Rwanda Maths Olympiad Camp Selection Test (Take Home)

Time allowed: 1 evening. You should receive this test from your teacher on a given day and return it to them on the next day.
You may not use calculators. You may not get help from any one.

Please explain your answers as best you can. Each question is worth 10 marks

Please label all questions clearly. Start each question on a new page.

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1. For any positive integer n define

$$E(n) = n(n+1)(n+2)(n+3)(n+4)(n+5)(n+6)(n+7)(n+8)(n+9)(n+10).$$

   Find the greatest common divisor of $E(1)$, $E(2)$, $E(3)$, . . . , $E(2009)$

2. Let ABC be a triangle, where $AB = AC$ and $BC = 12$. Let D be the midpoint of BC. Let E be a point in AC such that DE is perpendicular to AC. Let F be a point on AB such that EF is parallel to BC. If $EC = 4$, what is the length of EF?

3. Find for which values of n, an integer larger than 1 but smaller than 100, the following expression has its minimum value:

$$S = |n-1| + |n-2| + \ldots + |n-100|$$

4. Five men and seven women stand in a line in random order. What is the probability (as a fraction) that each man stands next to at least one woman?

Problems in Kinyarwanda

1. Kuri buri mubare n ushyitse uri hejuru ya zero (0), usobanura

$$E(n) = n(n+1)(n+2)(n+3)(n+4)(n+5)(n+6)(n+7)(n+8)(n+9)(n+10).$$

   Shaka umubare munini rusange ugabanya

$$E(1), E(2), E(3) \cdots E(2009)$$

2. Reka ABC ibe mpandeshatu, aho $AB = AC$ na $BC = 12$. Reka D ibe akadomo-ngwagati ku murongo BC. Reka E ibe akadomo ku murongo AC ku buryo DE ikora imfuruka igororotse kuri AC. Reka F ibe akadomo ku murongo AB ku buryo EF iba ibangikanye na BC. Niba $EC = 4$, EF yaba ifite uburebure bungana iki?

3. Shaka agaciro k'umubare wuzuye n, uruta 1 ariko ukarutwa na 100, ku buryo ihinamvugo rikurikira rigira agaciro gato gashoboka

$$S = |n-1| + |n-2| + \ldots + |n-100|$$

4. Abagabo batanu n'abagore barindwi bahagaze ku murongo ku buryo bubonetse (nta kintu bakurikije). Ni ayahe mahirwe (nk'umugabane) y'uko buri mugabo yahagarara nibura iruhande rw'umugore umwe?