OLD MUTUAL
SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2020 FIRST ROUND
JUNIOR SECTION: GRADE 9

12 March 2020 **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.

PRIVATE BAG X173, PRETORIA, 0001
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Organisations involved: AMESA, SA Mathematical Society,
SA Akademie vir Wetenskap en Kuns, ASTEMI

1. $\frac{2020}{202} =$

(A) 0 (B) 2 (C) 5 (D) 8 (E) 10

2. How many seconds are there in 20 minutes?

(A) 1200 (B) 1140 (C) 1080 (D) 1020 (E) 960

3. $\sqrt{2 \times 10 \times 2 \times 10} =$

(A) 10 (B) 20 (C) 30 (D) 40 (E) 50

4. A train is scheduled to leave the station at 20:20. The journey takes 20 minutes, and the train leaves 20 minutes late. At what time does it arrive at its destination?

(A) 19:00 (B) 20:00 (C) 21:00 (D) 22:00 (E) 23:00

5. Each step a duck takes is 20 cm. How many steps must the duck take to walk 20 m?

(A) 20 (B) 40 (C) 60 (D) 80 (E) 100

6. Which one of the following is NOT equal in value to the others?

(A) $2^0 + 2^0$ (B) $2+0+2\times0$ (C) $\sqrt{2+0+2-0}$

(D) $\frac{2+0}{2-0}$ (E) $\sqrt{2^{0+2-0}}$

7. What is $\frac{1}{4}$ of $\frac{1}{5}$ of 2020?

(A) 93 (B) 95 (C) 97 (D) 99 (E) 101

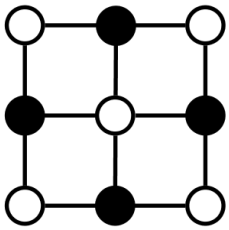
8. The word OLYMPIADS is reflected across a horizontal line. How many of the nine letters would look the same after the reflection?

(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

9. The average of five different natural numbers is 9. What is the greatest possible value of any one of these numbers?

(A) 35 (B) 36 (C) 38 (D) 40 (E) 41

10. A fly lands on one of the nine circles and then moves once along a path to an adjacent circle. What is the probability that it will end up on a black circle?



(A) $\frac{4}{9}$ (B) $\frac{5}{9}$ (C) $\frac{4}{5}$ (D) $\frac{1}{5}$ (E) $\frac{1}{9}$

11. How many 3-digit numbers are divisible by all three of the numbers 9, 10 and 12?

(A) 2 (B) 3 (C) 5 (D) 6 (E) 7

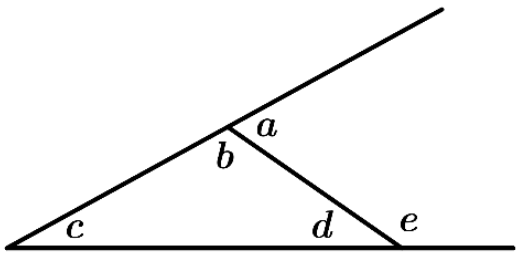
12. The diagonal of a rectangle is $\sqrt{41}$ cm and its area is 20 cm^2. Determine the perimeter of the rectangle in cm.

(A) 15 (B) 16 (C) 17 (D) 18 (E) 19

13. A bag contains R100, R50, R20 and R10 notes. There are 10 of each note. You put your hand into the bag and take out a note. If you keep doing this until you have four notes of the same value, what is the largest amount of money you could have?

(A) R640 (B) R630 (C) R620 (D) R610 (E) R600

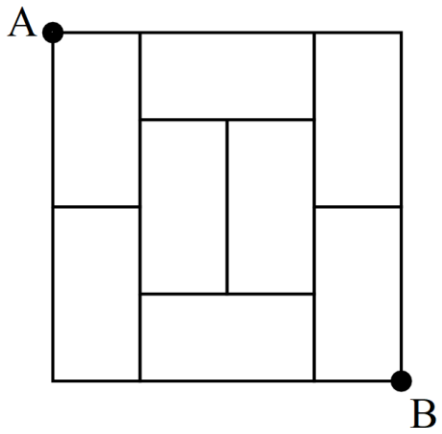
14. The diagram shows a triangle with two sides extended. Which one of the following statements is NOT true?



(A) $a > d$ (B) $c = a - d$ (C) $a + b + c > 180°$

(D) $b < e$ (E) $a + e < 180°$

15. Each rectangle below is 2 cm by 1 cm. What is the length, in centimetres, of the longest path from A to B along the edges? You can travel in any direction, but you may not go over the same edge more than once.



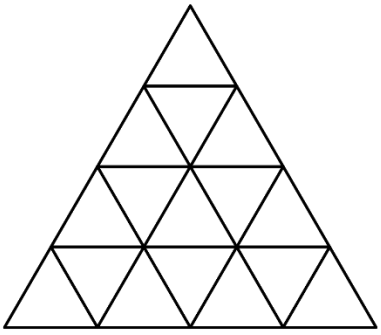
(A) 22 (B) 23 (C) 24 (D) 25 (E) 26

16. The digits 2, 4, 5, 6, 8 and 9 must replace the letters *a* to *f* in the grid below so that the sum of each column and each row equals K. Determine the value of K.

7	*a*	*b*	1
c			*d*
3	*e*	*f*	10

(A) 16 (B) 17 (C) 18 (D) 19 (E) 20

17. The diagram shows a grid of sixteen identical equilateral triangles. How many different rhombuses can be formed from two adjacent small triangles?



(A) 14 (B) 16 (C) 18 (D) 20 (E) 22

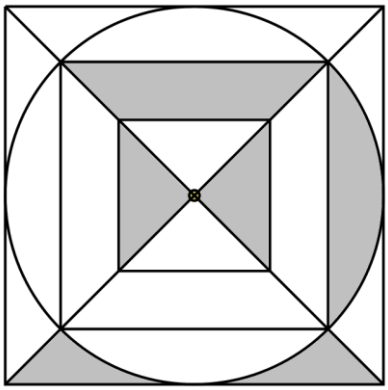
18. At 6 a.m. a clock was showing the correct time. It then lost 5 minutes every hour. The clock stopped two hours ago and is now showing the time 5 p.m. What is the correct time now?

(A) 7:55 p.m. (B) 8:00 p.m. (C) 3:55 p.m. (D) 4:00 p.m. (E) 8:05 p.m.

19. A dealer places a certain number of cards on a table. Some of them are face up and some are face down. The ratio of face up to face down cards is 1:2. When a certain number of cards are then turned over, the ratio of face up to face down cards becomes 2:3. What is the smallest number of cards that could have been on the table?

(A) 3 (B) 5 (C) 8 (D) 15 (E) 30

20. In the diagram the shaded area is 136 cm^2. The largest square has a side length of 20 cm. Determine the perimeter of the smallest square in cm.



(A) 48 (B) 46 (C) 44 (D) 42 (E) 40

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

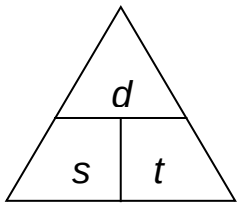
9.2 Surface area of a right prism is: (perimeter of base × h) + (2 × area of base)

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

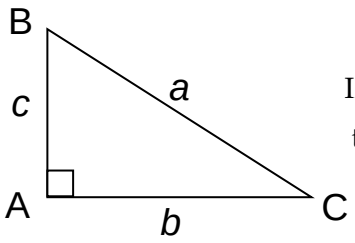


$d = s \times t$

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

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

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

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

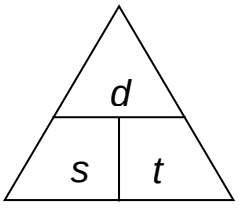
9.2 Buite-oppervlakte van 'n regte prisma is:
(omtrek van basis × h) + (2 × oppervlakte van basis)

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

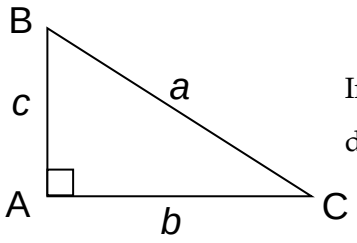


$d = s \times t$

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

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

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)

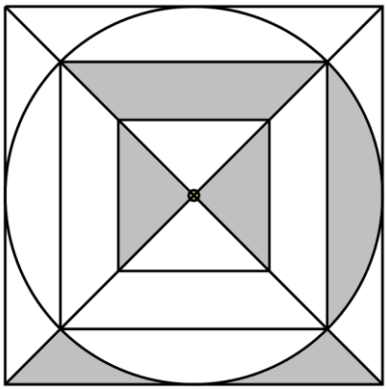
18. Om 6 vm. het ’n horlosie die korrekte tyd aangetoon. Dit het daarna elke uur, 5 minute verloor. Die horlosie het twee ure terug gestop en toon nou die tyd 5 nm. Wat is die korrekte tyd nou?

(A) 7:55 nm. (B) 8:00 nm. (C) 3:55 nm. (D) 4:00 nm. (E) 8:05 nm.

19. ’n Sekere hoeveelheid kaarte word op ’n tafel geplaas. Sommige van hulle is gesig na bo en sommige is gesig na onder. Die verhouding gesig na bo tot gesig na onder kaarte is 1:2. Wanneer ’n sekere hoeveelheid kaarte omgedraai word, word die verhouding gesig na bo tot gesig na onder kaarte 2:3. Wat is die kleinste aantal kaarte wat op die tafel kon gewees het?

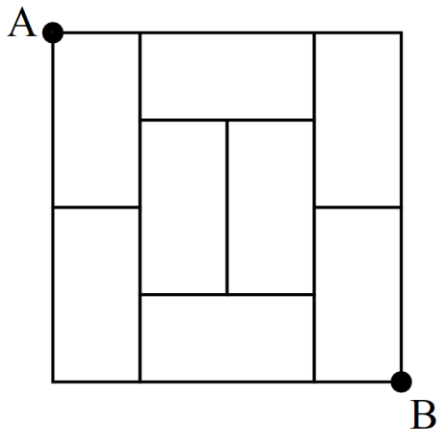
(A) 3 (B) 5 (C) 8 (D) 15 (E) 30

20. Die ingekleurde oppervlakte in die diagram is 136 cm^2. Die grootste vierkant het ’n sylengte van 20 cm. Bereken die omtrek van die kleinste vierkant in cm.



(A) 48 (B) 46 (C) 44 (D) 42 (E) 40

15. Elke reghoek hieronder is 2 cm by 1 cm. Wat is die lengte, in sentimeter, van die langste pad van A na B langs die sye? Jy kan in enige rigting beweeg, maar jy mag nie meer as een keer oor dieselfde sy beweeg nie.



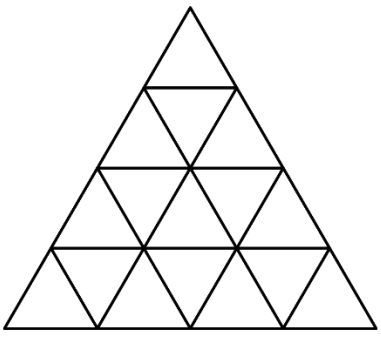
(A) 22 (B) 23 (C) 24 (D) 25 (E) 26

16. Die syfers 2, 4, 5, 6, 8 en 9 moet die letters *a* tot *f* vervang in die rooster hieronder sodat die som van elke kolom en elke ry gelyk is aan K. Bepaal die waarde van K.

7	*a*	*b*	1
c			*d*
3	*e*	*f*	10

(A) 16 (B) 17 (C) 18 (D) 19 (E) 20

17. Die diagram toon ’n rooster van sestien identiese gelyksydige driehoeke. Hoeveel verskillende ruite kan deur twee aangrensende klein driehoeke gevorm word?

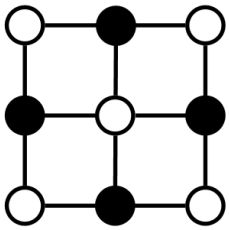


(A) 14 (B) 16 (C) 18 (D) 20 (E) 22

9. Die gemiddeld van vyf verskillende natuurlike getalle is 9. Wat is die grootste moontlike waarde van enige een van hierdie getalle?

(A) 35 (B) 36 (C) 38 (D) 40 (E) 41

10. ’n Vlieg land op een van die nege sirkels en beweeg dan een keer op ’n pad na ’n aangrensende sirkel. Wat is die waarskynlikheid dat dit op ’n swart sirkel sal eindig?



(A) $\frac{4}{9}$ (B) $\frac{5}{9}$ (C) $\frac{4}{5}$ (D) $\frac{1}{5}$ (E) $\frac{1}{9}$

11. Hoeveel 3-syfer getalle is deelbaar deur al drie die getalle 9, 10 en 12?

(A) 2 (B) 3 (C) 5 (D) 6 (E) 7

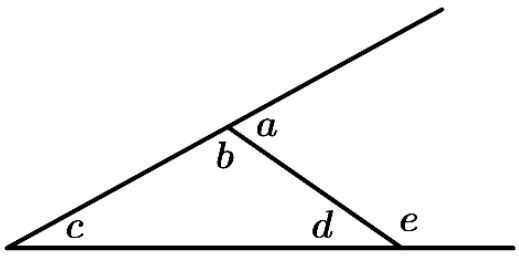
12. Die diagonaal van ’n reghoek is $\sqrt{41}$ cm en sy oppervlakte is 20 cm^2. Bepaal die omtrek van die reghoek in cm.

(A) 15 (B) 16 (C) 17 (D) 18 (E) 19

13. ’n Sak bevat R100, R50, R20 en R10 note. Daar is 10 van elke noot. Jy steek jou hand in die sak en haal ’n noot uit. As jy dit bly doen totdat jy vier note van dieselfde waarde het, wat is die grootste bedrag geld wat jy kan hê?

(A) R640 (B) R630 (C) R620 (D) R610 (E) R600

14. Die diagram toon ’n driehoek met twee sye wat verleng is. Watter een van die volgende stellings is NIE waar NIE?



(A) $a > d$ (B) $c = a - d$ (C) $a + b + c > 180°$

(D) $b < e$ (E) $a + e < 180°$

1. $\frac{2020}{202} =$

(A) 0 (B) 2 (C) 5 (D) 8 (E) 10

2. Hoeveel sekondes is daar in 20 minute?

(A) 1200 (B) 1140 (C) 1080 (D) 1020 (E) 960

3. $\sqrt{2 \times 10 \times 2 \times 10} =$

(A) 10 (B) 20 (C) 30 (D) 40 (E) 50

4. ’n Trein is geskeduleer om die stasie teen 20:20 te verlaat. Die reis neem 20 minute en die trein vertrek 20 minute laat. Teen watter tyd sal dit sy bestemming bereik?

(A) 19:00 (B) 20:00 (C) 21:00 (D) 22:00 (E) 23:00

5. Elke treë wat ’n eend gee is 20 cm. Hoeveel treë moet die eend gee om 20 m te stap?

(A) 20 (B) 40 (C) 60 (D) 80 (E) 100

6. Watter een van die volgende is NIE in waarde gelyk aan die ander NIE?

(A) $2^0 + 2^0$ (B) $2+0+2\times0$ (C) $\sqrt{2+0+2-0}$

(D) $\frac{2+0}{2-0}$ (E) $\sqrt{2^{0+2-0}}$

7. Wat is $\frac{1}{4}$ van $\frac{1}{5}$ van 2020?

(A) 93 (B) 95 (C) 97 (D) 99 (E) 101

8. Die woord OLYMPIADS word oor ’n horisontale lyn gereflekteer. Hoeveel van die nege letters sal na die refleksie dieselfde lyk?

(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

OLD MUTUAL
SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION

2020 EERSTE RONDTE
JUNIOR AFDELING: GRAAD 9

12 Maart 2020 **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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TEL: (012) 392-9372 E-pos: info@samf.ac.za

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