OLD MUTUAL
SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2022 FIRST ROUND
JUNIOR SECTION: GRADE 9

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. *The centre page is an information and formula sheet. Please tear out the page for your own use.*
7. *Start when the invigilator tells you to do so.*
8. *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. $2 \times 5^2 - 5 \times 2^2 =$

(A) 30 (B) 20 (C) 10 (D) 5 (E) 0

2. Which one of the following numbers lies between $\frac{1}{10}$ and $\frac{1}{5}$?

(A) 0,25 (B) 0,18 (C) 0,3 (D) 0,5 (E) 0,43

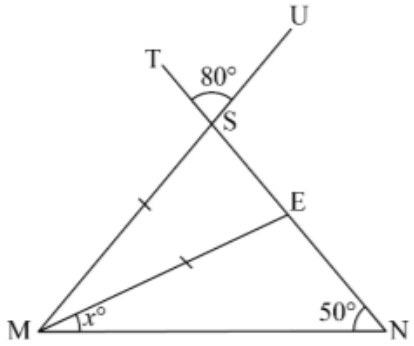
3. $\frac{20 \times 22}{2^0 \times 2^2} =$

(A) 80 (B) 90 (C) 100 (D) 110 (E) 120

4. If $\frac{\sqrt[3]{p}}{4} = 1$, then what is the value of p?

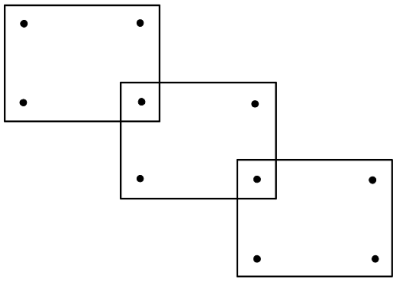
(A) 4 (B) 8 (C) 16 (D) 32 (E) 64

5. The diagram is made from four straight line segments with ME = MS. Find the size of the angle marked x.



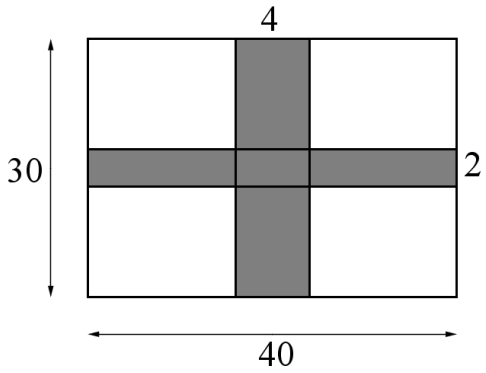
(A) 20° (B) 30° (C) 50° (D) 65° (E) 80°

6. A series of postcards are pinned to a board, in a diagonal line, using drawing pins. How many drawing pins would be needed to pin 25 postcards in a similar fashion?



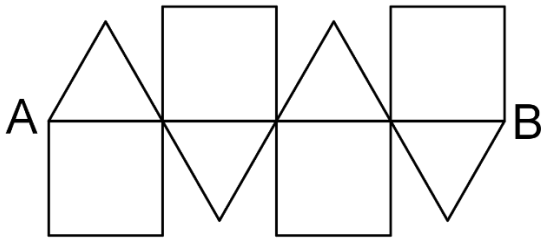
(A) 27 (B) 75 (C) 76 (D) 77 (E) 100

7. Determine the area of the shaded region.



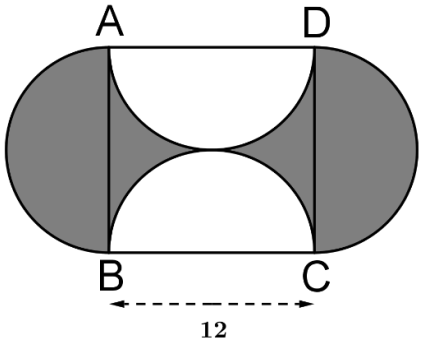
(A) 192 (B) 200 (C) 210 (D) 220 (E) 240

8. Camagu uses a length of wire to make the following shape. The shape contains four identical squares and four identical equilateral triangles. If the length of AB is 30 cm, how many centimetres of wire will be used?



(A) 150 (B) 165 (C) 180 (D) 215 (E) 220

9. ABCD is a square of side length 12, and each curve is a semicircle. Determine the area of the shaded region.



(A) 24 (B) 108 (C) 144 (D) 168 (E) 180

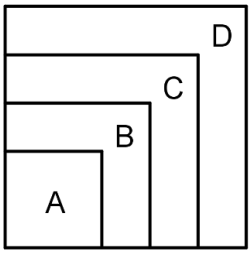
10. Which one of the following is the smallest?

(A) $\frac{\sqrt{5}}{5}$ (B) $\frac{1}{5\sqrt{5}}$ (C) $\sqrt{5}$ (D) $\frac{1}{\sqrt{5}}$ (E) $\frac{1}{5}$

11. Two wheels are rolled down a road. Wheel A has a diameter of 3 units. Wheel B has a diameter of 5 units. If wheel B makes 60 complete revolutions, how many revolutions does wheel A need to make to cover the same distance?

(A) 100 (B) 110 (C) 120 (D) 130 (E) 140

12. Four nested squares are shown. The four regions labelled A, B, C and D each have the same area. If the smallest square has a side length of 5 units, what is the side length of the largest square?

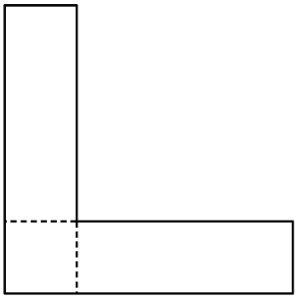


(A) 8 (B) 10 (C) 12 (D) 20 (E) 25

13. What is the obtuse angle formed by the hands of a clock at 9:10?

(A) 100° (B) 120° (C) 130° (D) 145° (E) 160°

14. Two identical rectangles, each with an area of 10 units^2, overlap to form an L-shape. If the perimeter of the L-shape is 20 units, determine the perimeter of each rectangle.



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

15. From a group of 5 people, you want to choose two teams to compete against each other. Each team must have 2 people. In how many ways can you do this?

(A) 11 (B) 12 (C) 13 (D) 14 (E) 15

16. P is a quarter of 20^{22}. What is one percent of P?

(A) 20^{20} (B) 5^{20} (C) 10^{10} (D) 4^{20} (E) 20^5

17. A liquid blend is made by mixing certain amounts of Brand A and Brand B. Brand A costs R15 per litre, and Brand B costs R10 per litre. If the blend is worth R12 per litre, how many litres of Brand A are needed to make 50 litres of the blend?

(A) 5 (B) 10 (C) 15 (D) 20 (E) 25

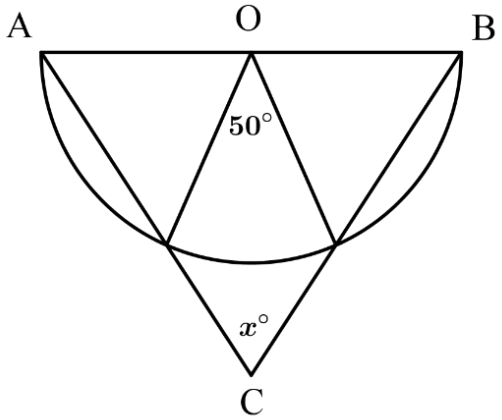
18. If you write down all of the integers from 300 to 400 inclusive, how many times would you write the digit 3?

(A) 105 (B) 115 (C) 120 (D) 125 (E) 130

19. The digits 1 to 5 are arranged in a random order to form a 5-digit number. What is the probability that this number is divisible by 6?

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{5}$ (D) $\frac{2}{3}$ (E) $\frac{2}{5}$

20. The diagram shows isosceles triangle ABC with AC = BC. Side AB is the diameter of a semi-circle with centre O. Determine the value of x.



(A) 50° (B) 55° (C) 60° (D) 65° (E) 70°

Formula and Information Sheet

1.1 The natural numbers are: 1; 2; 3; 4; 5; …

1.2 The whole numbers are: 0; 1; 2; 3; 4; 5; …

1.3 The integers are: …; –4; –3; –2; –1; 0; 1; 2; 3; 4; 5; …

2. In the fraction $\frac{a}{b}$, a is called the numerator and b the denominator.

3.1 Exponential notation:

$2 \times 2 \times 2 \times 2 \times 2 = 2^5$

$3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

$a \times a \times a \times a \times \ldots \times a = a^n$ (n factors of a)

(a is the base and n is the index (exponent))

3.2 Factorial notation:

2! = 2 x 1 = 2

3! = 3 x 2 x 1 = 6

4! = 4 x 3 x 2 x 1 = 24

1 x 2 x 3 x …. x n = n!

3.3 $1 + 2 + 3 + 4 \ldots. + n = \frac{1}{2}n(n+1)$

4 Area of a

4.1	triangle is:	$\frac{1}{2} \times$ (base $\times$ height) = $\frac{1}{2}(b.h)$
4.2	rectangle is:	length $\times$ width = lw length $\times$ breadth = lb
4.3	square is:	side $\times$ side = s^2
4.4	rhombus is:	$\frac{1}{2} \times$ (product of diagonals)
4.5	trapezium is:	$\frac{1}{2} \times$ (sum of parallel sides) $\times$ height
4.6	circle is:	πr^2 (r = radius)

5 Surface area of a:

5.1 rectangular prism is: $2lb + 2lh + 2bh\,(h = \text{height})$

5.2 sphere is: $4\pi r^2$

6 Perimeter of a:

6.1 rectangle is: $2 \times \text{length} + 2 \times \text{breadth}$

$2l + 2b$

or $2l + 2w$ $(w = \text{width})$

6.2 square is: $4s$

7. Circumference of a circle is: $2\pi r$

8. Volume of a:

8.1 cube is: $s \times s \times s = s^3$

8.2 rectangular prism is: $l \times b \times h$

8.3 cylinder is: $\pi r^2 h$

9.1 Volume of a right prism is: area of cross-section × perpendicular height

or area of base × perpendicular height

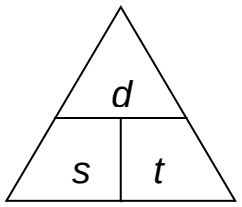
9.2 Surface area of a right prism is: (perimeter of base × h) + (2 × area of base)

10. Sum of the interior angles of a polygon is: $180^\circ(n-2)$ $[n = \text{number of sides}]$

11. Distance = speed × time $(d = s \times t)$

Speed = distance ÷ time $(s = \frac{d}{t})$

Time = distance ÷ speed $(t = \frac{d}{s})$

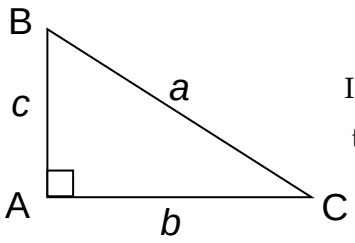


$d = s \times t$

$s = \frac{d}{t}$

$t = \frac{d}{s}$

12. Pythagoras:



If ΔABC is a right-angled triangle, then $a^2 = b^2 + c^2$

13. Conversions:

1 cm³ = 1 mℓ ; 1000 cm³ = 1 ℓ

1000 m = 1 km ; 1000 g = 1 kg ; 100 cm = 1 m

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5. Buite-oppervlakte van 'n

5.1 regte prisma is: $2lb + 2lh + 2bh$ (h = hoogte)

5.2 sfeer is: $4\pi r^2$

6 Omtrek van 'n:

6.1 reghoek is: 2×lengte + 2×breedte
$2l + 2b$

6.2 vierkant is: $4s$

7. Omtrek van 'n sirkel is: $2\pi r$

8. Volume van 'n:

8.1 kubus is: $s \times s \times s = s^3$

8.2 reghoekige prisma is: $l \times b \times h$

8.3 silinder is: $\pi r^2 h$

9.1 Volume van 'n regte prisma is: oppervlakte van dwarssnit × hoogte
of oppervlakte van basis × hoogte

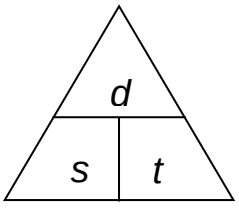
9.2 Buite-oppervlakte van 'n regte prisma is:
(omtrek van basis × h) + (2 × oppervlakte van basis)

10. Som van die binnehoeke van 'n veelhoek is: $180^\circ(n-2)$ [n = aantal sye]

11. Afstand is: spoed x tyd $(d = s \times t)$

Spoed = afstand ÷ tyd $(s = \frac{d}{t})$

Tyd = afstand ÷ spoed $(t = \frac{d}{s})$

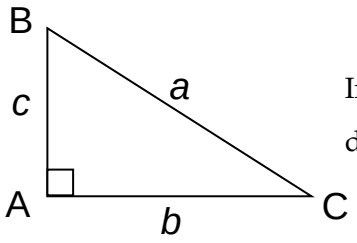


$d = s \times t$

$s = \frac{d}{t}$

$t = \frac{d}{s}$

12. Pythagoras:



Indien ΔABC 'n reghoekige driehoek is, dan sal $a^2 = b^2 + c^2$

13. Omskakelings:

1 cm³ = 1 mℓ ; 1000 cm³ = 1 ℓ

1000 m = 1 km; 1000 g = 1 kg ; 100 cm = 1 m

Formule- en Inligtingblad

1.1 Die natuurlike getalle is: 1; 2; 3; 4; 5; …

1.2 Die telgetalle is: 0; 1; 2; 3; 4; 5; …

1.3 Die heelgetalle is: …, –4; –3; –2; –1; 0; 1; 2; 3; 4; 5; …

2. In die breuk $\frac{a}{b}$, word a die teller en b die noemer genoem.

3.1 Eksponensiële notasie:

$2 \times 2 \times 2 \times 2 \times 2 = 2^5$

$3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

$a \times a \times a \times a \times \ldots\ldots \times a = a^n$ (n faktore van a)

(a is die grondtal en n is die indeks (eksponent))

3.2 Fakulteitnotasie:

$2! = 2 \times 1 = 2$

$3! = 3 \times 2 \times 1 = 6$

$4! = 4 \times 3 \times 2 \times 1 = 24$

$1 \times 2 \times 3 \times \ldots. \times n = n!$

3.3 $1 + 2 + 3 + 4 \ldots. + n = n(n + 1)/2$

4 Oppervlakte van 'n:

4.1 driehoek is: $\frac{1}{2} \times$ (basis $\times$ loodregte hoogte) = $\frac{1}{2}(b.h)$

4.2 reghoek is: lengte $\times$ breedte = lb

4.3 vierkant is: sy $\times$ sy = s^2

4.4 ruit (rombus) is: $\frac{1}{2}$ (produk van die diagonale)

4.5 trapesium is: $\frac{1}{2}(\text{som van ewewydige sye}) \times \text{hoogte}$

4.6 sirkel is: πr^2 (r = radius)

15. Uit ‘n groep van 5 mense, wil jy twee spanne kies om teen mekaar deel te neem. Elke span moet 2 lede hê. Op hoeveel maniere kan jy dit doen?

(A) 11 (B) 12 (C) 13 (D) 14 (E) 15

16. P is ‘n kwart van 20^{22}. Wat is een persent van P?

(A) 20^{20} (B) 5^{20} (C) 10^{10} (D) 4^{20} (E) 20^{5}

17. ‘n Vloeibare mengsel word gemaak deur sekere hoeveelhede van Tipe A en Tipe B te meng. Tipe A kos R15 per liter, en Tipe B kos R10 per liter. Indien die mengsel R12 per liter werd is, hoeveel liter van Tipe A is nodig om 50 liter van die mengsel te maak?

(A) 5 (B) 10 (C) 15 (D) 20 (E) 25

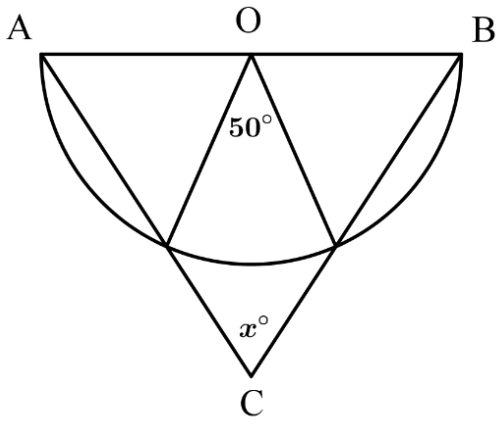
18. As jy al die heelgetalle van 300 tot 400, beide getalle ingesluit, neerskryf, hoeveel keer gaan jy die syfer 3 skryf?

(A) 105 (B) 115 (C) 120 (D) 125 (E) 130

19. Die syfers 1 tot 5 word willekeurig gerangskik om ‘n 5-syfer getal te maak. Wat is die waarskynlikheid dat hierdie getal deelbaar is deur 6?

(A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{5}$ (D) $\frac{2}{3}$ (E) $\frac{2}{5}$

20. In die figuur is gelykbenige driehoek ABC met AC = BC. Sy AB is die middellyn van ‘n halfsirkel met middelpunt O. Bepaal die waarde van x.

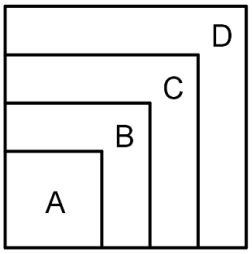


(A) 50° (B) 55° (C) 60° (D) 65° (E) 70°

11. Twee wiele word in ‘n pad afgerol. Wiel A het ‘n middellyn van 3 eenhede. Wiel B het ‘n middellyn van 5 eenhede. As wiel B 60 volledige omwentelings maak, hoeveel omwentelings moet wiel A maak om dieselfde afstand te dek?

(A) 100 (B) 110 (C) 120 (D) 130 (E) 140

12. Vier vierkante wat presies bo-op mekaar pas, word aangetoon. Die vier dele gemerk A, B, C en D het dieselfde gelyke oppervlaktes. As die kleinste vierkant ‘n sylengte van 5 eenhede het, wat is die sylengte van die grootste vierkant?

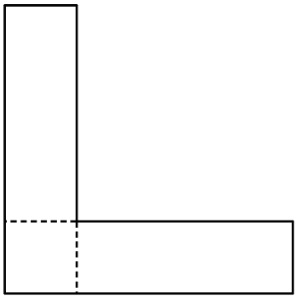


(A) 8 (B) 10 (C) 12 (D) 20 (E) 25

13. Bepaal die stomphoek, wat gevorm word deur die arms van ‘n horlosie, as dit 9:10 is.

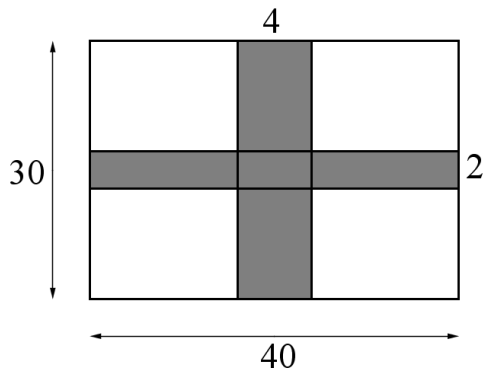
(A) 100° (B) 120° (C) 130° (D) 145° (E) 160°

14. Twee identiese reghoeke, elk met ‘n oppervlakte van 10 eenhede^2, word oormekaar geplaas om ‘n L-vorm te maak. As die omtrek van die L-vorm 20 eenhede is, bepaal die omtrek van elke reghoek.



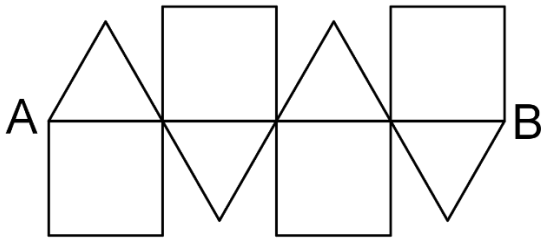
(A) 10 (B) 11 (C) 12 (D) 13 (E) 14

7. Bepaal die oppervlakte van die ingekleurde deel.



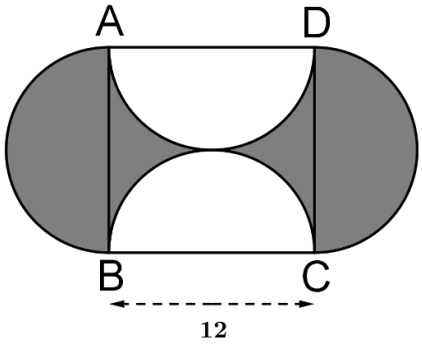
(A) 192 (B) 200 (C) 210 (D) 220 (E) 240

8. Camagu gebruik ‘n stuk draad om die vorm hieronder te maak. Die vorm bestaan uit vier identiese vierkante en vier identiese gelyksydige driehoeke. As die lengte van AB 30 cm is, hoeveel sentimeters draad gaan gebruik word?



(A) 150 (B) 165 (C) 180 (D) 215 (E) 220

9. ABCD is ‘n vierkant met sylengte 12, en elke kurwe is ‘n halfsirkel. Bepaal die oppervlakte van die ingekleurde deel.



(A) 24 (B) 108 (C) 144 (D) 168 (E) 180

10. Watter een van die volgende is die kleinste?

(A) $\frac{\sqrt{5}}{5}$ (B) $\frac{1}{5\sqrt{5}}$ (C) $\sqrt{5}$ (D) $\frac{1}{\sqrt{5}}$ (E) $\frac{1}{5}$

1. $2 \times 5^2 - 5 \times 2^2 =$

(A) 30 (B) 20 (C) 10 (D) 5 (E) 0

2. Watter een van die volgende getalle lê tussen $\frac{1}{10}$ en $\frac{1}{5}$?

(A) 0,25 (B) 0,18 (C) 0,3 (D) 0,5 (E) 0,43

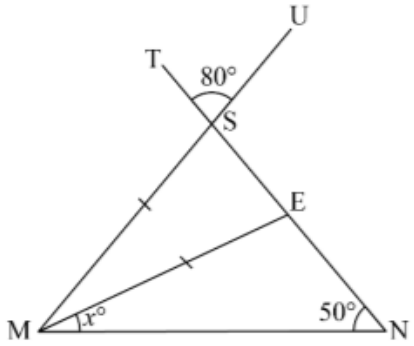
3. $\frac{20 \times 22}{2^0 \times 2^2} =$

(A) 80 (B) 90 (C) 100 (D) 110 (E) 120

4. As $\frac{\sqrt[3]{p}}{4} = 1$, wat is die waarde van p?

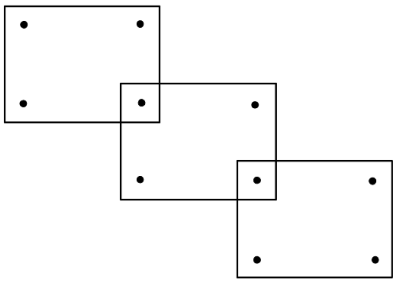
(A) 4 (B) 8 (C) 16 (D) 32 (E) 64

5. Die figuur word gevorm deur vier reguit-lynsegmente met ME = MS. Bepaal die grootte van die hoek gemerk met x.



(A) 20° (B) 30° (C) 50° (D) 65° (E) 80°

6. ‘n Reeks poskaarte word op ‘n bord, in ‘n diagonale lyn, met pennetjies vasgespeld. Hoeveel pennetjies word benodig om 25 poskaarte op ‘n soortgelyke wyse vas te speld?



(A) 27 (B) 75 (C) 76 (D) 77 (E) 100

OLD MUTUAL
SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION

2022 EERSTE RONDTE
JUNIOR AFDELING: GRAAD 9

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. *Die binneblad is 'n inligtings- en formuleblad. Skeur dit asseblief uit vir jou gebruik.*
7. *Begin sodra die toesighouer die teken gee.*
8. *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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Organisasies betrokke: AMESA, SA Wiskundevereniging,
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