SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2019 FIRST ROUND
JUNIOR SECTION: GRADE 8

12 March 2019 **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. $\dfrac{20+19}{20-19}$ =

(A) 0 (B) 1 (C) 2 (D) 29 (E) 39

2. $\sqrt{2\times 0+1\times 9}$ =

(A) 0 (B) 1 (C) 3 (D) 4 (E) 5

3. A printer prints 7 pages in 10 seconds. At the same rate, how many pages can it print in half a minute?

(A) 14 (B) 20 (C) 21 (D) 28 (E) 30

4. Which one of the following is an odd number?

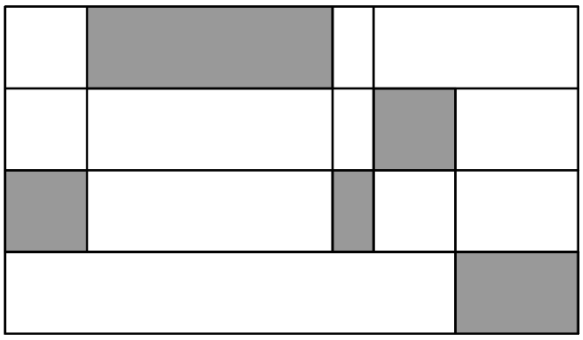
(A) $201-9$ (B) $2+0+1+9$ (C) $20\div(1+9)$

(D) 20×19 (E) $2+0+1\times 9$

5. $\dfrac{2019}{20+19}$ is closest to

(A) 20 (B) 30 (C) 40 (D) 50 (E) 60

6. The diagram shows a large rectangle that has been subdivided into various smaller rectangles. All vertical lines are parallel. All horizontal lines are parallel and evenly spaced. What fraction of the diagram is shaded?

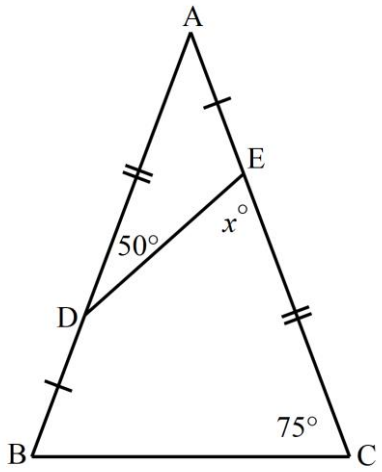


(A) $\dfrac{1}{3}$ (B) $\dfrac{1}{4}$ (C) $\dfrac{1}{5}$ (D) $\dfrac{2}{5}$ (E) $\dfrac{2}{7}$

7. A positive whole number is multiplied by 5 and then by 4. The final answer could be

(A) 2012 (B) 2014 (C) 2016 (D) 2018 (E) 2020

8. ABC is a triangle. The value of x is



(A) 55 (B) 60 (C) 65 (D) 70 (E) 80

9. In the sequence of shapes below, figure 3 has 6 dots inside the shape. How many dots are there inside figure 10?

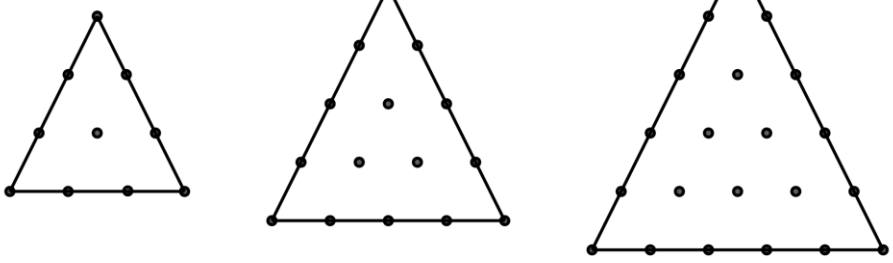


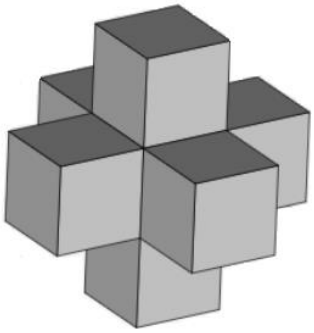
FIGURE 1 FIGURE 2 FIGURE 3

(A) 57 (B) 56 (C) 55 (D) 54 (E) 53

10. How many whole numbers from 1 to 400 are perfect squares?

(A) 18 (B) 19 (C) 20 (D) 21 (E) 22

11. 7 cubes are glued together, face to face, as shown below. The volume of the solid formed in this way is 56 cm^3. The surface area of the solid in cm^2 is



(A) 116 (B) 120 (C) 124 (D) 128 (E) 132

12. In this multiplication magic square the product of the three numbers in each row, column and diagonal is 1. Determine the value of $r + s$.

p	q	r
s	1	t
u	4	$\frac{1}{8}$

(A) $\frac{1}{2}$ (B) $\frac{3}{4}$ (C) $\frac{5}{4}$ (D) $\frac{9}{16}$ (E) $\frac{33}{16}$

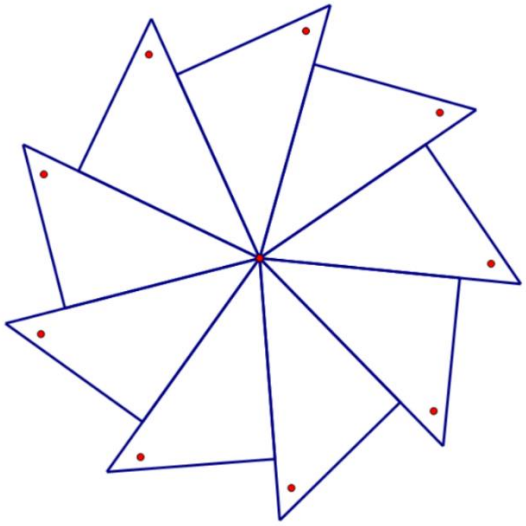
13. Determine $x + y$ if $(x - 20)^2 + (y + 19)^2 = 0$.

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

14. If $\frac{1}{a}+\frac{1}{a}=1$, $\frac{1}{b}+\frac{1}{b}+\frac{1}{b}=1$ and $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=1$, find the value of c.

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

15. The picture shows identical right-angled triangles. Triangles next to one another are connected along their edges. What is the angle at each of the tips that are marked with dots?

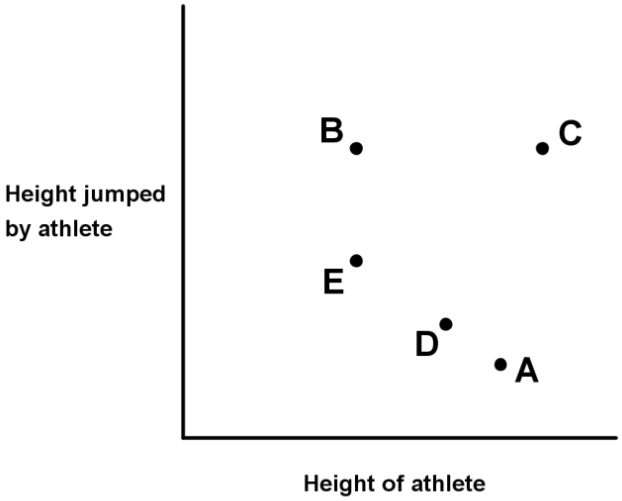


(A) 30° (B) 35° (C) 45° (D) 50° (E) 60°

16. Zebras have 4 legs, bees have 6 legs and spiders have 8 legs. Hagrid has twice as many zebras as spiders, and three times as many bees as spiders. The number of legs adds up to 102. How many spiders does he have?

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

17. The heights of athletes A, B, C, D and E versus their heights jumped are shown on the graph. Each athlete's score is determined by the formula: $\frac{\text{Height jumped by athlete}}{\text{Height of athlete}}$ Which athlete has the highest score?



(A) A (B) B (C) C (D) D (E) E

18. Donald lies on Mondays, Wednesdays and Fridays, and tells the truth on every other day. Herman lies on Tuesdays, Fridays and Saturdays, and tells the truth on every other day. One day Donald said "*Today is Wednesday*" and Herman responded "*Yes, it is*". Which day of the week was it?

(A) Monday (B) Wednesday (C) Thursday (D) Friday (E) Sunday

19. In the sum shown, different letters represent different digits.
Determine the value of $A + B + C$.

$$\begin{array}{r} \quad A \\ \quad A \\ +\ B\ B \\ \hline C\ C\ C \end{array}$$

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

20. 50 songs are played once each in a random order. Waheeda likes 44 of these songs. What is the minimum number of songs that need to be played to be sure that there would be 3 consecutive songs that Waheeda likes?

(A) 21 (B) 19 (C) 18 (D) 13 (E) 7

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

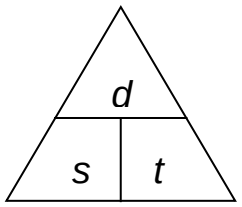
9.2 Surface area of a right prism is: (perimeter of base × h) + (2 × area of base)

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

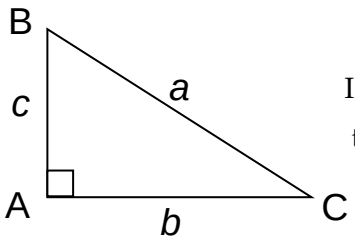


$d = s \times t$

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

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

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

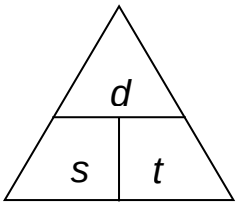
9.2 Buite-oppervlakte van 'n regte prisma is:
(omtrek van basis × h) + (2 × oppervlakte van basis)

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

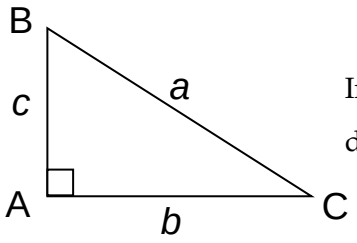


$d = s \times t$

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

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

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. Donald lieg op Maandae, Woensdae en Vrydae en vertel die waarheid op elke ander dag. Herman lieg op Dinsdae, Vrydae en Saterdae en vertel die waarheid op elke ander dag. Een dag sê Donald "*Vandag is Woensdag*" en Herman antwoord "*Ja, dit is*". Watter dag van die week was dit?

(A) Maandag (B) Woensdag (C) Donderdag (D) Vrydag (E) Sondag

19. In die som aangetoon verteenwoordig verskillende letters verskillende syfers. Bepaal die waarde van $A + B + C$.

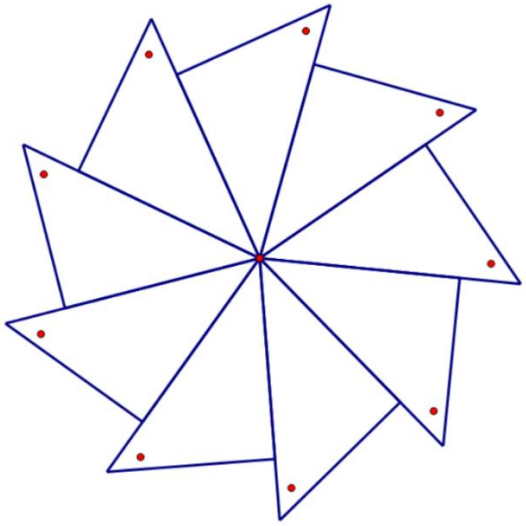
$$\begin{array}{r} \quad A \\ \quad A \\ +\ B\ B \\ \hline C\ C\ C \end{array}$$

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

20. 50 Liedjies word elkeen een keer in willekeurige orde gespeel. Waheeda hou van 44 van hierdie liedjies. Wat is die minimum aantal liedjies wat gespeel moet word om te verseker dat daar 3 opeenvolgende liedjies sal wees waarvan Waheeda hou?

(A) 21 (B) 19 (C) 18 (D) 13 (E) 7

15. Die figuur toon identiese reghoekige driehoeke. Driehoeke langs mekaar is aangrensend deur middel van hulle sye. Wat is die hoek by elk van die punte wat met kolletjies gemerk is?



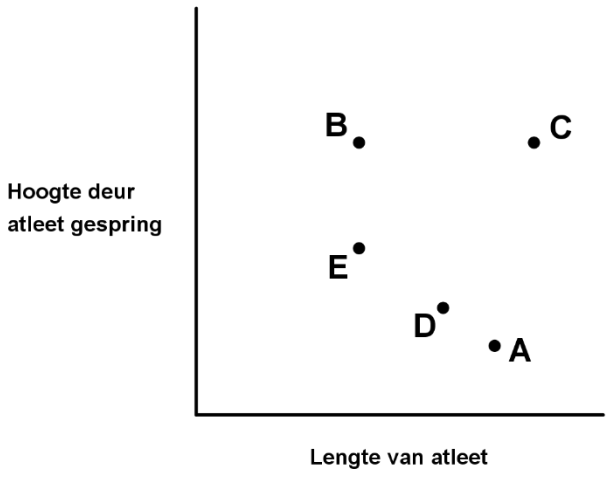
(A) 30° (B) 35° (C) 45° (D) 50° (E) 60°

16. Sebras het 4 bene, bye het 6 bene en spinnekoppe het 8 bene. Hagrid het twee keer soveel sebras as spinnekoppe en drie keer meer bye as spinnekoppe. Die totale aantal bene is 102. Hoeveel spinnekoppe het hy?

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

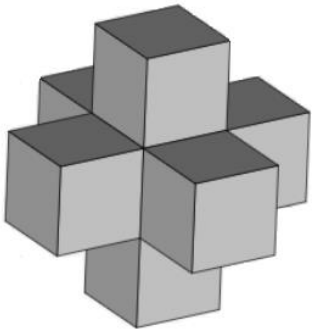
17. Die lengtes van atlete A, B, C, D en E teenoor hulle hoogtes gespring word op die grafiek aangetoon. Elke atleet se punt word bepaal deur die formule: $\frac{\text{Hoogte deur atleet gespring}}{\text{Lengte van atleet}}$

Watter atleet het die hoogste punt?



(A) A (B) B (C) C (D) D (E) E

11. 7 Kubusse is kant-teen-kant aanmekaar vasgegom soos hieronder getoon. Die volume van die vaste liggaam op hierdie manier gevorm is 56 cm^3. Die buite-oppervlakte van die vaste liggaam, in cm^2, is



(A) 116 (B) 120 (C) 124 (D) 128 (E) 132

12. In hierdie vermenigvuldiging-wondervierkant is die produk van die drie getalle in elke ry, kolom en diagonaal gelyk aan 1. Bepaal die waarde van $r + s$.

p	q	r
s	1	t
u	4	$\frac{1}{8}$

(A) $\frac{1}{2}$ (B) $\frac{3}{4}$ (C) $\frac{5}{4}$ (D) $\frac{9}{16}$ (E) $\frac{33}{16}$

13. Bepaal $x + y$ as $(x - 20)^2 + (y + 19)^2 = 0$.

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

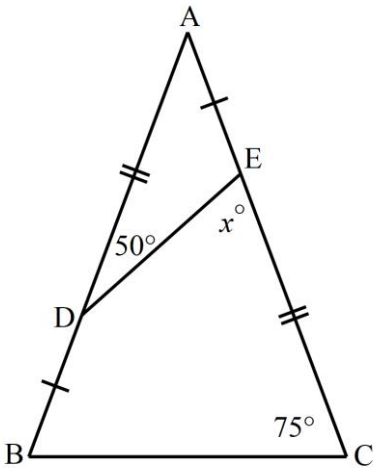
14. As $\frac{1}{a}+\frac{1}{a}=1$, $\frac{1}{b}+\frac{1}{b}+\frac{1}{b}=1$ en $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=1$, bepaal die waarde van c.

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

7. ’n Positiewe heelgetal word eers met 5 en daarna met 4 vermenigvuldig. Die finale antwoord kan die volgende wees:

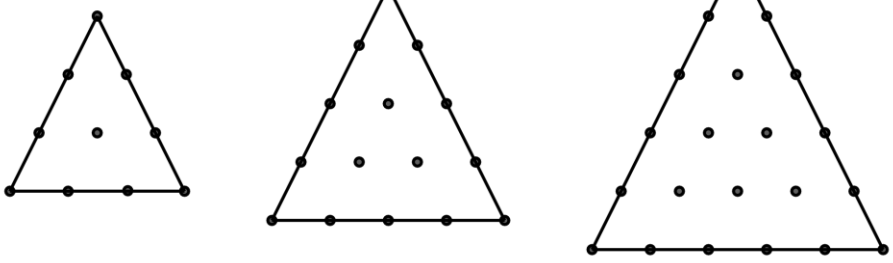
(A) 2012 (B) 2014 (C) 2016 (D) 2018 (E) 2020

8. ABC is ’n driehoek. Die waarde van x is



(A) 55 (B) 60 (C) 65 (D) 70 (E) 80

9. In die ry van vorms hieronder is daar 6 kolletjies binne-in figuur 3. Hoeveel kolletjies is daar binne-in figuur 10?



FIGUUR 1 FIGUUR 2 FIGUUR 3

(A) 57 (B) 56 (C) 55 (D) 54 (E) 53

10. Hoeveel heelgetalle van 1 tot 400 is volkome vierkante?

(A) 18 (B) 19 (C) 20 (D) 21 (E) 22

1. $\dfrac{20+19}{20-19}$ =

(A) 0 (B) 1 (C) 2 (D) 29 (E) 39

2. $\sqrt{2\times 0+1\times 9}$ =

(A) 0 (B) 1 (C) 3 (D) 4 (E) 5

3. ’n Drukker druk 7 bladsye in 10 sekondes. Hoeveel bladsye kan dit, teen dieselfde tempo, in ’n halwe minuut druk?

(A) 14 (B) 20 (C) 21 (D) 28 (E) 30

4. Watter een van die volgende is ’n onewe getal?

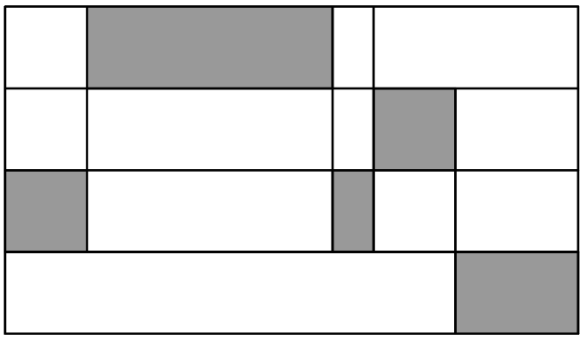
(A) $201-9$ (B) $2+0+1+9$ (C) $20\div(1+9)$

(D) 20×19 (E) $2+0+1\times 9$

5. $\dfrac{2019}{20+19}$ is naaste aan

(A) 20 (B) 30 (C) 40 (D) 50 (E) 60

6. Die diagram toon ’n groot reghoek wat verdeel is in verskeie kleiner reghoeke. Alle vertikale lyne is parallel. Alle horisontale lyne is parallel en ewe ver uit mekaar. Watter breukdeel van die diagram is ingekleur?



(A) $\dfrac{1}{3}$ (B) $\dfrac{1}{4}$ (C) $\dfrac{1}{5}$ (D) $\dfrac{2}{5}$ (E) $\dfrac{2}{7}$

SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION

2019 EERSTE RONDTE
JUNIOR AFDELING: GRAAD 8

12 Maart 2019 **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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