AIMS Rwanda Senior Challenge Round 2

Welcome to the Senior Round 2 Competition

*Required

1. Email address *

Personal Information

Please fill this in carefully before you start to look at the questions

2. Name *

3. Gender *

Mark only one oval.

- Female
- Male

4. Level *

Mark only one oval.

- S6
- S5
- S4

5. Subject combination *

Mark only one oval.

- PCM
- PCB
- MCB
- MPG
- MEG
- MCE
- MPC
- Other:

6. School *

Answers

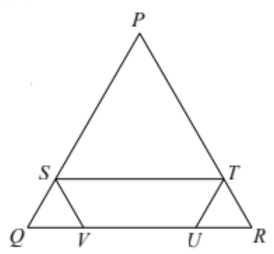
Please put number only answers in.

7. How man integers between 57 and 2021 are divisible by 4 but not divisible by 6.

8. How many 8-digit positive integers are made up of the digits 5 and 1 only, and are divisible by 6?

9. Coach Remy has a squad of 18 players. He needs to put 11 players on the pitch. However, there are three boys (Jules, Denis and Jado) who each refuse to play with one another. (for example if Jules is on the pitch, then Denis and Jado cannot be.) In how many ways can coach Remy pick 11 players?

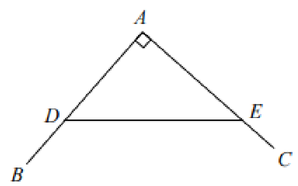
10. In the diagram, triangle PQR has |PQ| = |QR| = |RP| = 30. Points S and T are on PQ and PR, respectively, so that ST is parallel to QR. Points V and U are on QR so that T U is parallel to P Q and SV is parallel to PR. If |VS| + |ST| + |TU| = 35, the length of |VU| is?



11. F(0) = 3 and F(n) = F (n-1) +2. Find F(F(5))

12. The four sets A, B, C, and D each have 400 elements. The intersection of any two of the sets has 115 elements. The intersection of any three of the sets has 53 elements. The intersection of all four sets has 28 elements. How many elements are there in the union of the four sets?

13. In the diagram, ∠CAB = 90◦. Point D is on AB and point E is on AC so that AB = AC = DE, DB = 9, and EC = 8. What is the length of DE?



14. Determine all values of x where (x^2 +11)/(x+1) < 7 . Answer should be sets for example: {x s.t x<6} OR {x s.t x<5} U { x s.t x>9} OR {x s.t x>3} n {x s.t x<5} U=union n=intersection.

15. Two circles with radius 2 and radius 4 have a common center at P. Points A, B,and C on the larger circle are the vertices of an equilateral triangle. Point D is the intersection of the smaller circle and the line segment PB. What is the area of Triangle ADC?

16. a,b,c are positive integers. a+b/c =101, a/c+b=89, what is (a+b)/c?

17. a and b are positive integers with a x b = 10! (10 factorial). What is the minimum value of a+b?

18. Towers grow at points along a line. All towers start with height 0 and grow at the rate of one meter per second. When two adjacent towers are *each* at least 1 meter tall, a new tower begins to grow at a point along the line half way between those two adjacent towers. Before time 0 there are no towers, but at time 0 the first two towers begin to grow at two points along the line. At time 1 second, a new tower appears following the rules above. a) How many towers will there be at time 10 seconds? b) What is the sum of all the heights at time 10 seconds?

19. In the country of Nohills, each pair of cities is connected by a straight (and flat) road. The chart shows the distances along the straight roads between some pairs of cities. The distance along the straight road between city P and city R is closest to

	P	Q	R	S
P	0	25		24
Q	25	0	25	7
R		25	0	18
S	24	7	18	0

Mark only one oval.

- 30
- 25
- 27
- 24
- 24.5
- 40

20. Find the least positive integer that has exactly 20 positive integer divisors.

21. Eight teams compete in a tournament. Each pair of teams plays exactly one game against each other. There are no ties. If the two possible outcomes of each game are equally likely, what is the probability that every team loses at least one game?

22. The numbers a1, a2, a3, . . . form an arithmetic sequence with a1 not equal a2. The three numbers a1, a2, a6 form a geometric sequence in that order. Determine all possible positive integers k for which the three numbers a1, a4, ak also form a geometric sequence in that order.

23. A bag contains 16 kg of peanuts. 4 kg of peanuts are taken out and 4 kg of pumpkin seeds are added and mixed in. Then 4 kg are taken out from the bag, and 4 kg of pumpkin seeds are added and mixed in. What is the ratio of the mass (in kg) of peanuts to the mass (in kg) of pumpkin seeds in the final mixture?

24. Sandrine has eight boxes numbered 1 to 8 and eight balls numbered 1 to 8. In how many ways can she put the balls in the boxes so that there is one ball in each box AND ball 1 is not in box 1, ball 2 is not in box 2, and ball 3 is not in box 3?

25. Mucyo and Samuel race with the winner of each race receiving m gold coins and the loser receiving n gold coins. (m and n are integers with $m > n > 0$.) After several races, Mucyo has 42 coins and Samuel has 35 coins. Samuel has won exactly 2 races. The value of m is? (There are no ties)

26. There are two ways of choosing six different numbers from the list 1, 2, 3, 4, 5, 6, 7, 8, 9 so that the product of the six numbers is a perfect square. What are the two such perfect squares?