THE OLD MUTUAL SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2020 SECOND ROUND
JUNIOR SECTION: GRADE 8 & 9

14 May 2020 **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 6 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.

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TEL: (012) 392-9372 Email: info@samf.ac.za

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

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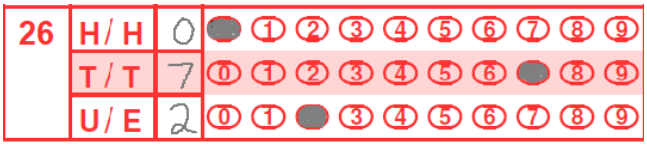
HOW TO COMPLETE THE ANSWER SHEET

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

26. 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 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 wrote down will not be marked, since it is only for your convenience — only the shaded circles will be marked.

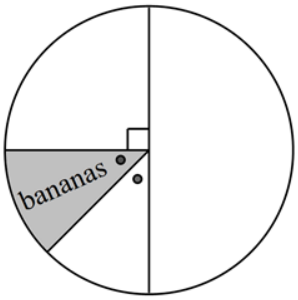
DO NOT TURN THE PAGE BEFORE YOU ARE TOLD TO DO SO

Part A: 3 marks each

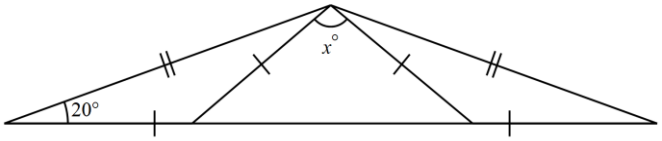
1. $\sqrt{20\times 8-20\times 3}=$

2. The year 1936 was a square number. It is now 2020. In how many years' time will the year next be a square number?

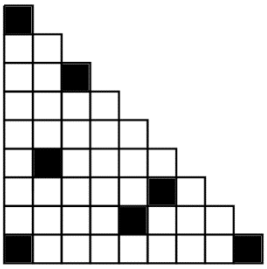
3. 160 students are surveyed at the school tuckshop. The shaded sector of the pie chart shows those who like bananas. How many students like bananas?



4. Three isosceles triangles are put together to create a larger isosceles triangle. What is the value of x?



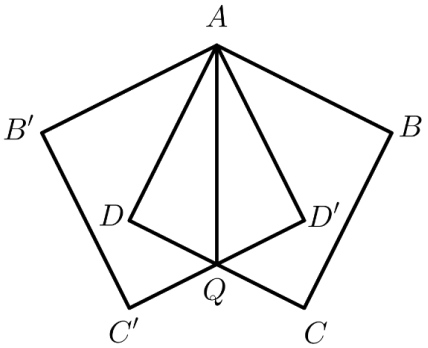
5. In the diagram, some of the squares are black. If we wish to have 20% of the whole diagram black, how many more squares need to be black?



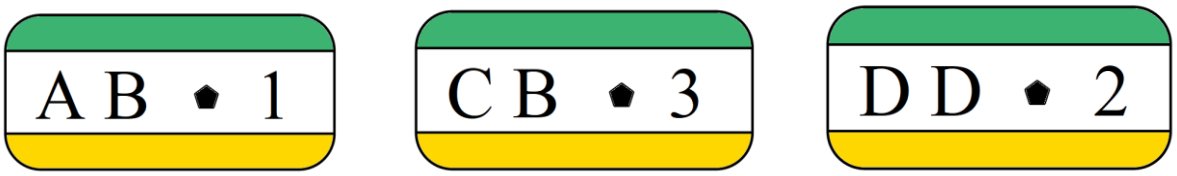
6. If $K\times 0{,}2\times\frac{20}{100}\times 20\%=1$, then determine the value of K.

7. A wheel turns at a constant rate of 50 revolutions per minute. Through what angle, in degrees, does the wheel turn in one second?

8. In the diagram, ABCD is a square with sides of length 4 cm. Q is the midpoint of CD. ABCD is reflected across the line AQ to give the square $AB'C'D'$. Determine the area, in cm^2, of quadrilateral $ADQD'$.



9. On the island of Pythageuleria, all vehicle number plates have two letters from the selection A, B, C, D followed by a number 1, 2, 3 or 4. For example:

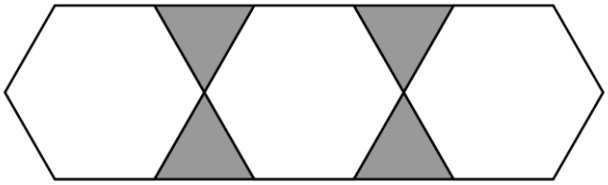


How many number plates contain both a single 'A' and an odd number?

10. Some 3-digit numbers have the following property: if you remove the first digit then the remaining 2-digit number is a perfect square **AND** if you remove the last digit the remaining 2-digit number is also a perfect square. What is the largest such 3-digit number?

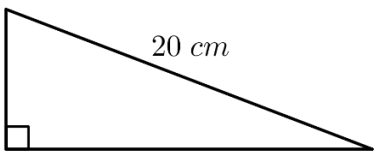
Part B: 4 marks each

11. The diagram shows three regular hexagons and four shaded equilateral triangles. If the TOTAL area of the diagram is 176 cm^2, what (in cm^2) is the area of the shaded region?

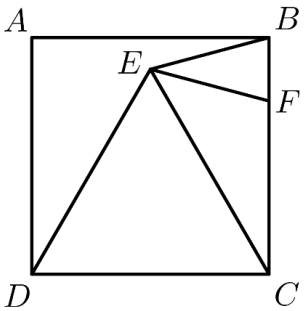


12. Busi correctly adds the lengths of three sides of a rectangle and gets 73 cm. Caleb correctly adds the lengths of three sides of the same rectangle and gets 77 cm. What is the perimeter of the rectangle in cm?

13. A right-angled triangle has a hypotenuse of length 20 cm. Of the two unknown sides, one is three times longer than the other. Determine the area of the triangle in cm^2.



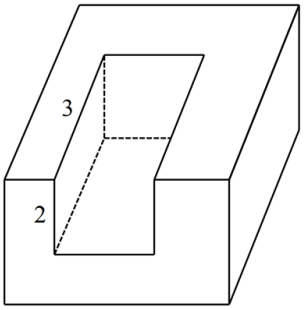
14. ABCD is a square and point F lies on BC. Triangle DEC is equilateral and EB = EF.
What is the size of $C\hat{E}F$ in degrees?



15. A broken calculator doesn't display the digit 5. So, for example, if we type in 51258 only the number 128 is displayed, with no spaces. Tebogo typed a 6-digit number into this broken calculator, but only 2020 appeared on the display. How many different 6-digit numbers could Tebogo have typed?

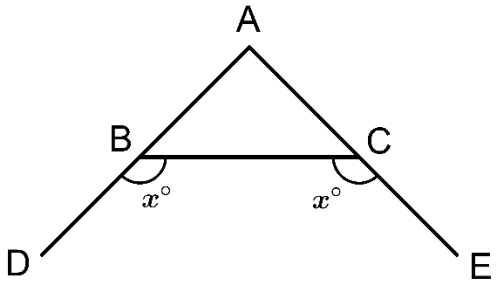
16. Three large buckets hold the same volume as four medium buckets. Five medium buckets hold the same volume as six small buckets. How many small buckets hold the same volume as 15 large buckets?

17. A rectangular prism, with two sides measuring 3 cm by 2 cm, is removed from a larger rectangular prism. If the original prism had a surface area of 96 cm^2, what is the surface area, in cm^2, of the new shape?



18. A school achieved a matric pass rate of exactly 96,8% (without any rounding). What is the smallest possible number of pupils who did not pass?

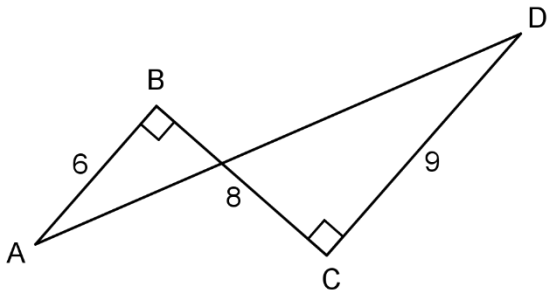
19. In the figure below, angles $D\hat{B}C$ and $E\hat{C}B$ are both equal to $x°$. Triangle ABC includes angles of size 48° and $y°$. What is the sum of the three different possible values of y?



20. The ratio of boys to girls in a class is 2:1. One boy leaves the class and two girls join the class. The new ratio of boys to girls is 3:2. How many pupils were there in the class originally?

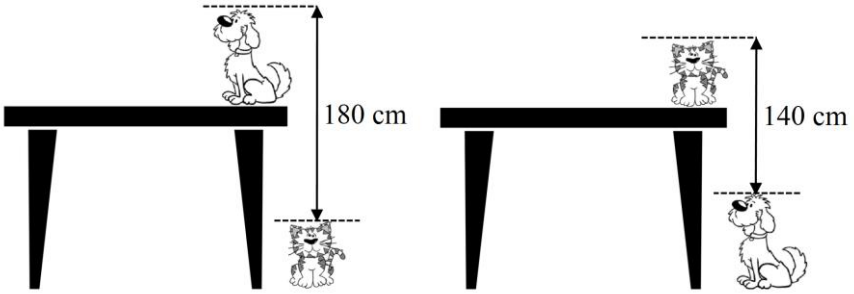
Part C: 6 marks each

21. In the diagram, angles $A\hat{B}C$ and $B\hat{C}D$ are right angles. AB = 6 cm, BC = 8 cm and CD = 9 cm. What is the length of AD in cm?

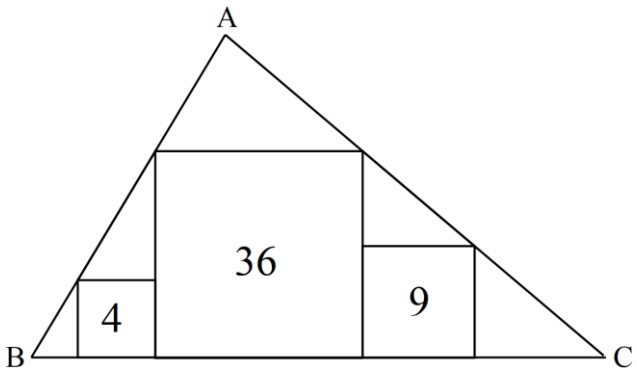


22. Vlad, Hagrid and Sanjev are running in a 1000 m race. They each run at a constant rate. After Vlad has run 250 m, he is 25 m ahead of Hagrid. After Hagrid has run 500 m, he is 20 m ahead of Sanjev. When Vlad finishes the race, how many metres behind him is Sanjev?

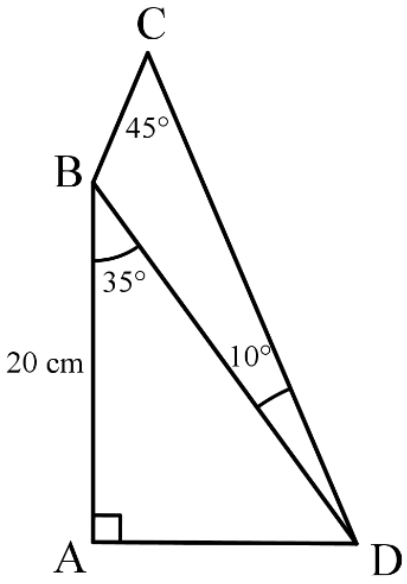
23. The diagrams show a cat, a dog and a table. Determine the height of the table in cm.



24. Three squares, with given areas, fit inside triangle ABC. Determine the length of BC.



25. Determine the area of quadrilateral ABCD in cm^2.



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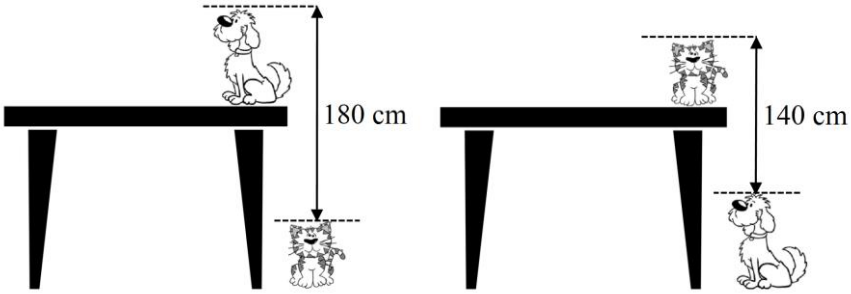
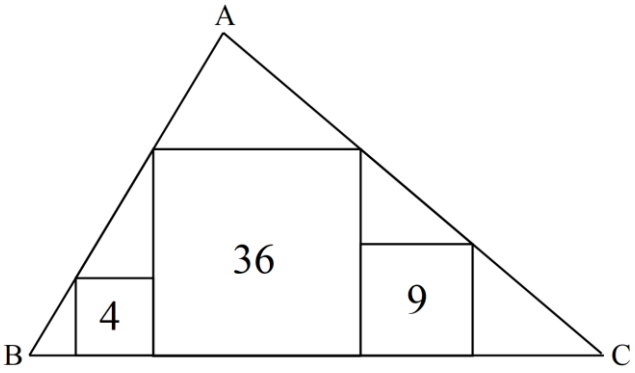
22. Vlad, Hagrid en Sanjev hardloop almal in ‘n 1000 m wedloop. Individueel hardloop elkeen teen ‘n konstante spoed. Nadat Vlad 250 m gehardloop het, is hy 25 m voor Hagrid. Nadat Hagrid 500 m gehardloop het, is hy 20 m voor Sanjev. Wanneer Vlad the wedloop voltooi, hoeveel meter agter hom sal Sanjev wees?

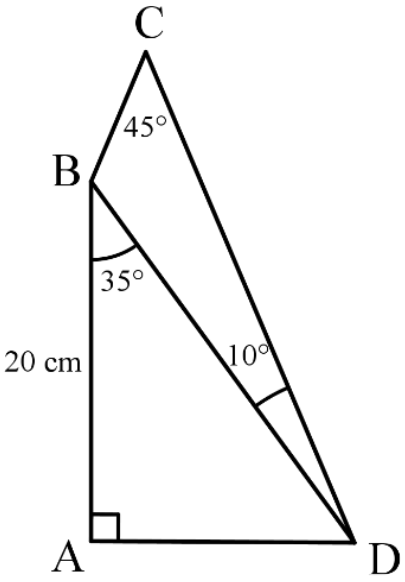
23. Die onderstaande diagramme toon ‘n kat, ‘n hond en ‘n tafel aan. Bepaal die hoogte van die tafel in cm.



24. In die onderstaande diagram word drie vierkante met hulle onderskeie areas aangedui. Al drie pas saam in driehoek ABC. Bepaal die lengte van BC.



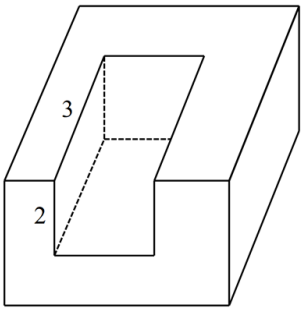
25. Bepaal die area van vierhoek ABCD in cm^2.



15. ‘n Gebreekte sakrekenaar kan nie die getal 5 vertoon nie. Byvoorbeeld, as ons 51258 in tik, sal net die getal 128, met geen spasies nie, vertoon word. Tebogo tik ‘n 6-syfer getal in hierdie gebreekte sakrekenaar in, en 2020 is die enigste syfers wat verskyn. Hoeveel verskillende 6-syfer getalle kon Tebogo ingetik het?

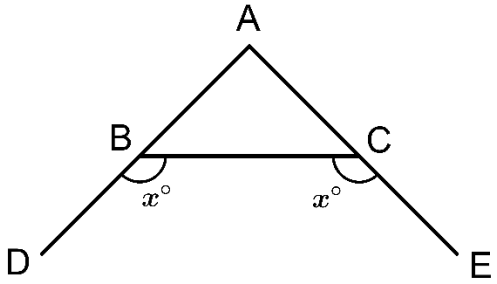
16. Drie groot emmers hou dieselfde volume as vier medium emmers. Vyf medium emmers hou dieselfde volume as ses klein emmers. Hoeveel klein emmers sal dieselfde volume as 15 groot emmers hou?

17. ‘n Reghoekige prisma, met twee sylengtes van 3 cm en 2 cm, word uit ‘n groter reghoekige prisma verwyder. As die oorspronklike groter reghoekige prisma ‘n buite-oppervlakte van 96 cm^2 gehad het, wat sal die buite-oppervlakte van die nuwe figuur in cm^2 wees?



18. ‘n Skool het ‘n matriekslaagsyfer van presies 96,8% behaal (sonder enige afronding). Wat is die kleinste moontlike getal leerders wat gedruip het?

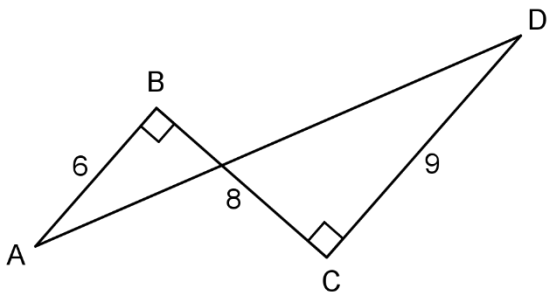
19. In die onderstaande figuur is hoeke $D\hat{B}C$ and $E\hat{C}B$ beide $x°$. Driehoek ABC het twee hoeke van groottes 48° en $y°$. Wat is die som van die drie verskillende moontlike waardes van y?



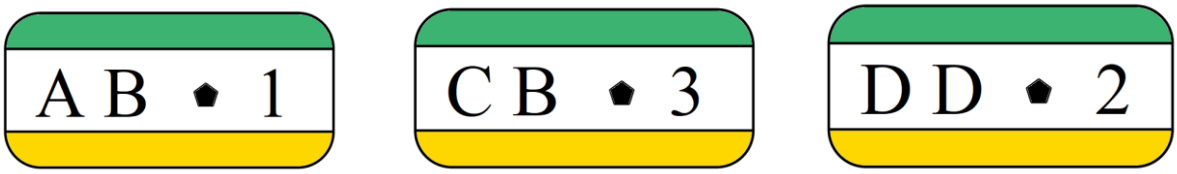
20. Die verhouding van seuns tot meisies in ‘n klas is 2:1. Een seun verlaat die klas en twee meisies sluit by die klas aan. Die nuwe verhouding van seuns tot meisies is 3:2. Hoeveel kinders was oorspronklik in die klas?

Deel C: 6 punte elk

21. In die diagram, is hoeke $A\hat{B}C$ en $B\hat{C}D$ beide regte hoeke. AB = 6 cm, BC = 8 cm en CD = 9 cm. Wat is die lengte van AD in cm?



9. Op die eiland Pythageuleria, bestaan alle karnommerplate uit twee van die volgende letters: A, B, C, of D gevolg deur een van die volgende syfers: 1, 2, 3 of 4. Byvoorbeeld:

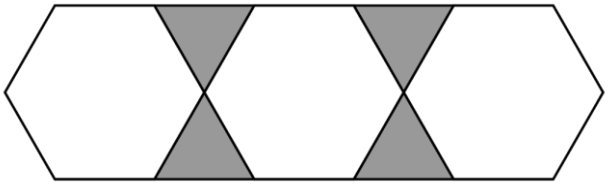


Hoeveel nommerplate sal ‘n enkele A en ‘n onewe getal bevat?

10. Sommige 3-syfer getalle het die volgende kenmerke: as jy die eeste syfer wegneem sal die twee syfers wat oorbly ‘n vierkantsgetal wees **EN** as jy die laasste syfer wegneem sal die twee syfers wat oorbly ook ‘n vierkantsgetal wees. Wat is die grootste 3-syfer getal met hierdie kenmerke?

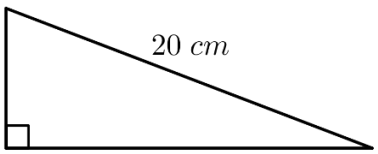
Deel B: 4 punte elk

11. Die diagram toon drie gelyksydige heksagone en vier grys gelyksydige driehoeke aan. As die TOTALE area van die diagram 176 cm^2 is, wat sal die area (in cm^2) van die grys gelyksydige driehoeke wees?

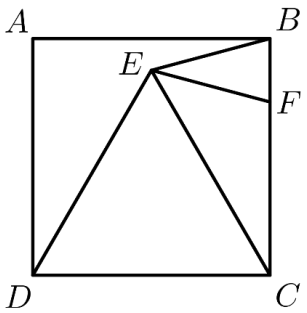


12. Busi tel die lengtes van drie sye van ‘n reghoek korrek op om 73 cm te kry. Caleb tel die lengtes van drie van die sye van dieselfde reghoek korrek op om 77 cm te kry. Wat is die omtrek van die reghoek in cm?

13. ‘n Reghoekige driehoek se skuinssy het ‘n lengte van 20 cm. Die een onbekende sy is driekeer langer as die ander onbekende sy. Bepaal die area van die driehoek in cm^2.



14. ABCD is ‘n vierkant en punt F lê op lyn BC. Driehoek DEC is gelyksydig en EB = EF. Wat is die grootte van $C\hat{E}F$ in grade?

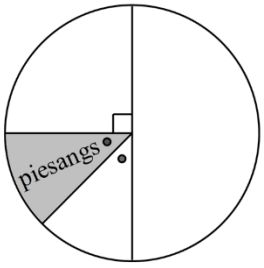


Deel A: 3 punte elk

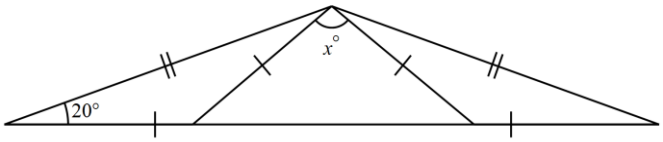
1. $\sqrt{20\times 8-20\times 3}=$

2. Die jaar 1936 was ‘n vierkantsgetal. Dit is nou die jaar 2020. Oor hoeveel jaar sal ons weer ‘n jaar, wat ‘n vierkantsgetal is, hê?

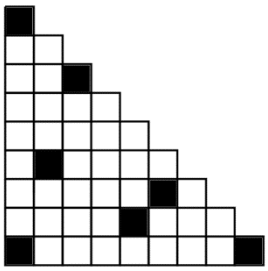
3. 160 studente is almal by die skoolsnoepie ondervra. Die grys gedeelte van die sirkelgrafiek dui die getal studente wat van piesangs hou, aan. Hoeveel studente hou van piesangs?



4. Drie gelykbenige driehoeke word bymekaar gevoeg om ‘n groter gelykbenige driehoek toe vorm. Bepaal die waarde van x.



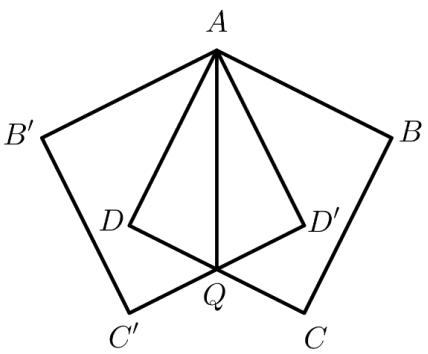
5. In die gegewe diagram is sommige van die vierkante swart. As ons graag 20% van die hele diagram swart wil hê, hoeveel meer vierkante moet swart wees?



6. Indien $K\times 0{,}2\times\frac{20}{100}\times 20\%=1$, bepaal die waarde van K.

7. ‘n Wiel draai teen ‘n konstante spoed van 50 revolusies per minuut. Bepaal die hoekgrootte, in grade, wat die wiel in een sekonde sal draai.

8. ABCD is ‘n vierkant met sylengtes van 4 cm elk. Q is die middelpunt van CD. ABCD word gereflekteer oor die lyn AQ om die vierkant $AB'C'D'$ te vorm. Bepaal die area, in cm^2, van vierhoek $ADQD'$.

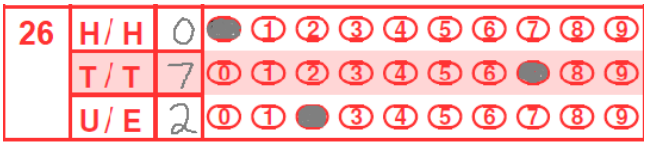


HOE OM DIE ANTWOORDBLAD TE VOLTOOI

Al die antwoorde is heelgetalle van 1 tot 999. Beskou die volgende voorbeeldvraag:

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

Die antwoord is 72, en dus moet jy die blok vir vraag 26 op die antwoordblad as volg voltooi: kleur 0 in honderde-ry in, 7 in die tiene-ry, en 2 in die ene-ry:



Skryf die syfers van jou antwoord in die oop blokkies links in die betrokke ry, soos in die voorbeeld aangetoon; honderde, tiene en ene van bo na onder. Die drie syfers wat jy neergeskryf het, word nie nagesien nie; dit is vir jou eie gerief — slegs die ingekleurde sirkels word gemerk.

MOENIE OMBLAAI VOORDAT JY VERSOEK WORD OM DIT TE DOEN NIE

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DIE OLD MUTUAL SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION

2020 TWEEDE RONDTE
JUNIOR AFDELING: GRAAD 8 & 9

14 Mei 2020 **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 6 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.

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