SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2019 SECOND ROUND
JUNIOR SECTION: GRADE 8 & 9

15 May 2019 **Time: 120 minutes** **Number of questions: 25**

Instructions

1. *The answers to all questions are integers from 0 to 999. Each question has only one correct answer.*
2. *Scoring rules:*
   2.1. *Each correct answer is worth 3 marks in Part A, 4 marks in Part B and 5 marks in Part C.*
   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.

PRIVATE BAG X173, PRETORIA, 0001
TEL: (012) 392-9372 Email: info@samf.ac.za

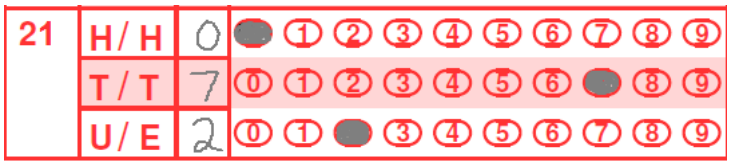
Organisations involved: AMESA, SA Mathematical Society,
SA Akademie vir Wetenskap en Kuns

HOW TO COMPLETE THE ANSWER SHEET

The answers to all questions are integers from 0 to 999. Consider the following **example question**:

21. If $3x - 216 = 0$, determine the value of x.

The answer is 72, so you must complete the block for question 26 on the answer sheet as follows: shade 0 in the hundreds row, 7 in the tens row, and 2 in the units row:

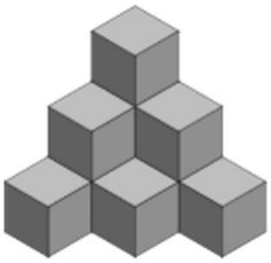


Write the digits of your answer in the blank blocks on the left of the respective rows, as shown in the example; hundreds, tens and units from top to bottom.
The three digits that you write down will not be marked, since it is only for your convenience - only the shaded circles will be marked.

Part A: 3 marks each

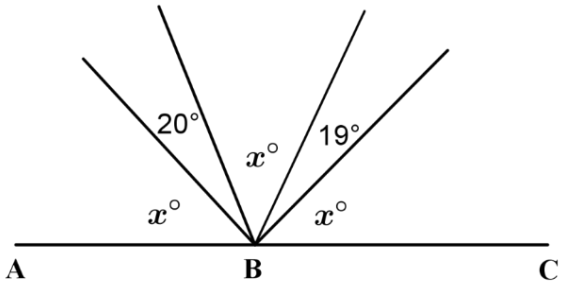
1. $\dfrac{20+1-9}{\sqrt{2^0-1+9}} =$

2. The sketch shows identical cubes stacked into a corner. How many cubes are there in the stack?



3. ABC is a straight line.

Determine the value of x.

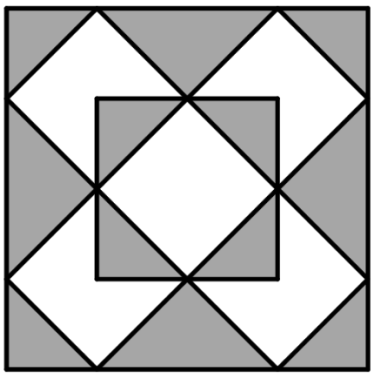


4. Calculate 20% of 20.

5. $\sqrt{20+\sqrt{19+\sqrt{20+16}}} =$

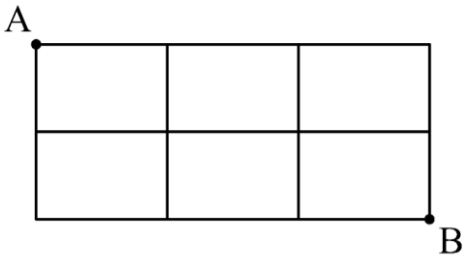
Part B: 4 marks each

6. What percentage of the diagram is shaded?



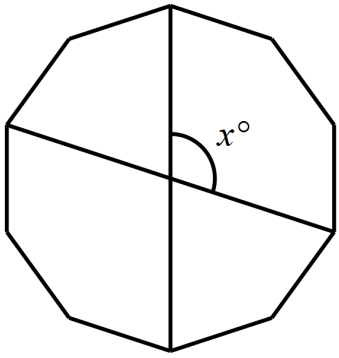
7. The ratio of boys to girls in a school is 20:19. If there are 117 pupils in the school, how many girls are there?

8. How many paths are there from A to B if you can only move downwards and to the right?



9. If x and y are two different positive whole numbers such that $x^y = y^x$, find the value of $x + y$.

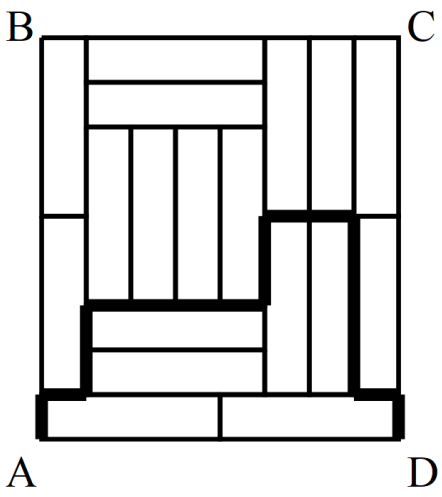
10. A regular decagon is shown. Determine the value of *x*.



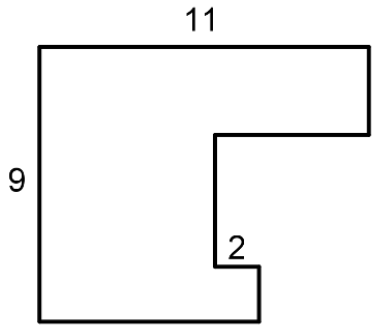
11. The pattern below contains consecutive odd numbers. What is the value of n if the sum of the numbers in row n is 1 000?

Row 1 1
Row 2 3 5
Row 3 7 9 11
Row 4 13 15 17 19
Row 5 21 23 25 27 29
⋮
Row n

12. 18 identical rectangles are arranged as shown below. Determine the area of rectangle ABCD in cm^2 if the length of the bold path from A to D is 36 cm.

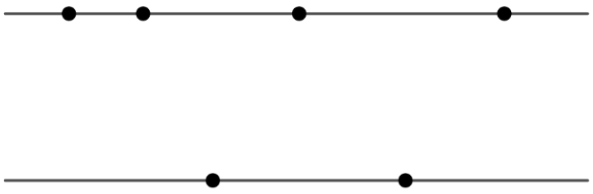


13. The shape alongside is composed of horizontal and vertical lines. Three distances are shown in centimetres. Determine the perimeter of the shape in centimetres.



14. For any positive whole numbers a and b, the operation $a \circledast b$ is defined as $\frac{a^2+b}{2}$. Determine the value of x if $x \circledast 19 = 70$.

15. The diagram shows two parallel lines with six points indicated. How many triangles can be drawn with their vertices chosen from these six points?

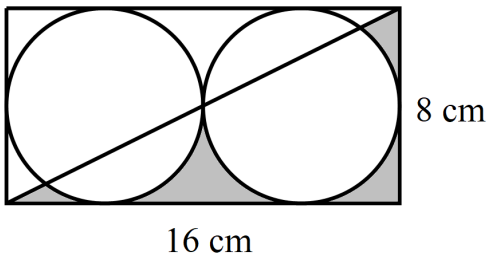


16. A hiker leaves home and walks south for 1½ hours, west for 2 hours, breaks for a 20 minute lunch, then walks directly home along a straight line. Assuming that he always walks at the same speed, for how many minutes was he away from home?

17. There are 367 pupils in a school hall. What is the probability, expressed as a percentage, that two of them have their birthday on the same day?

18. Determine the value of k if $\frac{20}{19}\left(\frac{1}{20}+\frac{1}{18}\right)=\frac{1}{k}$

19. Two identical circles are drawn inside a rectangle as shown. If the area of the shaded region is $x-y\pi$ cm^2, then what is the value of $x+y$ if both x and y are positive whole numbers?



20. Determine the units digit of $1!+2!+3!+4!+\cdots+2019!$
[Note: $3! = 3\times2\times1$ and $4! = 4\times3\times2\times1$ etc.]

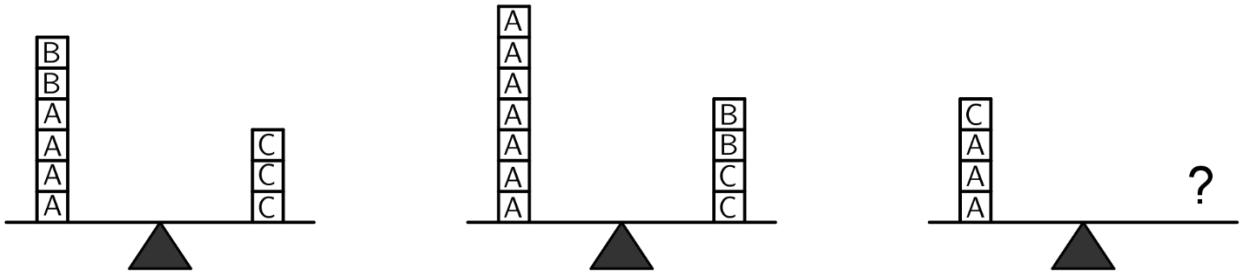
Part C: 5 marks each

21. Athletes A and B run at constant speeds in opposite directions around an athletics track. They begin at the same time from the same point. For every 2 laps that B completes, A completes 3 laps. How many times do they pass each other during A's first 10 laps?

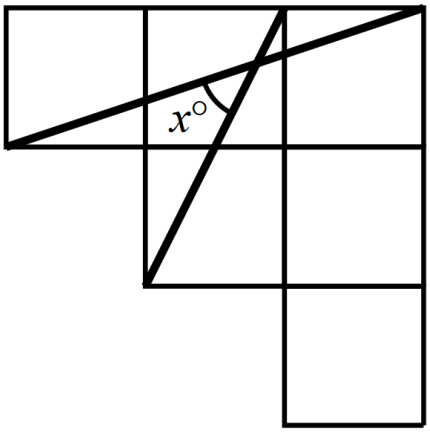
22. A number is chosen at random from the set containing all 3-digit and 4-digit whole numbers which read the same backwards and forwards, e.g. 101 and 4224. What is the probability, expressed as a percentage, that the chosen number is a 4-digit number?

23. A and B are both 2-digit numbers. They have a Highest Common Factor of 6 and a Lowest Common Multiple of 180. Determine the smallest possible value of A + B.

24. If the first two scales below are balanced, how many B's should replace the question mark to balance the third scale?



25. A grid is made up of six equal sized squares. Determine the value of x.



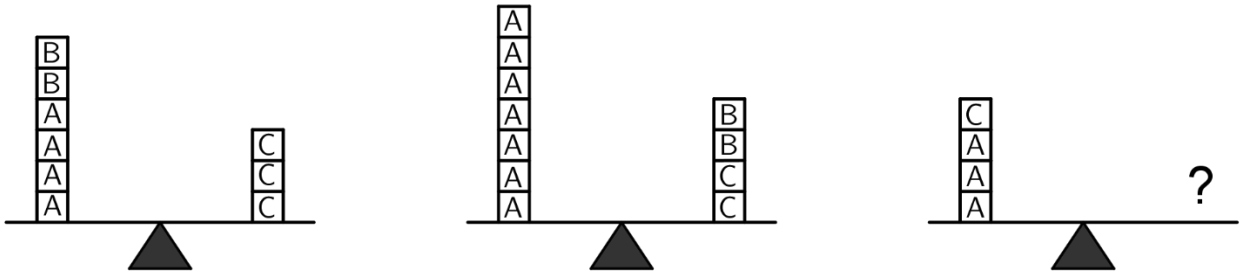
Deel C: 5 punte elk

21. Atlete A en B hardloop elk teen ’n konstante spoed in teenoorgestelde rigtings om ’n atletiekbaan. Hulle begin op dieselfde tyd vanaf dieselfde punt. Vir elke 2 rondtes wat B voltooi, voltooi A 3 rondtes. Hoeveel keer gaan hulle bymekaar verby gedurende A se eerste 10 rondtes?

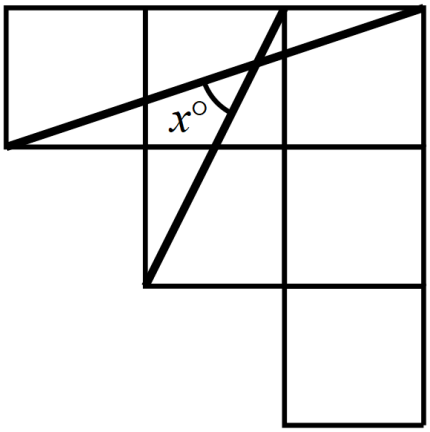
22. ’n Getal word willekeurig gekies uit die versameling wat alle 3-syfer en 4-syfer heelgetalle bevat, wat dieselfde vorentoe en agtertoe lees, bv. 101 en 4224. Wat is die waarskynlikheid, uigedruk as ’n persentasie, dat die getal wat gekies word ’n 4-syfer getal is?

23. A en B is beide 2-syfer getalle. Hulle het ’n Grootste Gemene Deler van 6 en Kleinste Gemene Veelvoud van 180. Bepaal die kleinste moontlike waarde van A + B.

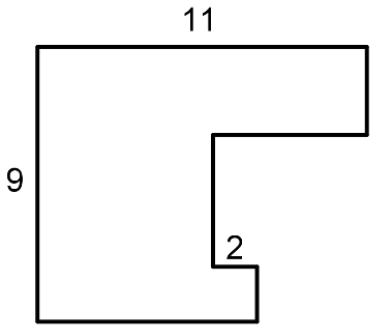
24. As die eerste twee skale hieronder gebalanseer is, hoeveel B’s moet die vraagteken vervang om die derde skaal te balanseer?



25. ’n Rooster word gevorm deur ses ewe groot vierkante. Bepaal die waarde van *x*.

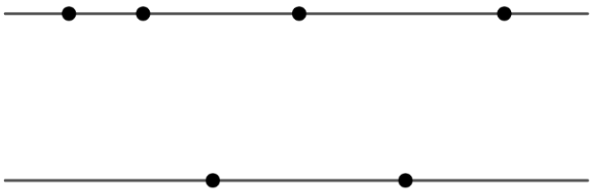


13. Die figuur hiernaas is saamgestel uit horisontale en vertikale lyne. Drie afstande word aangetoon in sentimeter. Bereken die omtrek van die figuur in sentimeter.



14. Vir enige positiewe heelgetalle a en b, word die bewerking $a \circledast b$ gedefinieer as $\frac{a^2+b}{2}$.
Bereken die waarde van x as $x \circledast 19 = 70$.

15. Die diagram toon twee parallelle lyne met ses punte soos aangetoon. Hoeveel driehoeke kan geskets word deur hulle hoeke uit hierdie ses punte te kies?

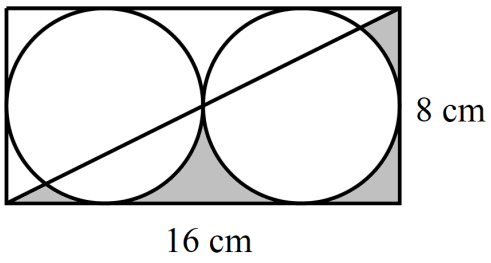


16. ’n Voetslaner verlaat sy huis en stap suid vir 1½ uur, wes vir 2 ure, stop vir ’n 20 minute etenstyd en stap dan direk huistoe in ‘n reguit lyn. As aanvaar word dat hy altyd teen dieselfde spoed stap, vir hoeveel minute was hy weg van die huis?

17. Daar is 367 leerlinge in ’n skoolsaal. Wat is die waarskynlikheid, uitgedruk as ’n persentasie, dat twee van hulle op dieselfde dag verjaar?

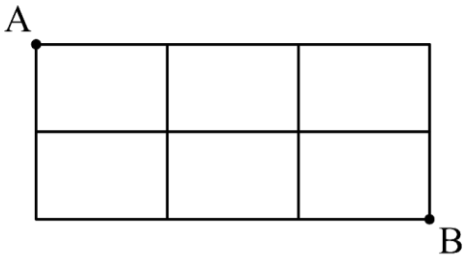
18. Bepaal die waarde van k as $\frac{20}{19}\left(\frac{1}{20}+\frac{1}{18}\right)=\frac{1}{k}$

19. Twee identiese sirkels word binne-in ’n reghoek getrek soos getoon. As die oppervlak van die ingekleurde gebied $x-y\pi$ cm^2 is, wat is die waarde van $x+y$ as beide x en y positiewe heelgetalle is?



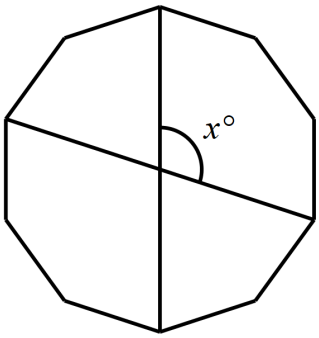
20. Bepaal die ene-syfer van $1!+2!+3!+4!+\cdots+2019!$
[Let op dat: $3!=3\times2\times1$ en $4!=4\times3\times2\times1$ ens.]

8. Hoeveel paaie is daar van A na B as jy slegs afwaarts en na regs kan beweeg?



9. As x en y twee verskillende positiewe heelgetalle is sodat $x^y = y^x$, bepaal die waarde van $x + y$.

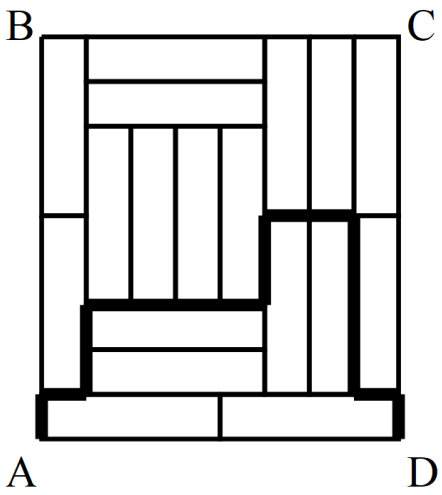
10. 'n Reëlmatige dekagoon word getoon. Bepaal die waarde van *x*.



11. Die patroon hieronder bevat opeenvolgende onewe getalle. Wat is die waarde van n as die som van die getalle in ry n gelyk is aan 1 000?

Ry 1	1				
Ry 2	3	5			
Ry 3	7	9	11		
Ry 4	13	15	17	19	
Ry 5	21	23	25	27	29
⋮					
Ry n					

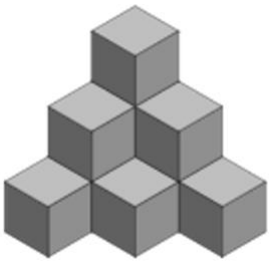
12. 18 identiese reghoeke word gerangskik soos aangetoon hieronder. Bereken die oppervlak van reghoek ABCD in cm^2 indien die lengte van die verdikte pad van A na B gelyk is aan 36 cm.



Deel A: 3 punte elk

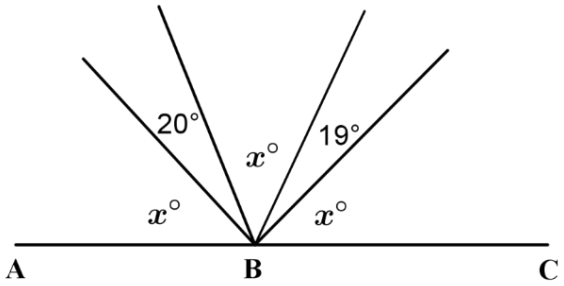
1. $\dfrac{20+1-9}{\sqrt{2^0-1+9}} =$

2. Die skets toon identiese kubusse wat in ’n hoek opgestapel is. Hoeveel kubusse is daar in die stapel?



3. ABC is ’n reguit lyn.

Bepaal die waarde van x.

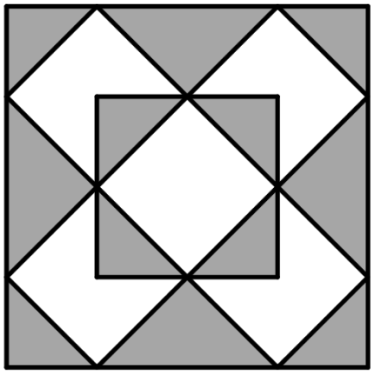


4. Bereken 20% van 20.

5. $\sqrt{20+\sqrt{19+\sqrt{20+16}}} =$

Deel B: 4 punte elk

6. Watter persentasie van die diagram is ingekleur?



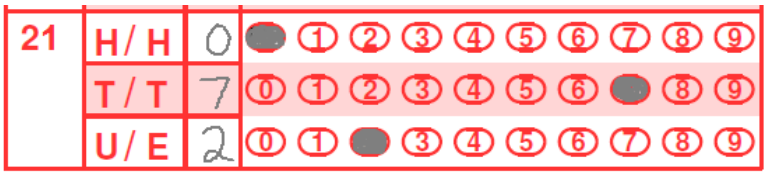
7. Die verhouding van seuns tot meisies in ’n skool is 20:19. As daar 117 leerlinge in die skool is, hoeveel meisies is daar?

HOE OM DIE ANTWOORDBLAD TE VOLTOOI

Die antwoorde op al die vrae is heelgetalle van 0 tot 999. Beskou die volgende **voorbeeldvraag**:

21. As $3x - 216 = 0$, bepaal die waarde van x.

Die antwoord is 72. Voltooi die blok vir vraag 26 op die antwoordblad soos volg: kleur die 0 in die honderde-ry in, die 7 in die tiene-ry en die 2 in die ene-ry:



Skryf die syfers van jou antwoord in die oop spasies aan die linkerkant van elke ry in, soos in die voorbeeld aangetoon: honderde, tiene en ene van bo na onder. Die drie syfers wat jy neergeskryf het, word nie nagesien nie omdat dit slegs vir jou eie gerief is – slegs die ingekleurde sirkeltjies word nagesien.

SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION

2019 TWEEDE RONDTE
JUNIOR AFDELING: GRAAD 8 & 9

15 Mei 2019 **Tyd: 120 minute** **Aantal vrae: 25**

Instruksies

1. *Die antwoorde op al die vrae is heelgetalle van 0 tot 999. Elke vraag het slegs een korrekte antwoord.*
2. *Puntetoekenning:*
   2.1. *Elke korrekte antwoord tel 3 punte in Afdeling A, 4 punte in Afdeling B en 5 punte in Afdeling C.*
   2.2. *Geen punte word afgetrek vir foutiewe antwoorde of onbeantwoorde vrae 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.

PRIVAATSAK X173, PRETORIA, 0001
TEL: (012) 392-9372 E-pos: info@samf.ac.za

Organisasies betrokke: AMESA, SA Wiskundevereniging,
SA Akademie vir Wetenskap en Kuns

LIBERTY