OLD MUTUAL
SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2022 FIRST ROUND
SENIOR SECTION: GRADE 10 - 12

10 March 2022 **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

The Mathematics Talent Search is a free online problem-solving course for learners from Gr 7 – 12 presented by the SAMF. All you have to do to participate is to click on https://mytutor.chat/samf-talent-search/ or to take a photograph of the QR code to go to the MyTutor.chat site easily.

1. Determine $2022^0 + 2 \times 2022$.

   (A) 4040 (B) 4045 (C) 6066 (D) 6065 (E) 2022

2. Gugu writes a sequence of 20 numbers. The first number is 43 and each number after that is 4 less than the number before it. How many of the numbers that Gugu writes are positive?

   (A) 15 (B) 13 (C) 12 (D) 11 (E) 9

3. Determine $\sqrt{\frac{1}{9} + \frac{1}{16}}$.

   (A) $\frac{1}{5}$ (B) $\frac{1}{4}$ (C) $\frac{3}{7}$ (D) $\frac{11}{12}$ (E) $\frac{5}{12}$

4. Which of the digits $1, 3, 5, 7$ or 9 cannot be the units digit of a power of 3?

   (A) 5 (B) 3 (C) 7 (D) 1 (E) 9

5. The number 2022 is divisible by two numbers between 100 and 1000. What is their sum?

   (A) 2022 (B) 1011 (C) 505 (D) 203 (E) 102

6. What is the sum of the two values of x which satisfy $(x - 10)^2 = 2022^2$?

   (A) 2012 (B) 2032 (C) 100 (D) 10 (E) 20

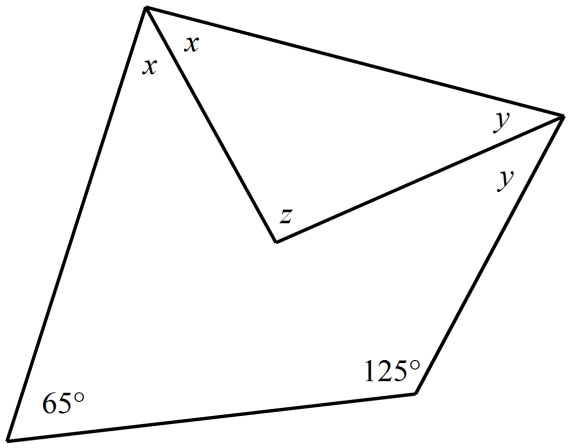
7. If $x > 0$ and $x(x + 1) = 6$, what is the value of $(x + 1)(x + 2)$?

   (A) 2 (B) 10 (C) 12 (D) 42 (E) 48

8. A rectangular poster's length is $\sqrt[6]{2022}$ and its width is $\sqrt[12]{2022}$. The area of the poster is $\sqrt[n]{2022}$. What is the value of n?

(A) $\frac{1}{2022}$ (B) $\frac{18}{25}$ (C) $\frac{1}{4}$ (D) 4 (E) 2022

9. Calculate the value of z.

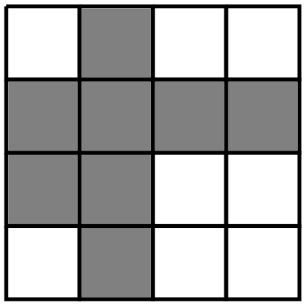


(A) 95° (B) 85° (C) 170° (D) 130° (E) 190°

10. For how many positive integers greater than 10 and less than 1000 is the product of the digits equal to 6?

(A) 10 (B) 12 (C) 13 (D) 15 (E) 16

11. The square in the picture is divided into smaller squares of equal size, as shown. If the area of the shaded region is 128 cm^2, determine the perimeter in cm of the big square.

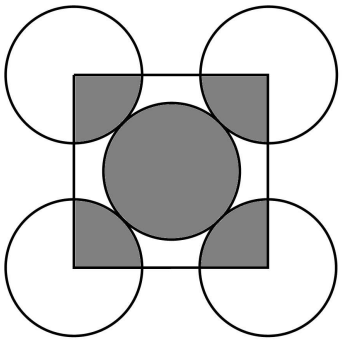


(A) 256 (B) 16 (C) 128 (D) 32 (E) 64

12. If Thomas scores 19 points in his last game, he will have an average of exactly 18 points per game for the season. If he can score 35 points in his last game, his average will be 20 points per game. How many games are played during the season?

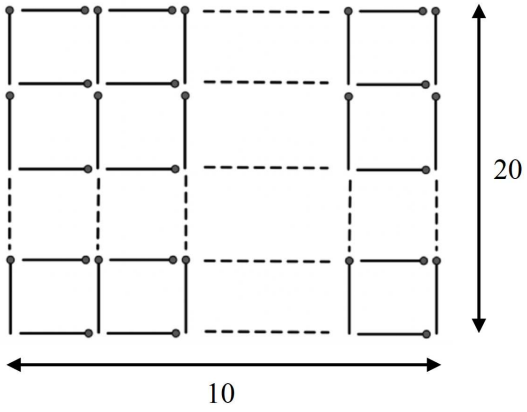
(A) 8 (B) 9 (C) 10 (D) 19 (E) 27

13. In the diagram, the five circles have the same radii and touch each other as shown. The square joins the centres of the four outer circles. What is the ratio of the area of the shaded parts of all five circles to the area of the unshaded parts of all five circles?



(A) 5 : 4 (B) 2 : 3 (C) 2 : 5 (D) 1 : 4 (E) 1 : 3

14. Match sticks of equal length are used to build a rectangular grid as shown. If the grid is 20 match sticks high and 10 match sticks wide, what is the total number of match sticks used?



(A) 30 (B) 210 (C) 410 (D) 420 (E) 430

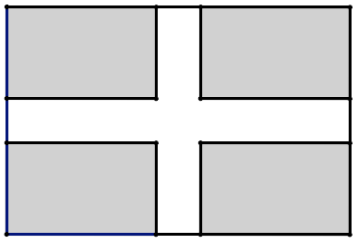
15. The letters in the word MADAGASCAR are placed in a bag. Three letters are taken out at random without replacement. What is the probability that the letters A, R and C are drawn, in that order?

(A) $\frac{1}{10}$ (B) $\frac{1}{180}$ (C) $\frac{1}{90}$ (D) $\frac{1}{80}$ (E) $\frac{1}{72}$

16. Nadi wants to bake a batch of giant cookies. She has pieces of three kinds of toppings available: 80 chocolate chips, 112 pecan nuts and 128 Smarties. She must use all these pieces in such a way that for each kind of topping the number of pieces is the same on every cookie. What is the largest number of giant cookies she can make?

(A) 8 (B) 16 (C) 20 (D) 24 (E) 32

17. In my 6×8 rectangular garden, the paths, shown unshaded, have equal widths. My garden's planting regions are shown as shaded rectangles. If the areas of shaded and unshaded regions are equal, how wide are the garden paths?



(A) 0.5 (B) 1 (C) 1.5 (D) 2 (E) 2.5

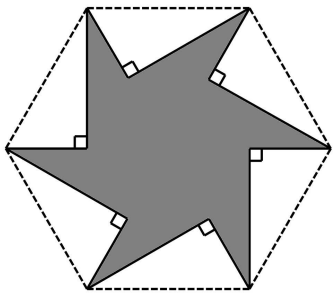
18. Three cubes of volume 1, 8 and 27 are glued together at their faces. What is the smallest possible surface area of the resulting configuration?

(A) 36 (B) 56 (C) 70 (D) 72 (E) 74

19. If $496 = 2^m - 2^n$, where m and n are integers, determine $m + n$.

(A) 13 (B) 9 (C) 4 (D) 14 (E) 5

20. A saw blade is made by cutting six triangles, each with angles of $30°$, $60°$ and $90°$, out of a regular hexagon. If the length of the longest diagonal of the hexagon is 12, what is the area of the saw blade?



(A) $9\sqrt{3}$ (B) $6\sqrt{27}$ (C) $27\sqrt{3}$ (D) 27×3 (E) $54\sqrt{3}$

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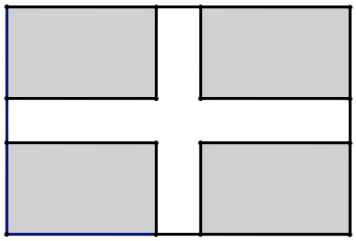
16. Nadi wil 'n klompie reusekoekies bak. Sy het stukke van drie soorte versierings beskikbaar: 80 sjokoladestukkies, 112 pekanneute en 128 Smarties. Sy moet al hierdie stukke op so 'n manier gebruik dat die aantal stukkies van elke soort versiering op elke reusekoekie dieselfde is. Wat is die grootste aantal reusekoekies wat sy kan bak?

(A) 8 (B) 16 (C) 20 (D) 24 (E) 32

17. In my 6×8 reghoekige tuin is die paadjies, wat nie ingekleur is nie, ewe breed. Die ingekleurde reghoeke in die skets is die dele van die tuin wat beplant is. As die oppervlaktes van die ingekleurde en oningekleurde dele gelyk is, wat is die breedte van die tuinpaadjies?



(A) 0.5 (B) 1 (C) 1.5 (D) 2 (E) 2.5

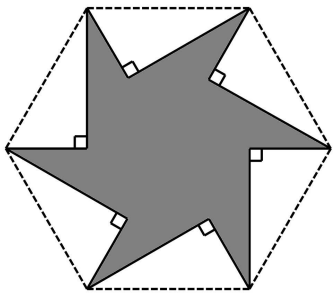
18. Drie kubusse met volumes 1, 8 en 27 se vlakke is aan mekaar vasgegom. Wat is die kleinste moontlike buite-oppervlakte van die konfigurasie wat so verkry kan word?

(A) 36 (B) 56 (C) 70 (D) 72 (E) 74

19. As $496 = 2^m - 2^n$, vir m en n heelgetalle, bepaal $m + n$.

(A) 13 (B) 9 (C) 4 (D) 14 (E) 5

20. 'n Saaglem word gemaak deur ses driehoeke, elk met hoeke 30°, 60° en 90°, uit 'n reëlmatige seshoek te sny. As die lengte van die langste hoeklyn van die seshoek gelyk is aan 12, wat is die oppervlakte van die saaglem?

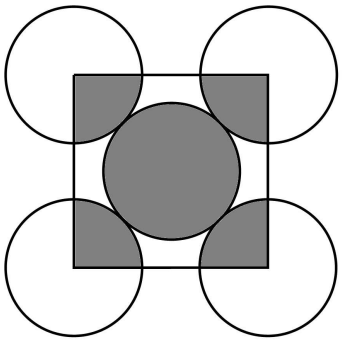


(A) $9\sqrt{3}$ (B) $6\sqrt{27}$ (C) $27\sqrt{3}$ (D) 27×3 (E) $54\sqrt{3}$

12. As Thomas 19 punte in sy laaste wedstryd kan aanteken, is sy gemiddeld presies 18 punte per wedstryd vir die seisoen. As hy 35 punte in sy laaste wedstryd kan aanteken, is sy gemiddeld per wedstryd 20 punte. Hoeveel wedstryde word daar hierdie seisoen gespeel?

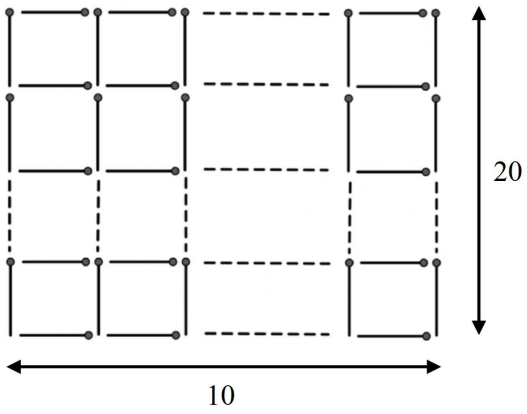
(A) 8 (B) 9 (C) 10 (D) 19 (E) 27

13. Die vyf sirkels in die diagram het dieselfde radii en raak mekaar soos aangetoon. Die vierkant verbind die middelpunte van die sirkels aan die buitekant. Wat is die verhouding van die oppervlakte van die ingekleurde dele van al vyf sirkels tot die oppervlakte van die wit dele van al vyf sirkels?



(A) 5 : 4 (B) 2 : 3 (C) 2 : 5 (D) 1 : 4 (E) 1 : 3

14. Vuurhoutjies van gelyke lengte word gebruik om 'n reghoekige rooster te bou soos aangetoon. As die rooster 20 vuurhoutjies hoog is en 10 vuurhoutjies breed, wat is die totale aantal vuurhoutjies wat gebruik word?



(A) 30 (B) 210 (C) 410 (D) 420 (E) 430

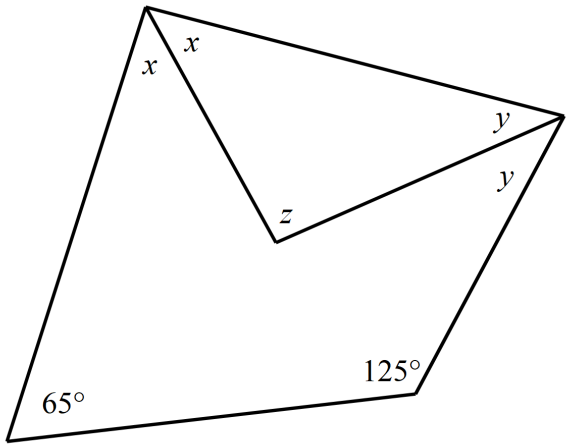
15. Die letters van die woord MADAGASCAR word in 'n sak gesit. Drie letters word ewekansig uitgehaal, sonder terugplasing. Wat is die waarskynlikheid dat die letters A, R en C in hierdie volgorde uitgehaal word?

(A) $\frac{1}{10}$ (B) $\frac{1}{180}$ (C) $\frac{1}{90}$ (D) $\frac{1}{80}$ (E) $\frac{1}{72}$

8. 'n Reghoekige plakkaat se lengte is $\sqrt[6]{2022}$ en sy breedte is $\sqrt[12]{2022}$. Die oppervlakte van die plakkaat is $\sqrt[n]{2022}$. Wat is die waarde van n?

(A) $\frac{1}{2022}$ (B) $\frac{18}{25}$ (C) $\frac{1}{4}$ (D) 4 (E) 2022

9. Bereken die waarde van z.

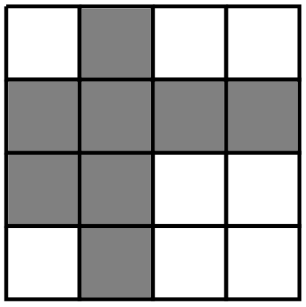


(A) 95° (B) 85° (C) 170° (D) 130° (E) 190°

10. Vir hoeveel positiewe heelgetalle groter as 10 en kleiner as 1000 is die produk van die syfers gelyk aan 6?

(A) 10 (B) 12 (C) 13 (D) 15 (E) 16

11. Die vierkant in die figuur is verdeel in kleiner vierkante wat almal ewe groot is. As die oppervlakte van die ingekleurde deel gelyk is aan 128 cm^2, bepaal die omtrek van die groot vierkant in cm.



(A) 256 (B) 16 (C) 128 (D) 32 (E) 64

1. Bepaal $2022^0 + 2 \times 2022$.

   (A) 4040 (B) 4045 (C) 6066 (D) 6065 (E) 2022

2. Gugu skryf 'n ry van 20 getalle neer. Die eerste getal is 43 en elke getal daarna is 4 minder as die getal voor dit. Hoeveel van die getalle wat Gugu neerskryf is positief?

   (A) 15 (B) 13 (C) 12 (D) 11 (E) 9

3. Bepaal $\sqrt{\frac{1}{9} + \frac{1}{16}}$.

   (A) $\frac{1}{5}$ (B) $\frac{1}{4}$ (C) $\frac{3}{7}$ (D) $\frac{11}{12}$ (E) $\frac{5}{12}$

4. Watter van die syfers $1, 3, 5, 7$ of 9 kan nie die enesyfer van 'n mag van 3 wees nie?

   (A) 5 (B) 3 (C) 7 (D) 1 (E) 9

5. Die getal 2022 is deelbaar deur twee getalle tussen 100 en 1000. Wat is hulle som?

   (A) 2022 (B) 1011 (C) 505 (D) 203 (E) 102

6. Wat is die som van die twee waardes van x wat $(x - 10)^2 = 2022^2$ bevredig?

   (A) 2012 (B) 2032 (C) 100 (D) 10 (E) 20

7. As $x > 0$ en $x(x + 1) = 6$, wat is die waarde van $(x + 1)(x + 2)$?

   (A) 2 (B) 10 (C) 12 (D) 42 (E) 48

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Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION

2022 EERSTE RONDTE
SENIOR AFDELING: GRAAD 10-12

10 Maart 2022 **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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TEL: (012) 392-9372 E-pos: info@samf.ac.za

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

Die Mathematics Talent Search is 'n gratis aanlyn probleemoplossing program vir leerders van Gr 7 – 12 aangebied deur die SAMF. Al wat jy moet doen om deel te neem, is om te klik op https://mytutor.chat/samf-talent-search/ of neem 'n foto van die QR kode om maklik na MyTutor.chat te gaan.