

Student Name: \_\_\_\_\_

Please write your name on *every* page.

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## Section E

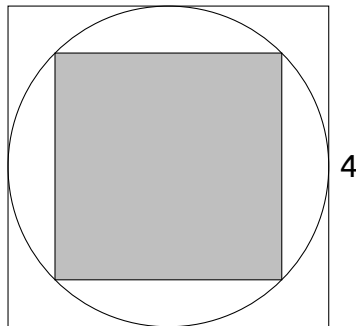
### E1

Alice tosses 3 coins and Bob tosses 1 coin. What is the probability that Alice gets more heads than Bob?

Answer to E1: \_\_\_\_\_

### E2

Inscribe a square in a circle, and that circle in a square. If the outer square has side length 4, what is the area of the inner square?



Answer to E2: \_\_\_\_\_

### E3

How many six-digit palindromes are divisible by 11?

Note: A palindrome is a number that reads the same forwards and backwards. For example, 123321 is a palindrome, as is 702207 or 888888. Do not include numbers like 012210 — that is a five-digit number, not a six-digit number.

Answer to E3: \_\_\_\_\_

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**E4**

What is the remainder when

$$2015^{2016^{2017}}$$

is divided by 9? Note that in the standard order of operations, the exponent is evaluated before the base, so for example  $2^{1^2} = 2^1 = 2$ .

Answer to E4: \_\_\_\_\_

**E5**

What is the *least* possible number of elements that must be deleted from the set

$$\{1, 2, 3, \dots, 20\}$$

so that the product of the remaining numbers is a perfect square?

Answer to E5: \_\_\_\_\_

**E6**

A car travels downhill at 120 km/h, on flat roads at 96 km/h, and uphill at 80 km/h. The car takes 4 hours to travel from town A to town B, and 5 hours for the return trip. Find the distance between the two towns in kilometres.

Answer to E6: \_\_\_\_\_

**E7**

How many positive integers smaller than 729 are relatively prime to 729? You may use the fact that  $729 = 3^6$ .

Note: Two numbers are relatively prime if their greatest common divisor is 1; that is, their only positive common factor is 1.

Answer to E7: \_\_\_\_\_

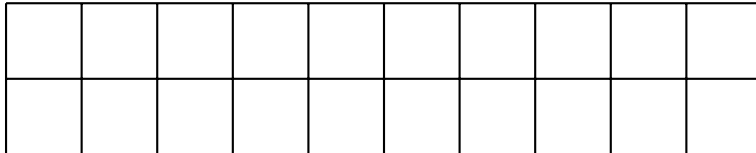
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**E8**

How many ways are there to colour some cells of the below  $2 \times 10$  grid black, such that each  $2 \times 2$  square has exactly two black grid cells?



Answer to E8: \_\_\_\_\_