

# 第1回 リスナー参加型 天下一学問会

高校レベル

問題用紙

英語

作問者：いーんちょ

問題数：大問1問

記述式

解答時間：45分

## 注意事項

1. 解答は専用フォームから行うこと

難易度：普通

目標点数

金：80点

銀：55点

銅：30点

次ページより問題を掲載

## 英語問題

以下の英文はエッフェル塔に関する記述である。これを読んで問いに答えよ。

When it was built, many were shocked by the tower's daring form. (A)Eiffel<sup>1)</sup> was accused of trying to create something artistic with no regard to the principles of engineering. However, Eiffel and his team – experienced bridge builders – understood the importance of wind forces, and knew that if they were going to build the tallest structure in the world, they had to be sure it could withstand<sup>2)</sup> them. In an interview with the newspaper *Le Temps*<sup>3)</sup> published on 14 February 1887, Eiffel said:

(B)Is it not true that the very conditions which give strength also conform to the hidden rules of harmony? ... Now to what phenomenon did I have to give primary concern in designing the Tower? It was wind resistance. Well then! I hold that the curvature of the monument's four outer edges, which is as mathematical calculation dictated it should be ... will give a great impression of strength and beauty, for it will reveal to the eyes of the observer the boldness of the design as a whole.

He used graphical methods to determine the strength of the tower and empirical evidence to account for the effects of wind, rather than a mathematical formula. Close examination of the tower reveals a basically exponential<sup>4)</sup> shape. All parts of the tower were overdesigned to ensure maximum resistance to wind forces. The top half was even assumed to have no gaps in the latticework<sup>5)</sup>. In the years since it was completed, engineers have put forward various mathematical hypotheses in an attempt to explain the success of the design. The most recent, devised in 2004 after letters sent by Eiffel to the French Society of Civil Engineers in 1885 were translated into English, is described as a non-linear<sup>6)</sup> integral equation based on counteracting<sup>7)</sup> the wind pressure on any point of the tower with the tension between the construction elements at that point.

The Eiffel Tower sways by up to 9 cm (3.5 in) in the wind.

注)

- 1) Eiffel エッフェル。フランスの技師であり構造化。エッフェル塔の設計者。
- 2) withstand 抵抗する 3) Le Temps かつて存在したフランスの日刊ニュース新聞
- 4) exponential 指数 5) latticework 格子造り
- 6) non-linear 非線型。二つの量が比例関係にないこと 7) counteract 逆らう。

[https://en.wikipedia.org/wiki/Eiffel\\_Tower](https://en.wikipedia.org/wiki/Eiffel_Tower)

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問1.本文中に登場する以下の単語のうち、下線部の発音が異なるものを一つ選べ。

- (1) something (2) strength (3) rather (4) mathematical

問2.下線部(A)を日本語訳せよ。

問3.エッフェルとその技師達が、当時世界一の高さの建造物を建築するにあたり最も重要視した作用(力)とは何か。本文中の英単語で答えよ。

問4.下線部(B)を日本語訳せよ。

問5.エッフェルは外側に向かって湾曲しながら塔を支えている脚部分が与える大きな印象を述べている。その要素二つと、またそれらの由来も述べよ。

問6.エッフェル塔の完成以降、多くの技術者達は塔の設計が成功している理由について多くの数学的仮説を提唱した。なぜ技術者達はこのような取り組みを実施したのか、その理由を述べよ。

問7.エッフェル塔の高さは 300 m である。塔の高さに対して最大揺れ幅の割合は何%か。

問8.本文の内容として適切な見出しはどれか、一つ選べ。

- A) Eiffel's life and his dream
- B) Art design of the Tower
- C) Wind and weather considerations
- D) Ideas from Mathematics