OLD MUTUAL SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2020 FIRST ROUND
SENIOR SECTION: GRADE 10 - 12

12 March 2020 **Time: 60 minutes** **Number of questions: 20**

Instructions

1. *This is a multiple choice question paper. Each question is followed by five answers marked A, B, C, D and E. Only one of these is correct.*
2. *Scoring rules:*
   2.1. *Each correct answer is worth 5 marks.*
   2.2. *There is no penalty for an incorrect answer or any unanswered question.*
3. *You must use an HB pencil. Rough work paper, a ruler and an eraser are permitted.* ***Calculators and geometry instruments are not permitted.***
4. *Figures are not necessarily drawn to scale.*
5. *Indicate your answers on the sheet provided.*
6. *Start when the invigilator tells you to do so.*
7. *Answers and solutions will be available at* `www.samf.ac.za`

Do not turn the page until you are told to do so.
Draai die boekie om vir die Afrikaanse vraestel.

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Organisations involved: AMESA, SA Mathematical Society,
SA Akademie vir Wetenskap en Kuns, ASTEMI

1. A number is multiplied by 20 to give a value of 2020. What is the number?

(A) 105 (B) 1010 (C) 110 (D) 101 (E) 111

2. How many letters of the word MICHAEL have no lines of symmetry?

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

3. What is the probability of getting a 5 or a 6 when a fair die is rolled once?

(A) 0 (B) $\frac{1}{6}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$ (E) $\frac{11}{6}$

4. What is the value of $\sqrt{(2023+3)(2023-3)+9}$?

(A) 2014 (B) 2016 (C) 2020 (D) 2023 (E) 2029

5. What is the value of the expression
$(2001-2002)(2003-2004)(2005-2006)\cdots(2019-2020)$?

(A) -1 (B) 0 (C) 1 (D) 6 (E) 8

6. An amount of money is shared in the ratio of $2:3:4$ and the one who received the most gets R76. What is the amount originally shared, in Rands?

(A) 171 (B) 266 (C) 162 (D) 172 (E) 161

7. Last Saturday, Randburg Fruiterers sold 120 kg of fruit. In a pie chart of the sales per kilogram, the sector for bananas has a central angle of 45°. How many kilograms of fruit sold were not bananas?

(A) 15 (B) 100 (C) 110 (D) 105 (E) 115

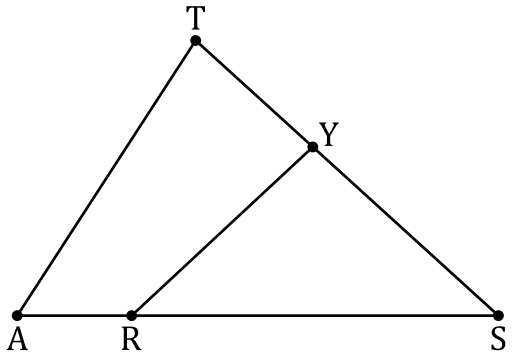
8. How many 3-digit numbers abc are there such that the sum of the first and last digits is 11?

(A) 4 (B) 8 (C) 36 (D) 40 (E) 80

9. Phil has a rectangular patio in his garden. He decides to make the patio larger by increasing both its length and width by 10%. What is the percentage increase in the area of the patio?

(A) 10 (B) 20 (C) 21 (D) 40 (E) 121

10. In triangle TAS, $YR = YS$, $\widehat{A} = 2\widehat{YRS}$ and $\widehat{T} = 3\widehat{YRS}$. What is the size of $\widehat{S}$ in degrees?



(A) 30 (B) 35 (C) 40 (D) 60 (E) 48

11. What is the size of each interior angle of a regular 720-sided polygon?

(A) 170° (B) $179\frac{1}{2}^\circ$ (C) 179° (D) $120\frac{1}{2}^\circ$ (E) 135°

12. How many zeros are there at the end of the number $9^{999} + 1$?

(A) 0 (B) 1 (C) 2 (D) 9 (E) 10

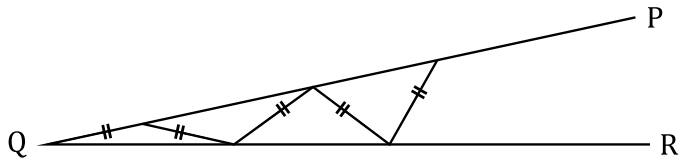
13. What is the remainder when the number $743\,589 \times 301\,647$ is divided by 5?

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

14. The captains and coaches of the four soccer teams Orlando Pirates, Mamelodi Sundowns, Kaizer Chiefs and Supersport United are having an arm wrestling competition. Each team has one captain and one coach. Everyone must wrestle everyone else, except that no captain will wrestle his own coach. How many arm wrestling bouts (matches) are there?

(A) 12 (B) 16 (C) 24 (D) 28 (E) 56

15. In the diagram $\angle PQR = 8°$, and a sequence of isosceles triangles is drawn as shown. What is the largest number of such triangles that can be drawn?

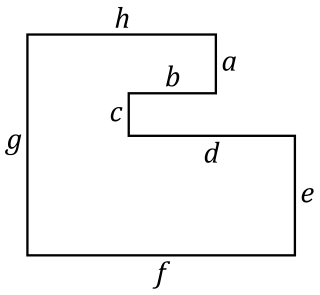


(A) 10 (B) 11 (C) 12 (D) 13 (E) 14

16. Jack and Peter live 13 km from one another. One afternoon at 16:00 Jack started at his house and rode on his bicycle towards Peter's house. Peter started a few minutes later at his house and rode towards Jack's house. They met after Peter rode for x hours and Jack for $3x$ hours. Jack's speed is $\frac{3}{4}$ Peter's speed. How many kilometres is Peter from his house when they meet?

(A) 10 (B) 8 (C) 7 (D) 5 (E) 4

17. All angles in the figure are 90°. The lengths of g, h and d are 7, 6 and 3, respectively. What is the perimeter of the figure?



(A) 14 (B) 16 (C) 25 (D) 30 (E) 32

18. You may start at any square on the diagram and move up, down, left or right (NOT diagonally) to an adjacent square. No square may be used more than once. Write down the digits of each square as you proceed. What is the MIDDLE DIGIT of the largest 9-digit number that can be made?

5	9	1
8	4	7
3	6	2

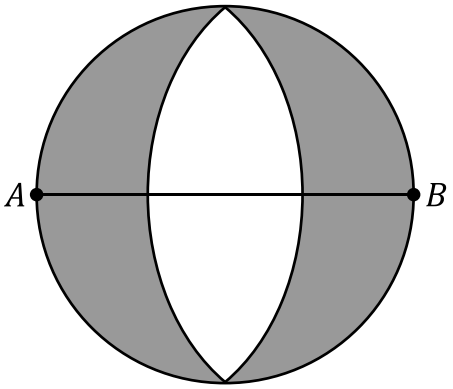
(A) 2 (B) 3 (C) 5 (D) 7 (E) 8

19. For each odd integer we can write $S_1 = 1$, $S_2 = 1 + 3 = 4$, $S_3 = 1 + 3 + 5 = 9$ etc. For every second odd integer we can write $C_1 = 1$, $C_2 = 1 + 5 = 6$, $C_3 = 1 + 5 + 9 = 15$, etc. Which fraction does not belong to the sequence below?

$$\frac{S_1}{C_1}, \frac{S_2}{C_2}, \frac{S_3}{C_3}, \ldots \quad ?$$

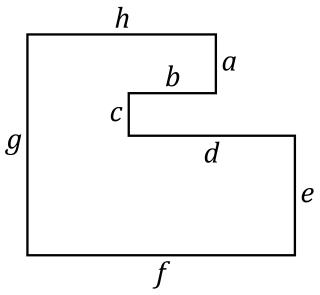
(A) $\frac{6}{11}$ (B) $\frac{12}{23}$ (C) $\frac{13}{25}$ (D) $\frac{30}{61}$ (E) $\frac{42}{83}$

20. AB is a diameter of a circle with radius 1 cm. Two circular arcs of equal radius are drawn with centres A and B. These arcs meet on the circle, as shown. What is the shaded area, in cm^2?



(A) $\frac{\pi}{2}$ (B) 1 (C) $\pi - 1$ (D) 2 (E) $\frac{2\pi}{3}$

17. Al die hoeke in die figuur is 90°. Die lengtes van g, h en d is onderskeidelik 7, 6 en 3. Wat is die omtrek van die figuur?



(A) 14 (B) 16 (C) 25 (D) 30 (E) 32

18. Jy mag op enige vierkant in die diagram begin en op, af, regs of links beweeg (NIE diagonaal nie) na 'n aanliggende vierkant. Geen vierkant mag meer as een keer gebruik word nie. Skryf die syfer van elke vierkant neer soos wat jy aangaan. Wat is die MIDDELSTE SYFER van die grootste 9-syfergetal wat so gevorm kan word?

5	9	1
8	4	7
3	6	2

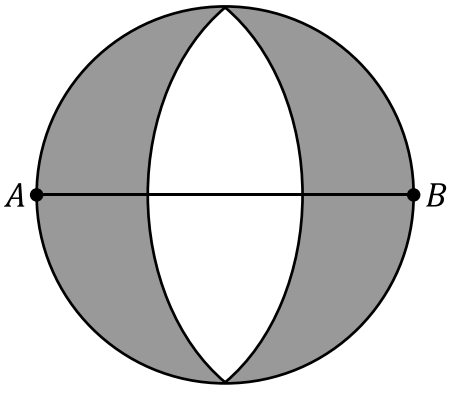
(A) 2 (B) 3 (C) 5 (D) 7 (E) 8

19. Vir die onewe getalle kry 'n mens $S_1 = 1$, $S_2 = 1+3 = 4$, $S_3 = 1+3+5 = 9$, ens. Vir elke tweede onewe getal kry jy $C_1 = 1$, $C_2 = 1+5 = 6$, $C_3 = 1+5+9 = 15$, ens. Watter breuk behoort nie aan die ry hieronder nie?

$$\frac{S_1}{C_1}, \frac{S_2}{C_2}, \frac{S_3}{C_3}, \ldots$$

(A) $\frac{6}{11}$ (B) $\frac{12}{23}$ (C) $\frac{13}{25}$ (D) $\frac{30}{61}$ (E) $\frac{42}{83}$

20. AB is 'n middellyn van 'n sirkel met radius 1 cm. Twee sirkelboë met gelyke radii en middelpunte A en B word getrek. Die boë ontmoet op die sirkel soos aangetoon. Wat is die oppervlakte van die ingekleurde deel, in cm^2?



(A) $\frac{\pi}{2}$ (B) 1 (C) $\pi - 1$ (D) 2 (E) $\frac{2\pi}{3}$

12. Hoeveel nulle is daar aan die einde van die getal $9^{999} + 1$?

(A) 0 (B) 1 (C) 2 (D) 9 (E) 10

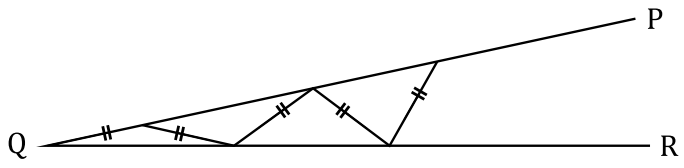
13. Wat is die res as die getal $743\,589 \times 301\,647$ deur 5 gedeel word?

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

14. Die kapteins en afrigters van die vier sokkerspanne Orlando Pirates, Mamelodi Sundowns, Kaizer Chiefs en Supersport United neem deel aan 'n armdrukkompetisie. Elke span het een kaptein en een afrigter. Elkeen moet armdruk teen elk van die ander, maar 'n kaptein mag nie teen sy eie afrigter armdruk nie. Hoeveel armdrukwedstryde is daar?

(A) 12 (B) 16 (C) 24 (D) 28 (E) 56

15. In die diagram is $\angle PQR = 8°$, en 'n opeenvolging van gelykbenige driehoeke word geteken. Wat is die grootste getal driehoeke wat so geteken kan word?



(A) 10 (B) 11 (C) 12 (D) 13 (E) 14

16. Jack en Peter woon 13 km van mekaar. Een middag om 16:00 vertrek Jack van sy huis en ry met sy fiets na Peter se huis. Peter het 'n paar minute later vanaf sy huis vertrek en na Jack se huis gery. Hulle ontmoet mekaar nadat Peter vir x uur en Jack vir $3x$ uur gery het. Jack se spoed is $\frac{3}{4}$ van Peter se spoed. Hoeveel kilometer is Peter van sy huis af toe hulle mekaar ontmoet?

(A) 10 (B) 8 (C) 7 (D) 5 (E) 4

7. Saterdag het Randburg Winkel 120 kg vrugte verkoop. Die verkope van die vrugte word per kilogram in 'n sirkeldiagram aangetoon. Die middelpuntshoek van die piesangsektor is 45°. Hoeveel kilogram vrugte, uitgesluit die piesangs, is verkoop?

(A) 15 (B) 100 (C) 110 (D) 105 (E) 115

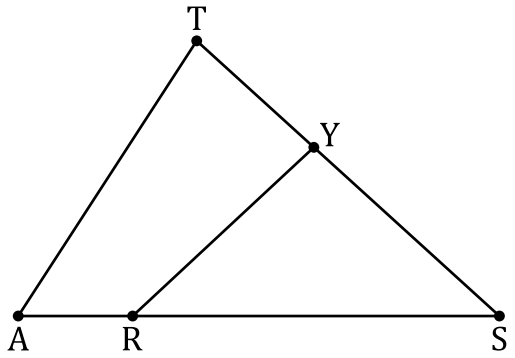
8. Hoeveel 3-syfergetalle abc is daar met die som van die eerste en derde syfers 11?

(A) 4 (B) 8 (C) 36 (D) 40 (E) 80

9. Phil het 'n reghoekige patio in sy tuin. Hy besluit om die patio groter te maak deur beide die lengte en die breedte met 10% te verleng. Met watter persentasie sal die oppervlakte van die patio toeneem?

(A) 10 (B) 20 (C) 21 (D) 40 (E) 121

10. In driehoek TAS is $YR = YS$, $\widehat{A} = 2\widehat{YRS}$ en $\widehat{T} = 3\widehat{YRS}$. Wat is die grootte van $\widehat{S}$ in grade?



(A) 30 (B) 35 (C) 40 (D) 60 (E) 48

11. Hoe groot is elk van die binnehoeke van 'n reëlmatige veelhoek met 720 sye?

(A) 170° (B) $179\frac{1}{2}^\circ$ (C) 179° (D) $120\frac{1}{2}^\circ$ (E) 135°

1. 'n Getal wat met 20 vermenigvuldig word, gee 'n waarde van 2020. Wat is die getal?

(A) 105 (B) 1010 (C) 110 (D) 101 (E) 111

2. Hoeveel letters van die woord MICHAEL het geen simmetrielyne nie?

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

3. Wat is die waarskynlikheid om 'n 5 of 'n 6 te kry wanneer 'n standaard dobbelsteentjie een keer gerol word?

(A) 0 (B) $\frac{1}{6}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$ (E) $\frac{11}{6}$

4. Wat is die waarde van $\sqrt{(2023+3)(2023-3)+9}$?

(A) 2014 (B) 2016 (C) 2020 (D) 2023 (E) 2029

5. Wat is die waarde van die uitdrukking
$(2001-2002)(2003-2004)(2005-2006)\cdots(2019-2020)$?

(A) -1 (B) 0 (C) 1 (D) 6 (E) 8

6. 'n Bedrag geld word in die verhouding $2:3:4$ verdeel en die een wat die meeste kry, ontvang R76. Wat is die bedrag, in Rand, wat oorspronklik verdeel is?

(A) 171 (B) 266 (C) 162 (D) 172 (E) 161

OLD MUTUAL SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION

2020 EERSTE RONDTE
SENIOR AFDELING: GRAAD 10-12

12 Maart 2020 **Tyd: 60 minute** **Aantal vrae: 20**

Instruksies

1. *Hierdie is 'n veelvuldige-keuse vraestel. Na elke vraag is vyf antwoorde, genommer A, B, C, D en E. Net een van hulle is reg.*
2. *Puntetoekenning:*
   2.1. *Elke korrekte antwoord tel 5 punte.*
   2.2. *Daar is geen penalisering vir foutiewe antwoorde of vrae wat nie beantwoord is nie.*
3. *Gebruik 'n HB potlood. Papier vir rofwerk, 'n liniaal en uitveër word toegelaat.* ***Sakrekenaars en meetkunde-instrumente word nie toegelaat nie.***
4. *Figure is nie noodwendig volgens skaal geteken nie.*
5. *Beantwoord die vrae op die antwoordblad wat voorsien word.*
6. *Begin sodra die toesighouer die teken gee.*
7. *Antwoorde en oplossings sal beskikbaar wees by* `www.samf.ac.za`

Moenie omblaai voordat dit aan jou gesê word nie.
Turn the booklet over for the English paper.

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