

[ 1 ]

次の英文を読み、それぞれの下線部の意味を日本語で表しなさい。  
答えは解答欄 [ 1 ] に記入しなさい。

### Advances in Sports Science

When Clive Woodward, the coach of England's World Cup-winning rugby team of 2003, was asked how he had managed to turn his players into champions, he answered: "We just did 100 things one percent better." That is basically what the field of sports science is all about. We have all heard depressing stories of sportspeople turning to drugs in order to gain an advantage over their competitors. (1)However, using the power of technology, sports science helps athletes improve their performance without cheating.

Sports science works in two areas, which are closely linked: the improvement of fitness and the improvement of athletic results. (2)In fact, neither of these aims is new. The ancient Greeks wrote essays on health, nutrition, and fitness to help athletes prepare for the Olympic Games. The difference these days is that modern technology allows coaches to be much more precise in understanding both what competitors need and how best to provide it. While exercising, many sportspeople now wear sensors that measure heart rates, blood pressure, body water levels, and muscle fatigue. They also have GPS trackers that show not only exactly how far they have run, but also their different speeds, changes of direction, and rates of speeding up and slowing down.

(3)All of this data can be used to create training programs that build athletic skills and support safety in sports. After a particularly hard activity, such as a full game of soccer, treatments are employed to ensure the quickest recovery. For instance, Manchester City, a soccer team in England's Premier League, has a very cold room, which is cooled by liquid nitrogen to  $-150^{\circ}\text{C}$ . Players enter the room and remain inside for three minutes, allowing the freezing temperature to aid the recovery of injuries and tired muscles.

Aside from fitness, sports science is also used to improve other aspects of performance. GPS trackers can monitor the position of each player on the field. (4)With this information, coaches make game plans for sports like soccer, rugby, and American football. Other technologies are used to develop players' visual processing by tracking their eye movements, powers of concentration, and spatial awareness through training on computer simulators.

Many universities in Japan have opened sports science departments to produce the next generation of elite coaches, nutritionists, and fitness instructors. (5)There is no doubt that sports will continue to be an important area of scientific research.

Adapted from *Science Arena*, Seibido

[2]

次の日本語それぞれの意味を英語で表しなさい。

答えは解答欄 [2] に記入しなさい。

- (6) 私の母はロンドンにある会社に勤めています。
- (7) 来週の金曜日までに、宿題を提出してください。
- (8) この店の最新のスマートフォンは二か月前に売り切れました。
- (9) エミは明日試験を受けるために早起しなればなりません。
- (10) 東京へ引っ越したとき、あなたは何歳でしたか。

[ 1 ] 次の関数  $f(x)$  の導関数  $f'(x)$  を求めなさい。

(1)  $f(x) = x^2 - \frac{1}{x^2} + \sqrt{x}$

(2)  $f(x) = \log(x^2 + 1)$

(3)  $f(x) = (7x - 2) \cos x$

(4)  $f(x) = \tan^{-1} x \quad (= \arctan x)$

[ 解答 ]

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[ 2 ] 次の関数  $f(x)$  の不定積分  $\int f(x) dx$  を求めなさい。

(1)  $f(x) = x^2 - \frac{1}{x^2} + \sqrt{x}$

(2)  $f(x) = x e^{1-x^2}$

(3)  $f(x) = (3x + 1) \cos x$

(4)  $f(x) = \frac{1}{\sqrt{1-x^2}}$

[ 解答 ]

得点	
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[ 3 ] (1) 関数  $f(x, y) = x^2 - 3xy - 7y^2 + 5x - 6y - 2$  の偏導関数  $f_x(x, y)$ ,  $f_y(x, y)$  を求めなさい。

(2) 2重積分

$$\iint_D y \, dx \, dy \quad D = \{ (x, y) \mid x + y \leq 3 \text{ かつ } x \geq 0 \text{ かつ } y \geq 0 \}$$

の値を求めなさい。

[ 解答 ]

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[ 4 ] (1) 行列に関する次の等式を満たす  $a, b, c, d, e, f$  の値を求めなさい。

$$1) \begin{pmatrix} a & 2 \\ 4 & 5 \end{pmatrix} \begin{pmatrix} -2 & 3 \\ b & -4 \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ 7 & c \end{pmatrix}$$

$$2) \begin{pmatrix} 5 & d+e & 0 \\ 3 & 5 & 7 \\ 3e & -2f & 0 \end{pmatrix} + 2 \begin{pmatrix} 2 & d & e \\ e & 0 & -3 \\ d & f & 0 \end{pmatrix} = \begin{pmatrix} 9 & -f+7 & 2e \\ -2d+f & 5 & 1 \\ 2f-8 & 0 & 0 \end{pmatrix}$$

(2) 行列  $\begin{pmatrix} 2g & 5g-3 \\ g+2 & 3g \end{pmatrix}$  が逆行列をもたないとき、 $g$  の値を求めなさい。

[ 解答 ]

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