

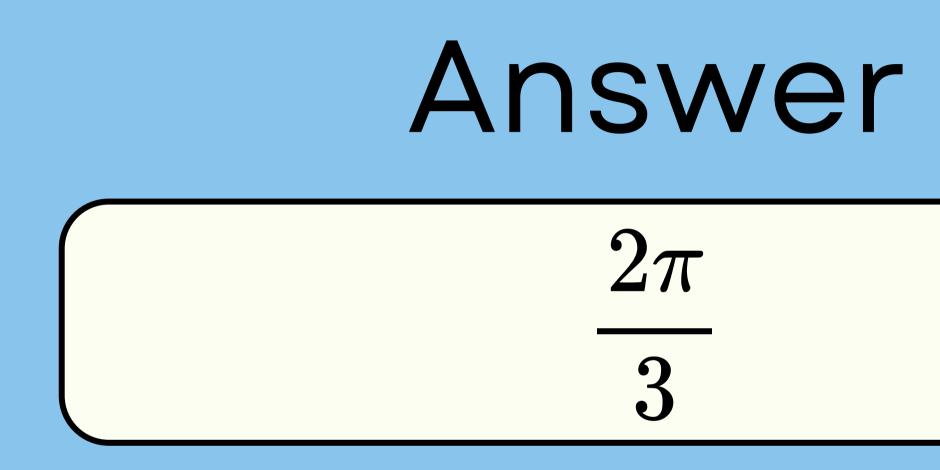
Rules

- The following three events will happen simultaneously: one, the question will appear on the screen, two, the quizmaster will start reading the question, and three, the buzzers will go live
- The fastest team to hit their buzzer gets to answer
- Once a buzzer is pressed, the QM will stop reading immediately, mic will be brought to the team that buzzed and they must give their answer
- If they answer correctly, they get full points (+30)
- If they answer incorrectly or dont answer immediately, they'll incur a penalty (-15) points, and the question passes to the team which was the 2nd fastest
- If the next team buzzes and answers incorrectly as well, or if nobody gets the correct answer within 90 seconds of opening the question, the question passes to the audience

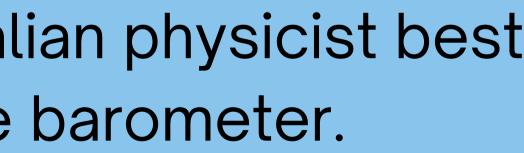


Given a set of points in Euclidean space, the geometric median is the unique point which minimizes the sum of distances to these points. A triangle's geometric median is called its Torricelli point. Consider a triangle with sides 13,14 and 15. Determine the angle subtended by the side of length 13 at the Torricelli point of the triangle.



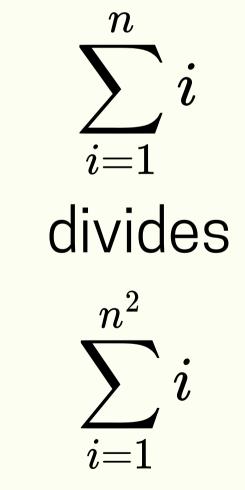


PS: Evangelista Torricelli was an Italian physicist best known for the invention of the barometer.



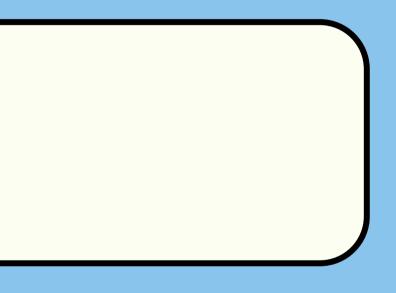


Find the largest positive integer 'n' such that





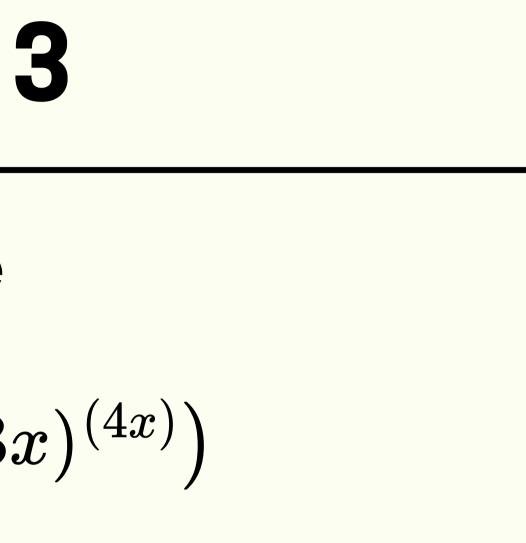






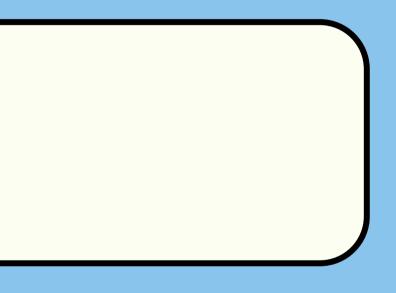
Determine

 $\lim_{x
ightarrow 0^+}(2x)^{((3x)^{(4x)})}$







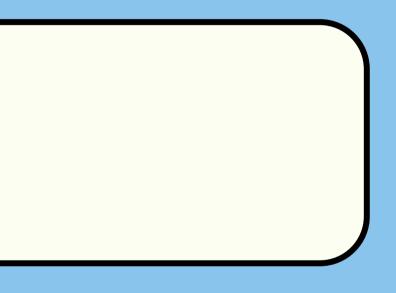




Given a (not necessarily meaningful) word made using the lowercase English alphabet, it is called *freaky* if between any 2 identical letters in it there are no 2 identical letters. Find the maximum possible length of a *freaky* word.









What is the given paper about?

Properties of 3

Basic Constructions 3.1

In order to understand construction, we will need to understand some of the most basic folds that can be created. The following is the definition given by Auckly and Cleveland of pair. This definition is the basis of what we mean by " " in this paper:

Definition 3.1. $\{\mathcal{P}, \mathcal{L}\}$ is an pair if \mathcal{P} is a set of points in \mathbb{R}^2 and \mathcal{L} is a collections of lines in \mathbb{R}^2 satisfying:

- L_2 is in \mathcal{L} .
- is the mirror reflection of L_2 about L_1 .



a) The point of intersection of any two non-parallel lines in L is a point in

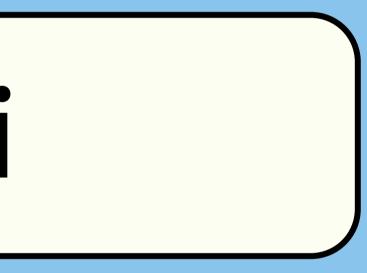
b) Given any two distinct points in P, there is a line L going through them. c) Given any two distinct points in \mathcal{P} , the perpendicular bisector of the line segment with given end points is a line in \mathcal{L} .

d) If L_1 and L_2 are lines in \mathcal{L} , then the line which is equidistant from L_1 and

e) If L_1 and L_2 are lines in \mathcal{L} , then there exists a line L_3 in \mathcal{L} such that L_3



Origami



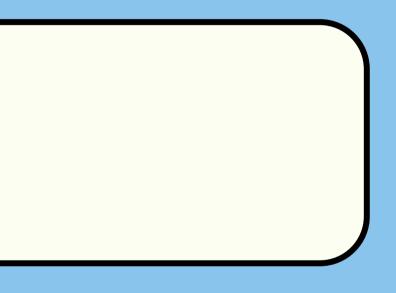


For how many numbers 'n' between 1 and 69 (both inclusive) is the fraction $\frac{n^2+4}{n+5}$

in reduced form?



67





Consider a polynomial P(x) with positive coefficients such that

 $P(1) \ge 3.5$

Find the minimum value of

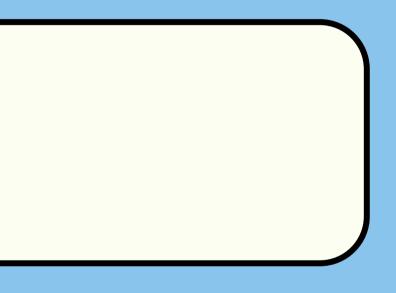
 $P(x)P\left(rac{1}{x}
ight)$

over the positive reals





12.25

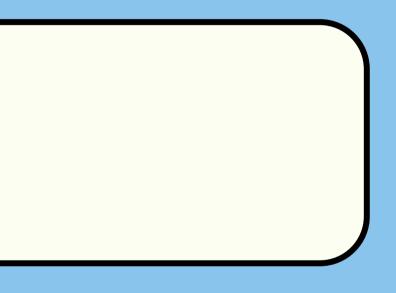




Let S(n) denote the sum of the digits of the integer n. If S(n) = 2027, what is the smallest possible value of S(n + 1)?



3





Find the remainder when

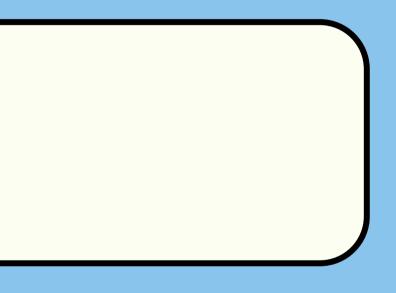
$$243^{243^{242^{241\cdots}^1}}$$

is divided by 5.





3



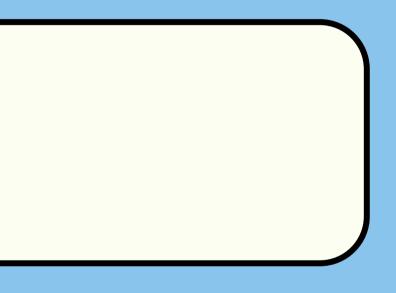


Question 10

Approximately 80,000 marriages took place in New York last year. Estimate the probability that for at least one of these couples, both partners were born on June 31.



 $\left(\right)$





Question 11

This algorithm used in arithmetic geometry determines whether a "given set of sections provides a basis for the Mordell-Weil group of an elliptic surface $E \rightarrow S$, where S is isomorphic to the projective line". In 2021 one of the co-authors remarked that "...a few weeks after we met, we realized that we had to write a joint paper because the combination of our last names, in the usual alphabetical order, is remarkably obscene." ID the algorithm.



Cox-Zucker Machine

Question 12

The number 452668172 can be converted into the square of a certain even integer N by changing one of its digits. Give the digit to be changed and its new value.



Last digit should be changed from 2 to 6

Final

Consider all matrices with 4 rows and 4 columns, with 0s on the main diagonal and with elements chosen from $\{-1, 1\}$ elsewhere. What is the probability of the determinant of a randomly chosen matrix amongst these being 0?

