

# SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the  
**SOUTH AFRICAN MATHEMATICS FOUNDATION**

## 2019 FIRST ROUND JUNIOR SECTION: GRADE 9

**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](http://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.  $\frac{20+19}{20-19} =$

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

2.  $\sqrt[3]{(2+0+1)\times 9} =$

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

3. A printer prints 19 pages in 20 seconds. At the same rate, how many pages can it print in one minute?

- (A) 38                      (B) 40                      (C) 57                      (D) 60                      (E) 76

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

- (A)  $201-9$     (B)  $2+0+1+9$     (C)  $20\div(1+9)$   
(D)  $20\times 19$     (E)  $2+0+1\times 9$

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

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

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

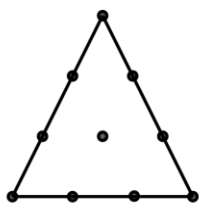


FIGURE 1

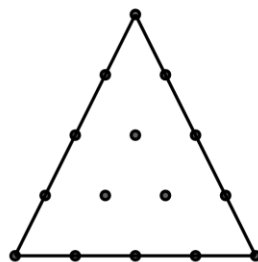


FIGURE 2

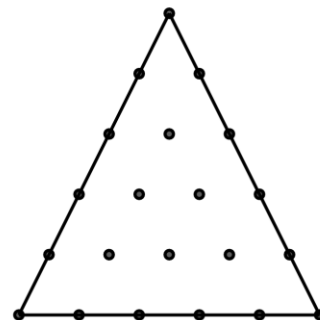
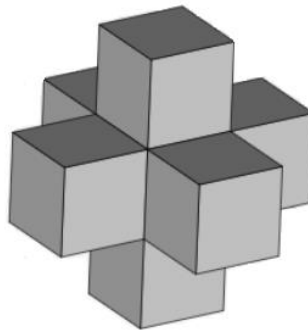


FIGURE 3

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

7. A triangle has sides of length 6 cm, 8 cm and 10 cm. What is the area of this triangle in  $\text{cm}^2$ ?
- (A) 16                      (B) 20                      (C) 24                      (D) 28                      (E) 32

8. 7 cubes are glued together, face to face, as shown below. The volume of the solid formed in this way is  $56 \text{ cm}^3$ . The surface area of the solid in  $\text{cm}^2$  is

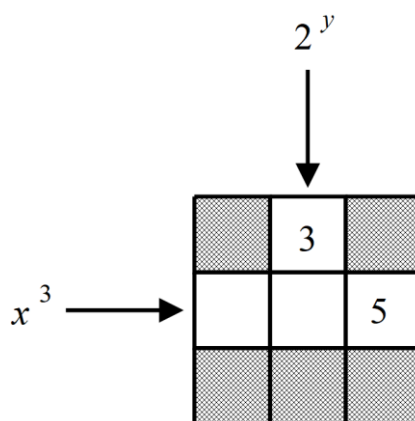


- (A) 116                      (B) 120                      (C) 124                      (D) 128                      (E) 132
9. If  $\frac{1}{a} + \frac{1}{a} = 1$ ,  $\frac{1}{b} + \frac{1}{b} + \frac{1}{b} = 1$  and  $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 1$ , find the value of  $c$ .
- (A) 2                      (B) 3                      (C) 4                      (D) 5                      (E) 6
10. P% of all natural numbers from 1 to 400 are perfect squares. Determine the value of P.
- (A) 1                      (B) 2                      (C) 3                      (D) 4                      (E) 5
11. Ayanda and Mbali share a packet of sweets in the ratio 7:5. Ayanda gets 14 more sweets than Mbali. The number of sweets in the packet is
- (A) 84                      (B) 24                      (C) 56                      (D) 49                      (E) 26

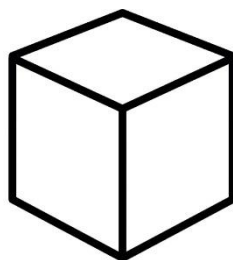
12. In this multiplication magic square the product of the three numbers in each row, column and diagonal is 1. Determine the value of  $r + s$ .

|     |     |               |
|-----|-----|---------------|
| $p$ | $q$ | $r$           |
| $s$ | 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. A cross-number puzzle is given below with the clues as shown.  $2^y$  is a 2-digit number starting with the digit 3.  $x^3$  is a 3-digit number ending with the digit 5. Determine the value of  $x + y$ .

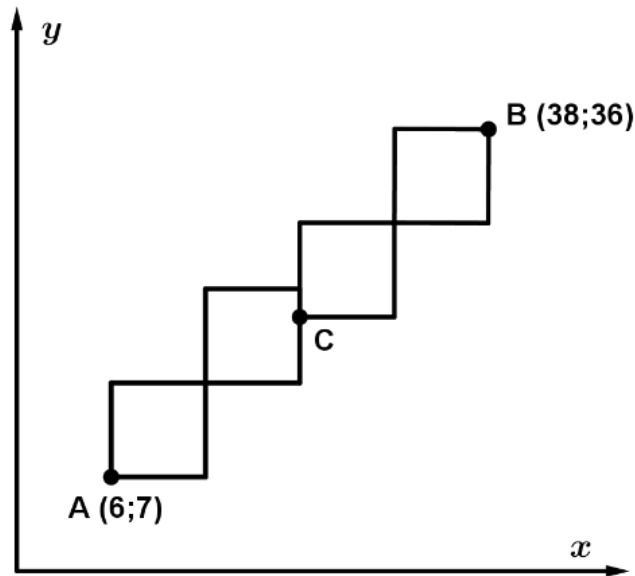


- (A) 10      (B) 9      (C) 8      (D) 7      (E) 6
14. The diagram shows a cube with side length 1 cm. If two vertices are chosen at random, determine the probability of the distance between the vertices being exactly 1 cm.

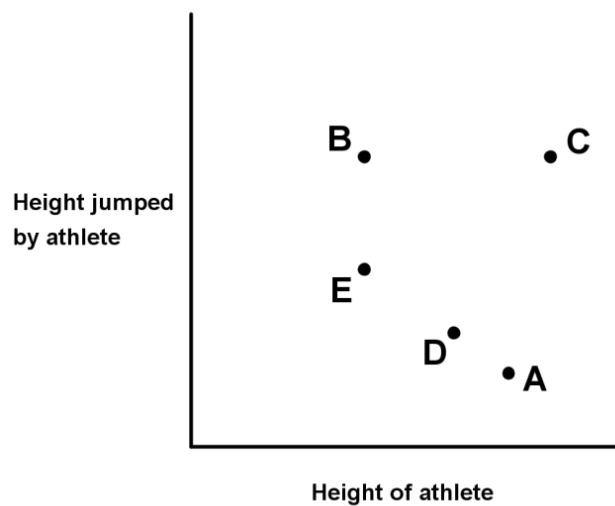


- (A)  $\frac{2}{7}$       (B)  $\frac{3}{7}$       (C)  $\frac{4}{7}$       (D)  $\frac{5}{7}$       (E)  $\frac{6}{7}$

15. A pattern is made from four identical squares. The sides of the squares are parallel to the axes. Point A has coordinates (6;7). Point B has coordinates (38;36). Point C is marked on the diagram. Determine the coordinates of point C.



- (A) (22;17) (B) (22;18) (C) (22;19) (D) (22;20) (E) (22;21)
16. 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

17. 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
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  $A + B + C$ .

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

- (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) 5                      (B) 13                      (C) 18                      (D) 21                      (E) 24

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## Formula and Information Sheet

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

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**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:

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

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

$$a \times a \times a \times a \times \dots \times a = a^n \quad (n \text{ factors of } a)$$

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

---

**3.2** Factorial notation:

$$2! = 2 \times 1 = 2$$

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

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

$$1 \times 2 \times 3 \times \dots \times n = n!$$

---

**3.3**  $1 + 2 + 3 + 4 \dots + n = \frac{1}{2}n(n+1)$

---

**4** Area of a

---

**4.1** triangle is:  $\frac{1}{2} \times (\text{base} \times \text{height}) = \frac{1}{2}(b.h)$

---

**4.2** rectangle is:  $\text{length} \times \text{width} = lw$   
 $\text{length} \times \text{breadth} = lb$

---

**4.3** square is:  $\text{side} \times \text{side} = s^2$

---

**4.4** rhombus is:  $\frac{1}{2} \times (\text{product of diagonals})$

---

**4.5** trapezium is:  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

---

**4.6** circle is:  $\pi r^2$  ( $r$  = 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  $\times$  perpendicular height  
or area of base  $\times$  perpendicular height

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

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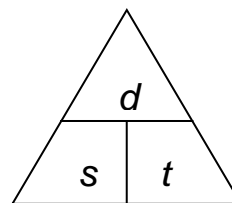
10. Sum of the interior angles of a polygon is:  $180^\circ(n - 2)$  [ $n = \text{number of sides}$ ]

---

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

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

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



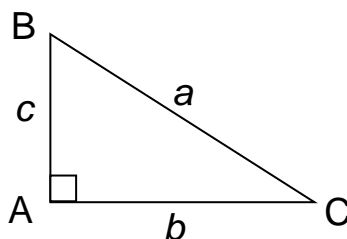
$$d = s \times t$$

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

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

---

12. Pythagoras:



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

---

13. Conversions:

$$1 \text{ cm}^3 = 1 \text{ ml} ;$$

$$1000 \text{ cm}^3 = 1 \ell$$

$$1000 \text{ m} = 1 \text{ km} ;$$

$$1000 \text{ g} = 1 \text{ kg} ;$$

$$100 \text{ cm} = 1 \text{ m}$$

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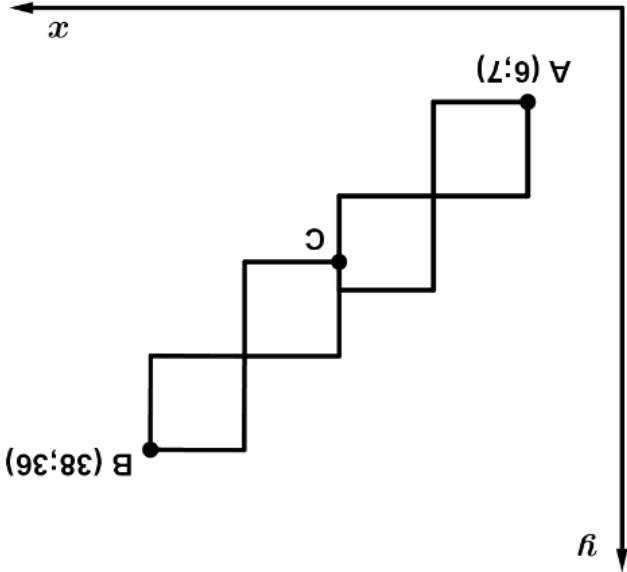


## Formule- en Inligtingblad

|     |  |  |
|-----|--|--|
| 1.1 | Die natuurlike getalle is:   | 1; 2; 3; 4; 5; ...   |
| 1.2 | Die teelgetalle 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 | Eksponeensiële notasie:  | $2 \times 2 \times 2 \times 2 \times 2 = 2^5$<br>$3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$<br>$a \times a \times a \times a \times a \times \dots \times a = a^n$ ( $n$ faktore van $a$ )<br>$(a$ is die grondtal en $n$ is die indeks (eksponent)) |
| 3.2 | Fakultei notasie:  | $2! = 2 \times 1 = 2$<br>$3! = 3 \times 2 \times 1 = 6$<br>$4! = 4 \times 3 \times 2 \times 1 = 24$<br>$1 \times 2 \times 3 \times \dots \times n = n!$  |
| 3.3 | $1 + 2 + 3 + 4 \dots + n = n(n + 1)/2$                                     |  |
| 4   | Oppervlakte van 'n:  |  |
| 4.1 | driehoek is:   | $\frac{1}{2} \times (\text{basis} \times \text{loodregte hoogte}) = \frac{1}{2}(b \cdot h)$  |
| 4.2 | reghoek is:  | lengte $\times$ breedte = $lb$   |
| 4.3 | vierkant is:   | $s_y \times s_y = s^2$   |
| 4.4 | ruit (rombus) is:  | $\frac{1}{2}$ (produk van die diagonale)   |
| 4.5 | trapesium is:  | $\frac{1}{2}$ (som van ewewydige sye) $\times$ hoogte  |
| 4.6 | sirkel is:   | $\pi r^2$ ( $r$ = radius)  |

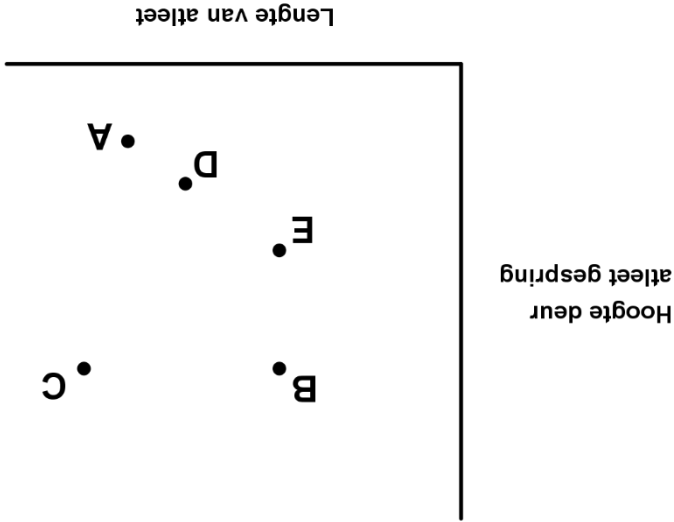
17. Sebras het 4 bene, bye het 6 bene en spinnkoppe het 8 bene. Hagrid het twee keer soveel sebras as spinnkoppe en drie keer meer bye as spinnkoppe. Die totale aantal bene is 102. Hoeveel spinnkoppe het hy?
- (A) 2 (B) 3 (C) 4 (D) 5 (E) 6
18. Donald lieg op Maandae, Woensdae en Vrydae en vertel die 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  $A + B + C$ .
- $$\begin{array}{r}
 A \\
 A \\
 + \quad B \\
 C \quad C \quad C \\
 \hline
 C \quad C \quad C
 \end{array}$$
- (A) 16 (B) 17 (C) 18 (D) 19 (E) 20
20. 50 Liedjies word elkeen een keer in willekeurige orde gespeel. Waheda 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 Waheda hou?
- (A) 5 (B) 13 (C) 18 (D) 21 (E) 24

15. 'n Patroon word gevorm met vier identiese vierkante. Die sye van die vierkante is parallel aan die asse. Punt A het koördinate (6;7). Punt B het koördinate (38;36). Punt C is gemerk op die diagram. Bepaal die koördinate van punt C.



- (A) (22;17) (B) (22;18) (C) (22;19) (D) (22;20) (E) (22;21)

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



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

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  $r + s$ .

|               |     |     |
|---------------|-----|-----|
| $n$           | $s$ | $d$ |
| $\frac{1}{8}$ | $l$ | $r$ |

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

13. 'n Getalle blokraaisel word hieronder gegee met die leidrade soos aangetoon.  $2^y$  is 'n 2-syfer getal wat met die syfer 3 begin.  $x^3$  is 'n 3-syfer getal wat met die syfer 5 eindig. Bepaal die waarde van  $x + y$ .

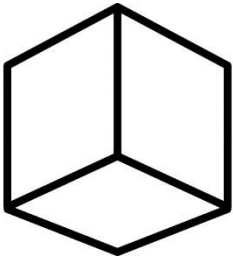
|   |   |  |
|---|---|--|
|   |   |  |
| 5 |   |  |
|   | 3 |  |

$2^y$

$x^3$

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

14. Die diagram toon 'n kubus met sylengte 1 cm. As twee hoek willekeurig gekies word, bepaal die waarskynlikheid dat die afstand tussen die hoek presies 1 cm is.

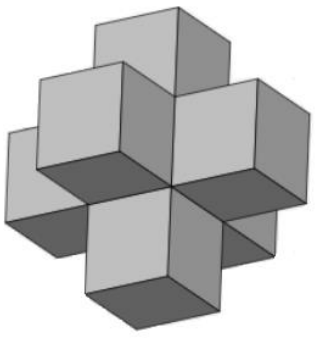


- (A)  $\frac{7}{2}$  (B)  $\frac{7}{3}$  (C)  $\frac{7}{4}$  (D)  $\frac{7}{5}$  (E)  $\frac{7}{6}$

7. 'n Driehoek het sye met lengtes 6 cm, 8 cm en 10 cm. Wat is die oppervlakte van hierdie driehoek in  $\text{cm}^2$ ?

- (A) 16 (B) 20 (C) 24 (D) 28 (E) 32

8. 7 Kubusse is kant-teen-kant aanmekaar vasgegom soos hieronder getoon. Die volume van die vaste liggaam op hierdie manier gevorm is  $56 \text{ cm}^3$ . Die buite-oppervlakte van die vaste liggaam, in  $\text{cm}^2$ , is



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

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

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

10. P% van alle natuurlike getalle van 1 tot 400 is perfekte vierkante. Bepaal die waarde van P.

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

11. Ayanda en Mbali deel 'n pakkie lekkers in die verhouding 7:5. Ayanda kry 14 meer lekkers as Mbali. Die getal lekkers in die pakkie is

- (A) 84 (B) 24 (C) 56 (D) 49 (E) 26

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

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

2.  $\sqrt[3]{(2+0+1) \times 9} =$

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

3. 'n Drukker druk 19 bladsye in 20 sekondes. Hoeveel bladsye kan dit druk teen dieselfde tempo in een minuut?

- (A) 38 (B) 40 (C) 57 (D) 60 (E) 76

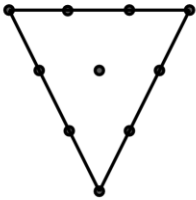
4. Watter een van die volgende is 'n onewe getal?

- (A)  $201 - 9$  (B)  $2 + 0 + 1 + 9$  (C)  $20 \div (1 + 9)$   
 (D)  $20 \times 19$  (E)  $2 + 0 + 1 \times 9$

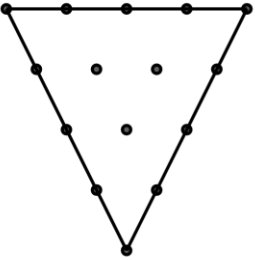
5.  $\frac{2019}{20+19}$  is naaste aan

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

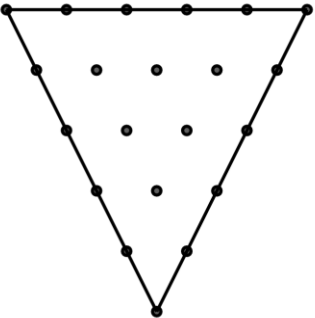
6. In die ry van vorms hieronder het figuur 3 binne-in 6 kolletjies. Hoeveel kolletjies is daar binne-in figuur 10?



FIGUUR 1

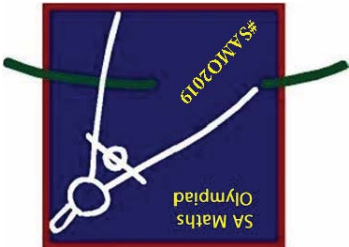


FIGUUR 2



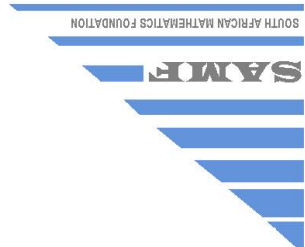
FIGUUR 3

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



# SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die  
SOUTH AFRICAN MATHEMATICS FOUNDATION



## 2019 EERSTE RONDTE JUNIOR AFDELING: GRAAD 9

12 Maart 2019 Tyd: 60 minute Aantal vrae: 20

### Instruksies

1. Hierdie is 'n veelvuldige-keuse vraestel. Na elke vraag is vyf antwoorde, genummer A, B, C, D en E. Net een van hulle is reg.
2. Punttoekennings:
  - 2.1. Elke korrekte antwoord tel 5 punte.
  - 2.2. Daar is geen penaliserings 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](http://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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