OLD MUTUAL
SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2021 FIRST ROUND JUNIOR
SECTION: GRADE 8

11 March 2021 **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

1. $20{,}21 + 20 + 2{,}1 =$

(A) 40,33 (B) 41,21 (C) 42,31 (D) 43,42 (E) 44,20

2. $\sqrt{20 + 20 + 20 + 21} =$

(A) 10 (B) 9 (C) 8 (D) 7 (E) 6

3. The time is now 20:21. What will the time be after 200 minutes?

(A) 21:41 (B) 22:21 (C) 22:41 (D) 23:21 (E) 23:41

4. Which of the following is closest to a quarter of 2021?

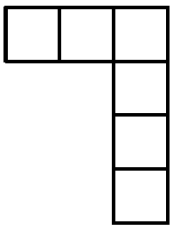
(A) 505 (B) 404 (C) 55 (D) 50 (E) 44

5. A whole number between 10 and 30 has the following properties. It is not even, it is not a prime number, and it is not a multiple of 3. What is the number?

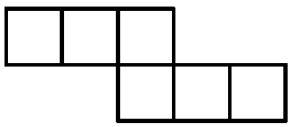
(A) 17 (B) 19 (C) 23 (D) 25 (E) 27

6. Which one of these nets can be folded to form a cube?

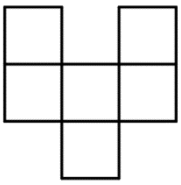
(A)



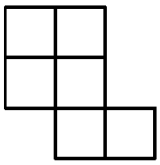
(B)



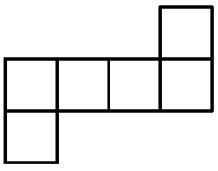
(C)



(D)



(E)



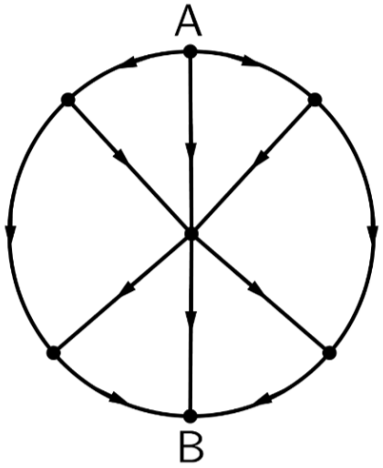
7. The average age of a group of five people is 20. The ages of four of the people are 10, 15, 20 and 22. How old is the fifth person?

(A) 24 (B) 27 (C) 30 (D) 33 (E) 36

8. A tank holds 400 litres of water when full. Water flows into the tank at a rate of 8 litres per minute. If the tank is empty, how many minutes will it take to fill?

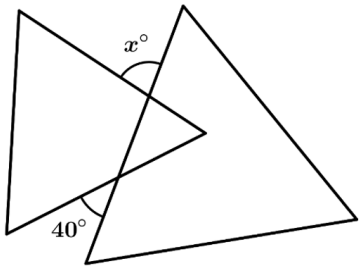
(A) 50 (B) 60 (C) 70 (D) 80 (E) 90

9. If you can only travel in the directions indicated by the arrows, how many pathways are there from A to B?



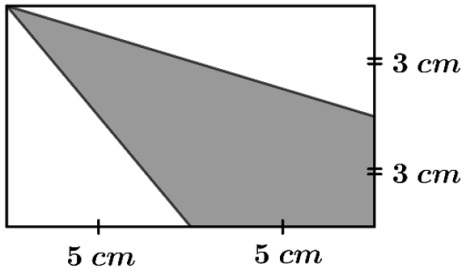
(A) 16 (B) 11 (C) 6 (D) 5 (E) 3

10. Two equilateral triangles overlap as shown. Determine the value of x.



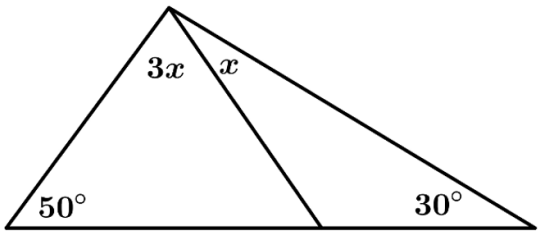
(A) 40° (B) 50° (C) 60° (D) 70° (E) 80°

11. The diagram shows a rectangle with a shaded region. Determine the area of the shaded region in cm^2.



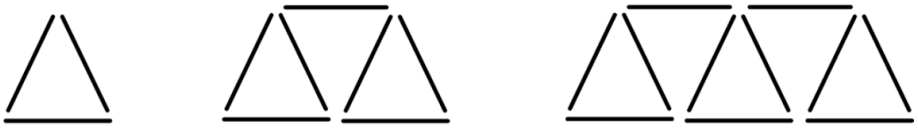
(A) 30 (B) 31 (C) 32 (D) 33 (E) 34

12. Determine the value of x.



(A) 15° (B) 20° (C) 25° (D) 30° (E) 35°

13. The diagram shows the first three shapes in a pattern. How many sticks would there be in the 50^{th} shape?



(A) 199 (B) 198 (C) 197 (D) 196 (E) 195

14. What is the largest 2-digit number that is the sum of two different perfect squares?

(A) 85 (B) 89 (C) 97 (D) 98 (E) 99

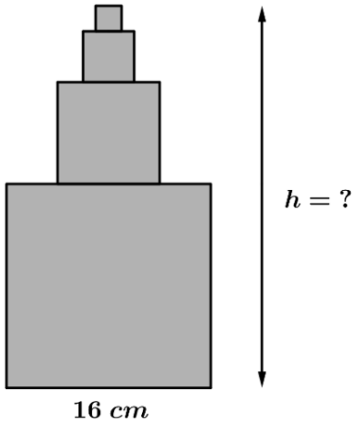
15. The sequence of natural numbers is divided into groups of three:

$$\{1; 2; 3\}\ ;\ \{4; 5; 6\}\ ;\ \{7; 8; 9\}\ ;\ ...$$

What is the sum of the numbers in the 100^{th} group?

(A) 297 (B) 300 (C) 303 (D) 897 (E) 903

16. A tower of four squares is shown. The area of each square is a quarter of the area of the square just below it. The bottom square has a side length of 16 cm. What is the height of the tower in cm?



(A) 32 (B) 30 (C) 28 (D) 26 (E) 24

17. Hamdani is out running. He is now $\frac{3}{5}$ (three-fifths) of the way through the second half of his run. What fraction of the whole run has he completed?

(A) $\frac{2}{5}$ (B) $\frac{3}{5}$ (C) $\frac{7}{10}$ (D) $\frac{4}{5}$ (E) $\frac{9}{10}$

18. In a 5-digit numerical code each group of four adjacent digits adds to 19 and each group of three adjacent digits adds to 15. What is the sum of all five digits?

(A) 22 (B) 23 (C) 24 (D) 25 (E) 26

19. ABBA is a 4-digit number where A and B represent different digits. The sum of its digits is the 2-digit number CC. What is the value of A + B + C?

(A) 9 (B) 10 (C) 11 (D) 12 (E) 13

20. In the number pattern 2018 ; 121 ; 16 ; … each term is the square of the sum of the digits of the previous term. What is the 100^{th} term in the pattern?

(A) 196 (B) 225 (C) 256 (D) 289 (E) 324

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

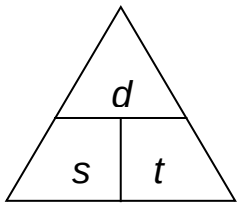
9.2 Surface area of a right prism is: (perimeter of base × h) + (2 × area of base)

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

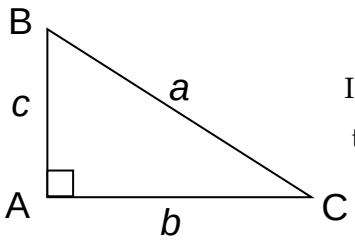


$d = s \times t$

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

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

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

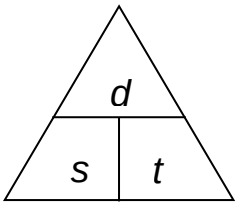
9.2 Buite-oppervlakte van 'n regte prisma is:
(omtrek van basis × h) + (2 × oppervlakte van basis)

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

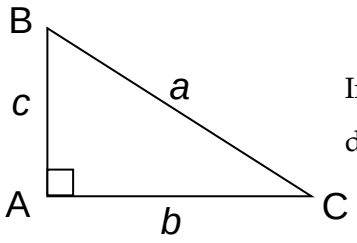


$d = s \times t$

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

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

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

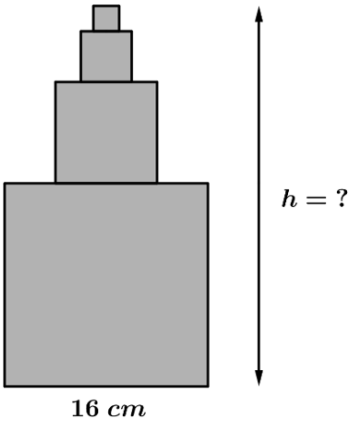
4.3 vierkant is: sy $\times$ sy = s^2

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)

16. 'n Toring van vier vierkante word aangetoon. Die oppervlakte van elke vierkant is 'n kwart van die oppervlakte van die vierkant onder dit. Die onderste vierkant het 'n sylengte van 16 cm. Wat is die hoogte van die toring in cm?



(A) 32 (B) 30 (C) 28 (D) 26 (E) 24

17. Hamdani is besig om te draf. Hy is $\frac{3}{5}$ (drie-vyfdes) klaar met die tweede helfte van sy roete. Watter breukdeel van die roete het hy reeds voltooi?

(A) $\frac{2}{5}$ (B) $\frac{3}{5}$ (C) $\frac{7}{10}$ (D) $\frac{4}{5}$ (E) $\frac{9}{10}$

18. In 'n 5-syfer numeriese kode tel elke groep van vier aangrensende syfers op na 19 en elke groep van drie aangrensende syfers tel op na 15. Wat is die som van al vyf syfers?

(A) 22 (B) 23 (C) 24 (D) 25 (E) 26

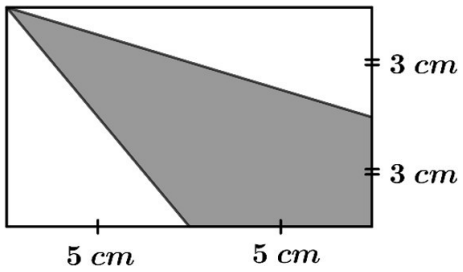
19. ABBA is 'n 4-syfer getal met A en B wat verskillende syfers voorstel. Die som van die getal se syfers is die 2-syfer getal CC. Wat is die waarde van A + B + C?

(A) 9 (B) 10 (C) 11 (D) 12 (E) 13

20. In die getalpatroon 2018 ; 121 ; 16 ; … is elke getal die vierkant van die som van die syfers van die vorige getal. Wat is die 100^{ste} getal in die patroon?

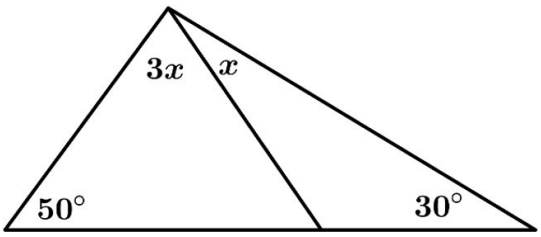
(A) 196 (B) 225 (C) 256 (D) 289 (E) 324

11. Die figuur toon 'n reghoek met 'n ingekleurde gebied. Bepaal die oppervlakte van die ingekleurde gebied in cm^2.



(A) 30 (B) 31 (C) 32 (D) 33 (E) 34

12. Bepaal die waarde van x.



(A) 15° (B) 20° (C) 25° (D) 30° (E) 35°

13. Die skets toon die eerste drie figure in 'n patroon. Hoeveel stokkies sal daar in die 50^{ste} figuur wees?

(A) 199 (B) 198 (C) 197 (D) 196 (E) 195

14. Wat is die grootste 2-syfer getal wat die som van twee verskillende volkome vierkante is?

(A) 85 (B) 89 (C) 97 (D) 98 (E) 99

15. Die ry van natuurlike getalle word in groepe van drie verdeel:

$$\{1; 2; 3\} ; \{4; 5; 6\} ; \{7; 8; 9\} ; ...$$

Wat is die som van die getalle in die 100^{ste} groep?

(A) 297 (B) 300 (C) 303 (D) 897 (E) 903

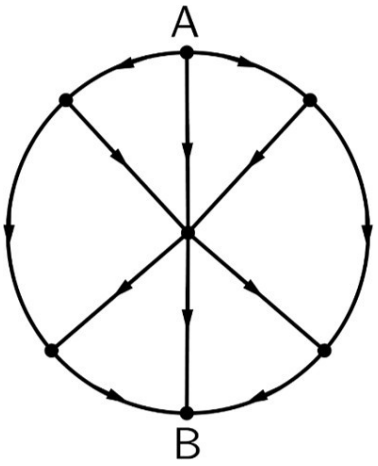
7. Die gemiddelde ouderdom van 'n groep van vyf mense is 20. Vier van die mense is 10, 15, 20 en 22 jaar oud. Hoe oud is die vyfde persoon?

(A) 24 (B) 27 (C) 30 (D) 33 (E) 36

8. 'n Tenk kan 400 liter water hou as dit vol is. Water vloei in die tenk in teen 'n tempo van 8 liter per minuut. As met ‘n leë tenk begin word, hoeveel minute sal dit neem om vol te word?

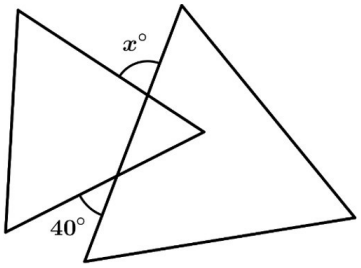
(A) 50 (B) 60 (C) 70 (D) 80 (E) 90

9. In die diagram kan jy slegs in 'n rigting soos deur die pyltjies aangetoon word, beweeg. Hoeveel verskillende maniere is daar om van A na B te beweeg?



(A) 16 (B) 11 (C) 6 (D) 5 (E) 3

10. Twee gelyksydige driehoeke lê bo-oor mekaar soos aangetoon. Bepaal die waarde van x.



(A) 40° (B) 50° (C) 60° (D) 70° (E) 80°

1. $20{,}21 + 20 + 2{,}1 =$

(A) 40,33 (B) 41,21 (C) 42,31 (D) 43,42 (E) 44,20

2. $\sqrt{20 + 20 + 20 + 21} =$

(A) 10 (B) 9 (C) 8 (D) 7 (E) 6

3. Die tyd is nou 20:21. Hoe laat sal dit oor 200 minute wees?

(A) 21:41 (B) 22:21 (C) 22:41 (D) 23:21 (E) 23:41

4. Watter een van die volgende is die naaste aan 'n kwart van 2021?

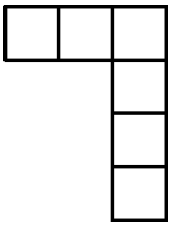
(A) 505 (B) 404 (C) 55 (D) 50 (E) 44

5. 'n Heelgetal tussen 10 en 30 het die volgende eienskappe: dit is nie 'n ewe getal nie, dit is nie 'n priemgetal nie en dit is nie 'n veelvoud van 3 nie. Wat is die getal?

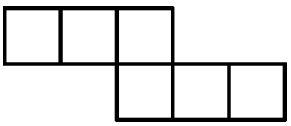
(A) 17 (B) 19 (C) 23 (D) 25 (E) 27

6. Watter een van hierdie ontvouings sal 'n kubus vorm as dit gevou word?

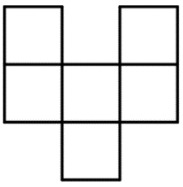
(A)



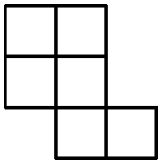
(B)



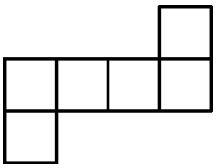
(C)



(D)



(E)



OLD MUTUAL
SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION

2021 EERSTE RONDTE
JUNIOR AFDELING: GRAAD 8

11 Maart 2021 **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,
SA Akademie vir Wetenskap en Kuns, ASTEMI