



## 2023 Tiebreaker Round

1. Let  $n = p_1^{e_1} p_2^{e_2} \dots p_k^{e_k} = \prod_{i=1}^k p_i^{e_i}$ , where  $p_1 < p_2 < \dots < p_k$  are primes and  $e_1, e_2, \dots, e_k$  are positive integers,

and let  $f(n) = \prod_{i=1}^k e_i^{p_i}$ . Find the number of integers  $n$  such that  $2 \leq n \leq 2023$  and  $f(n) = 128$ .

2. The lengths of the altitudes of  $\triangle ABC$  are the roots of the polynomial  $x^3 - 34x^2 + 360x - 1200$ . Find the area of  $\triangle ABC$ .

Indiv ID: \_\_\_\_\_

Team ID: \_\_\_\_\_

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1. \_\_\_\_\_

2. \_\_\_\_\_

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- 10 minutes
- no calculators
- positive integer answers
- ranking will be determined by score, then by time