toward unintended impacts, and help their teams navigate raising issues and concerns. Empowering people within teams ensures that they have the contextual intelligence and credibility needed to be trusted and effective.

9   You can create the most well-designed process, but no one will follow it, or they will turn it into a superficial [54](1. nit-picking 2. bug-fixing 3. box-checking) exercise, if they aren't incentivized to do so. The priority for most engineers is to ship their products fast. To get real about responsible innovation, companies need to build these practices into individual and team objectives and performance reviews, as well as criteria for promotions, raises, bonuses, and even hiring.

10   These hard incentives need to be [55](1. contested 2. contradicted 3. complemented) with a range of soft incentives. Think about how your company celebrates a new product or feature launch. Maybe the team is congratulated over email or at the weekly meeting. How can you do something similar when a new product isn't launched because an ethical concern was surfaced? Employees have a keen sense of what is valued in an organization, and ethics executives are seeing that subtle cues like these can go a long way in changing behavior to avoid further "techlash".

—Based on Krieger, Z. (2020). "A practical guide for building ethical tech," *Wired.com*.

[56] In the 3rd paragraph, what does the author believe caused recent scandals involving technology companies?

1. Insufficient foresight rather than malicious intentions.

2. The desire to pursue maximum economic profits.

3. Intentional decisions to release dangerous products.

4. Tight schedules and severely overworked employees.

[57] According to the article, what is the problem with processes created to address ethical issues?

1. Giving employees extra duties to perform is unreasonable.

2. They are not effective at preventing the issues they are meant to solve.

3. They are not followed because they take too much time to implement.

4. Developers are too biased in favor of their products to focus on ethical issues.

[58] According to the author, which of the following is likely **_NOT_** a duty that ethics "ambassadors" or "champions" would perform?

1. Considering how a new user interface might disadvantage people with disabilities.

2. Helping an advertiser use the company's facial recognition system to prevent theft.

3. Preparing a report on potential racial bias in an AI algorithm for the executives.

4. Analyzing privacy problems that have arisen in the company's other tech products.

[59] How does the author think companies should ensure their technology products are developed in an ethical manner?

1. By consistently providing both concrete and abstract rewards for ethical behavior.

2. By giving financial incentives, such as bonuses, when employees behave ethically.

3. By creating an ethics office to handle ethical questions for the entire company.

4. By giving control of development projects to ethics champions or ambassadors.

[60] Based on the article, which of the following would be an example of "techlash"?

1. A government banning a foreign application for reasons of national policy.

2. A technology company criticizing another company for monopolistic practices.

3. Users boycotting a social media app because they think it causes cyberbullying.

4. Artists suing a company for using their intellectual property without permission.

注 意 事 項 2

問題冊子に数字の入った □ があります．それらの数字は解答用紙の解答欄の番号を表しています．対応する番号の解答欄の 0 から 9 までの数字または − (マイナスの符号) をマークしてください．

　□ が 2 個以上つながったとき，数は右詰めで入れ，左の余った空欄には 0 を入れてください．負の数の場合には，マイナスの符号を先頭の □ に入れてください．また，小数点以下がある場合には，左詰めで入れ，右の余った空欄には 0 を入れてください．

(例)　12　⟶　| 0 | 1 | 2 |　　　　−3　⟶　| - | 0 | 3 |

　　　1.4　⟶　| 0 | 0 | 1 . | 4 | 0 |　　　−5　⟶　| - | 0 | 5 . | 0 | 0 |

分数は約分した形で解答してください．マイナスの符号は分母には使えません．

(例)　$\dfrac{4}{8}$ ⟶ $\dfrac{1}{2}$ ⟶ $\dfrac{\boxed{0}\,\boxed{1}}{\boxed{0}\,\boxed{2}}$　　　$-\dfrac{6}{9}$ ⟶ $-\dfrac{2}{3}$ ⟶ $\dfrac{\boxed{-}\,\boxed{2}}{\boxed{0}\,\boxed{3}}$

ルート記号の中は平方因子を含まない形で解答してください．

(例)　$\sqrt{50}$ ⟶ $\boxed{0}\,\boxed{5}\sqrt{\boxed{0}\,\boxed{2}}$　　　$-\sqrt{24}$ ⟶ $\boxed{-}\,\boxed{2}\sqrt{\boxed{0}\,\boxed{6}}$

　　　$\sqrt{13}$ ⟶ $\boxed{0}\,\boxed{1}\sqrt{\boxed{1}\,\boxed{3}}$　　　$-\dfrac{\sqrt{18}}{6}$ ⟶ $\dfrac{\boxed{-}\,\boxed{1}\sqrt{\boxed{0}\,\boxed{2}}}{\boxed{0}\,\boxed{2}}$

数式については，つぎの例のようにしてください．分数式は約分した形で解答してください．

(例)　$\sqrt{12a}$ ⟶ $\boxed{0}\,\boxed{2}\sqrt{\boxed{0}\,\boxed{3}a}$

　　　$-a^2-5$ ⟶ $\boxed{-}\,\boxed{1}a^2+\boxed{0}\,\boxed{0}a+\boxed{-}\,\boxed{5}$

　　　$\dfrac{4a}{2a-2}$ ⟶ $\dfrac{-2a}{1-a}$ ⟶ $\dfrac{\boxed{0}\,\boxed{0}+\boxed{-}\,\boxed{2}a}{1-\boxed{0}\,\boxed{1}a}$

　また，選択肢の番号を選ぶ問題では，最も適切な選択肢を 1 つだけ選びなさい．同じ選択肢を複数回選んでもかまいません．

数学III

(1) 各面が白色あるいは黒色で塗られた正四面体について，いずれか1つの面を等確率 $\frac{1}{4}$ で選択し，選択した面を除いた3つの面の色を，白色であれば黒色に，黒色であれば白色に塗り直す試行を繰り返す．正四面体のすべての面が白色の状態から開始するとき
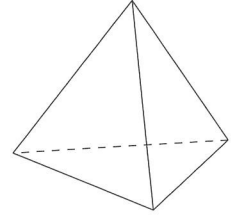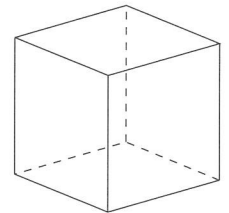
(a) 2つの面が白色，2つの面が黒色になる最小の試行回数は $\boxed{(61)}\boxed{(62)}$ 回であり，この試行回数で同状態が実現する確率は $\dfrac{\boxed{(63)}\boxed{(64)}}{\boxed{(65)}\boxed{(66)}}$ である．

(b) すべての面が黒色になる最小の試行回数は $\boxed{(67)}\boxed{(68)}$ 回であり，この試行回数で同状態が実現する確率は $\dfrac{\boxed{(69)}\boxed{(70)}}{\boxed{(71)}\boxed{(72)}}$ である．

(2) 各面が白色あるいは黒色で塗られた立方体について，いずれか1つの面を等確率 $\frac{1}{6}$ で選択し，選択した面を除いた5つの面の色を，白色であれば黒色に，黒色であれば白色に塗り直す試行を繰り返す．立方体のすべての面が白色の状態から開始するとき

(a) 3つの面が白色，3つの面が黒色になる最小の試行回数は $\boxed{(73)}\boxed{(74)}$ 回であり，この試行回数で同状態が実現する確率は $\dfrac{\boxed{(75)}\boxed{(76)}}{\boxed{(77)}\boxed{(78)}}$ である．
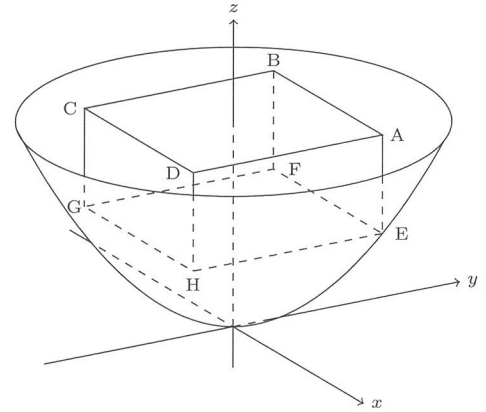
(b) すべての面が黒色になる最小の試行回数は $\boxed{(79)}\boxed{(80)}$ 回であり，この試行回数で同状態が実現する確率は $\dfrac{\boxed{(81)}\boxed{(82)}\boxed{(83)}}{\boxed{(84)}\boxed{(85)}\boxed{(86)}}$ である．

数学Ⅳ

xyz 空間において，直方体 ABCD–EFGH が $z \geqq x^2 + y^2$ $(0 \leqq z \leqq 1)$ を満たす立体の周辺および内部に存在する．この直方体の面 ABCD，EFGH は xy 平面に平行であり，頂点 A, B, C, D は平面 $z = 1$ 上に，頂点 E, F, G, H は曲面 $z = x^2 + y^2$ 上に存在する．

(1) 直方体 ABCD–EFGH の面 ABCD および EFGH が 1 辺の長さ a の正方形のとき，正の実数である a の取り得る値の範囲は $0 < a < \sqrt{\dfrac{(87)}{(88)}}$ であり，この直方体の体積は $\dfrac{(89)(90)}{(91)(92)} a^4 + \boxed{(93)(94)} a^2$ である．

(2) 直方体 ABCD–EFGH の面 ABFE および DCGH が 1 辺の長さ b の正方形のとき，正の実数である b の取り得る値の範囲は $0 < b < \boxed{(95)(96)} + \boxed{(97)(98)} \sqrt{\boxed{(99)(100)}}$ であり，この直方体の体積は $b^2 \sqrt{\boxed{(101)(102)} b^2 + \boxed{(103)(104)} b + \boxed{(105)(106)}}$ である．

(3) 直方体 ABCD–EFGH のすべての面が 1 辺の長さ c の正方形のとき，すなわち直方体 ABCD–EFGH が立方体のとき，正の実数である c の値は $\boxed{(107)(108)} + \sqrt{\boxed{(109)(110)}}$ であり，立方体 ABCD–EFGH の体積は $\boxed{(111)(112)(113)} + \boxed{(114)(115)} \sqrt{\boxed{(116)(117)}}$ である．

数学V

ある国の有識者会議が，経済活性化に資する公共サービスの供給量 x と，医療・公衆衛生に関する公共サービスの供給量 y の組合せの検討を行っている．供給量の組合せ (x, y) は，予算やマンパワー，既存の法律など，さまざまな要因により，その実現可能性に制約を受け，次の不等式を満たすものとする．

$$\begin{cases} 2x + 5y \leqq 405 & \cdots\cdots(1) \\ x^2 + 75y \leqq 6075 & \cdots\cdots(2) \\ x \geqq 0 & \cdots\cdots(3) \\ y \geqq 0 & \cdots\cdots(4) \end{cases}$$

供給量の組合せ (x, y) を x 軸と y 軸の 2 次元座標で表わすと，実現可能な供給量の組合せ (x, y) の領域は，$0 \leqq x \leqq \boxed{(118)}\boxed{(119)}$ の範囲で (1) と (4) を満たす (x, y) の部分の領域と，$\boxed{(118)}\boxed{(119)} \leqq x \leqq \boxed{(120)}\boxed{(121)} \sqrt{\boxed{(122)}\boxed{(123)}}$ の範囲で (2) と (4) を満たす (x, y) の部分の領域の 2 つからなることが分かる．

いま，有識者会議の目標が xy の最大化であるとすると，供給量の組合せを

$$(x, y) = \left(\boxed{(124)}\boxed{(125)}, \boxed{(126)}\boxed{(127)} \right)$$

とする結論を得る．

次に，情勢の変化に伴って，上記の (1), (2), (3), (4) に新たな不等式

$$x + y \leqq 93 \quad \cdots\cdots(5)$$

が加わったとすると，実現可能な (x, y) の領域は，$0 \leq x \leqq \boxed{(128)}\boxed{(129)}$ の範囲で (1) と (4) を満たす (x, y) の部分の領域と，$\boxed{(128)}\boxed{(129)} \leqq x \leqq \boxed{(130)}\boxed{(131)}$ の範囲で (5) と (4) を満たす (x, y) の部分の領域と，$\boxed{(130)}\boxed{(131)} \leqq x \leqq \boxed{(120)}\boxed{(121)} \sqrt{\boxed{(122)}\boxed{(123)}}$ の範囲で (2) と (4) を満たす (x, y) の部分の領域の 3 つに分けることができる．また，政府の方針にそって，有識者会議の目標が $x^2 y$ の最大化に変更されたとすると，供給量の組合せを

$$(x, y) = \left(\boxed{(132)}\boxed{(133)}, \boxed{(134)}\boxed{(135)} \right)$$

とする結論を導くことになる．