

# SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the  
**SOUTH AFRICAN MATHEMATICS FOUNDATION**

## 2018 FIRST ROUND JUNIOR SECTION: GRADE 9

**14 March 2018      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. Determine the value of  $\sqrt[3]{20-1+8}$ .

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

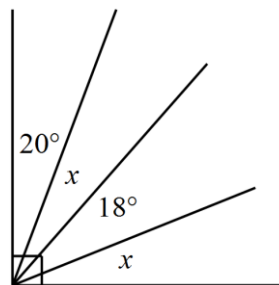
2. Which one of the following is closest to  $\frac{2018}{8102}$ ?

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

3. Two numbers have a sum of 20. If one of the numbers is  $-18$ , determine the other number.

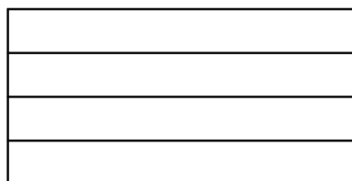
- (A) 32                      (B) 34                      (C) 36                      (D) 38                      (E) 42

4. Determine the value of  $x$  in degrees.



- (A)  $25^\circ$                       (B)  $26^\circ$                       (C)  $27^\circ$                       (D)  $28^\circ$                       (E)  $29^\circ$

5. What is the total number of rectangles in the diagram?

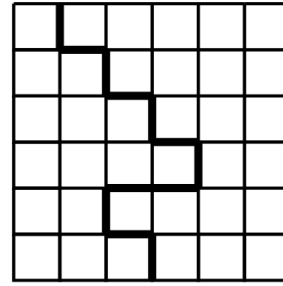


- (A) 5                      (B) 6                      (C) 8                      (D) 10                      (E) 12

6. Andrew thinks of a whole number, doubles it, adds 1 and squares the result. If he ends up with 81, what was the number he thought of?

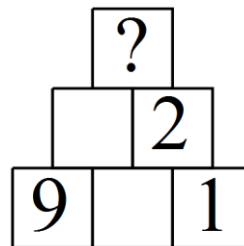
- (A) 8                      (B) 7                      (C) 6                      (D) 5                      (E) 4

7. The diagram shows a 6 by 6 grid of squares divided into two parts by a bold line. If each of the small squares has side length 1 cm, find the difference between the perimeters of the two parts (in cm).



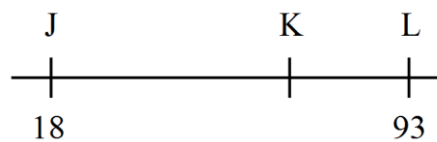
(A) 1                      (B) 2                      (C) 3                      (D) 4                      (E) 5

8. In the following number pyramid, each number is the average of the two numbers immediately below it. What number will be at the top of the pyramid?



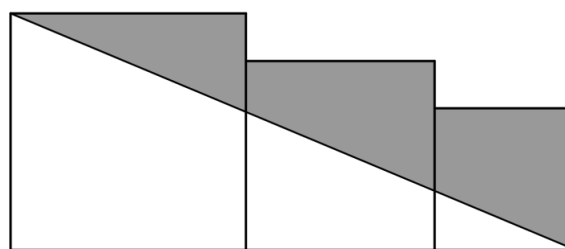
(A) 4                      (B) 5                      (C) 6                      (D) 7                      (E) 8

9. If K is a point two thirds ( $\frac{2}{3}$ ) of the way from J to L on the number line, what is the number at K?



(A) 50                      (B) 56                      (C) 62                      (D) 66                      (E) 68

10. Three squares, with side lengths 10 cm, 8 cm and 6 cm respectively, are placed side-by-side. What is the area of the shaded region?



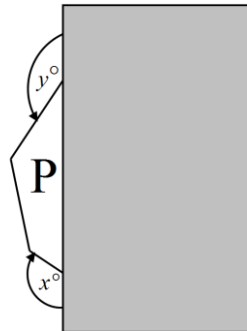
(A)  $80 \text{ cm}^2$       (B)  $90 \text{ cm}^2$       (C)  $100 \text{ cm}^2$       (D)  $120 \text{ cm}^2$       (E)  $140 \text{ cm}^2$

11. What number should replace the letter N to make the following statement true?

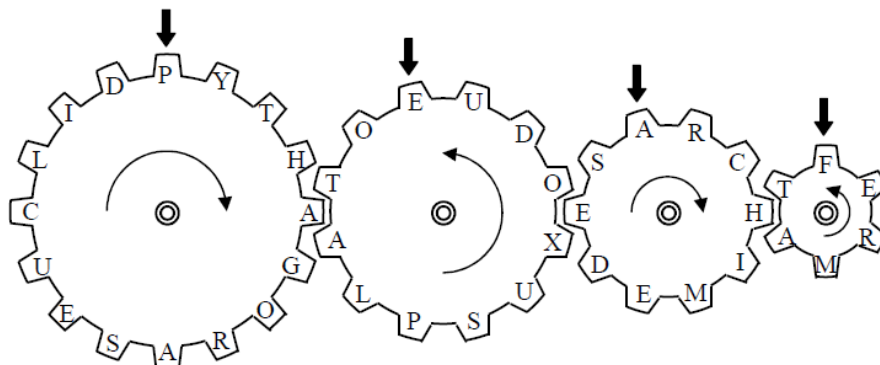
$$14 \times 14 \times 14 = 7 \times N \times 7$$

- (A) 7                      (B) 14                      (C) 28                      (D) 42                      (E) 56
12. From 2, 0, 1 and 8, two different digits are chosen. What is the probability that their sum is even?
- (A) 30%                      (B) 40%                      (C) 50%                      (D) 60%                      (E) 70%
13. A group of sisters and their mother are at a family gathering. Each sister gives one gift to her mother and one gift to each of her sisters. Which one of the following is a possible value for the total number of gifts given?
- (A) 17                      (B) 32                      (C) 49                      (D) 66                      (E) 80
14. Did you know:  $4! = 4 \times 3 \times 2 \times 1$  and  $5! = 5 \times 4 \times 3 \times 2 \times 1$   
If  $6! = p! \times q!$  then determine the value of  $p + q$  if both  $p$  and  $q$  are greater than 1.
- (A) 8                      (B) 9                      (C) 10                      (D) 11                      (E) 12

15. P is a polygon which has equal sides and equal angles. It is partially hidden by a magazine which is covering it.
- If  $x + y = 270^\circ$ , how many sides does P have?

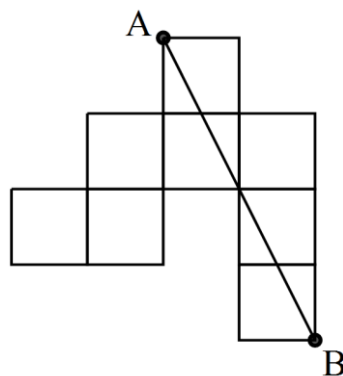


- (A) 5                      (B) 6                      (C) 7                      (D) 8                      (E) 9
16. The diagram shows four interlocking gears with 16, 12, 10 and 6 teeth respectively. When the largest gear has completed 5 full revolutions in a clockwise direction, determine the four letters in the positions indicated by the black arrows.



- (A) PLAR      (B) PDMT      (C) POAM      (D) PPER      (E) PXCR

17. The figure shown is made up of 8 identical squares. If  $AB = 15$  cm, find the area of the complete figure in  $\text{cm}^2$ .

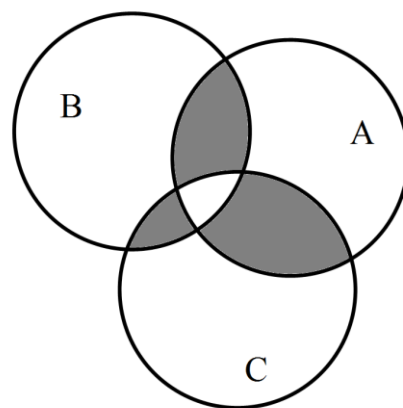


- (A) 95      (B) 90      (C) 85      (D) 80      (E) 75

18. Each of the circles shown has an area of  $120 \text{ cm}^2$ .

$\frac{1}{4}$  of the area of circle A is shaded,  
 $\frac{1}{5}$  of the area of circle B is shaded, and  
 $\frac{1}{6}$  of the area of circle C is shaded.

What is the sum of the shaded areas in  $\text{cm}^2$ ?

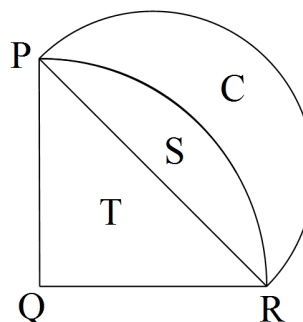


- (A) 33      (B) 34      (C) 35      (D) 36      (E) 37

19. A group of 12 friends go to a theme park. 8 of the friends go on the Swings, 10 on the Slide and 9 on the Big Wheel. What is the minimum number of these friends who went on all 3 rides?

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

20.  $PQ = QR = 1$  which are the radii of a quarter circle. A semi-circle is drawn on  $PR$ .  $T$ ,  $S$  and  $C$  represent the areas of the Triangle, Segment and Crescent. Calculate the ratio  $\frac{T}{C}$ .



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



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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; ...

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**1.3** The integers are: ...; -4; -3; -2; -1; 0; 1; 2; 3; 4; 5; ...

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

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**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))

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**3.2** Factorial notation:

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

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

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

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

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

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**4** Area of a

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**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)

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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:  $\pi r^2 h$

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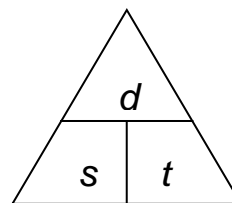
10. Sum of the interior angles of a polygon is:  $180^\circ(n - 2)$  [ $n = \text{number of sides}$ ]

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

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

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



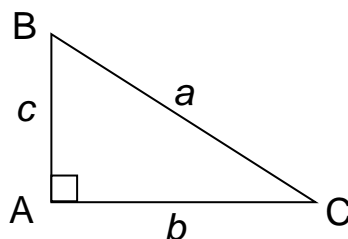
$$d = s \times t$$

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

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

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12. Pythagoras:



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

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13. Conversions:

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

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

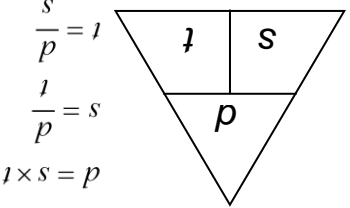
$$1000 \text{ m} = 1 \text{ km} ;$$

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

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

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5.	Buite-oppervlakte van 'n	
5.1	regte prisma is:	$2lb + 2lh + 2bh$ (h = hoogte)
5.2	steer is:	$4\pi r^2$
6	Omtek van 'n:	
6.1	reghoek is:	$2l \times \text{lengte} + 2 \times \text{breedte}$ $2l + 2b$
6.2	vierkant is:	$4s$
7.	Omtek 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 dwarsnit $\times$ hoogte
	or	
9.2	Buite-oppervlakte van 'n regte prisma is:	(omtek van basis $\times$ h) + (2 $\times$ oppervlakte van basis)
10.	Som van die binnehoeke van 'n veelhoek is:	$180^\circ(n - 2)$ [n = aantal sye]
11.	Afstand is:	spoed $\times$ tyd (d = s $\times$ t)
	=	afstand $\div$ tyd (s = $\frac{d}{t}$ )
	=	afstand $\div$ spoed (t = $\frac{s}{d}$ )
	Tyd	=
12.	Pythagoras:	 <p>Indien <math>\triangle ABC</math> 'n reghoekige driehoek is, dan sal <math>a^2 = b^2 + c^2</math></p>
13.	Omskakelings:	$1000 \text{ m} = 1 \text{ km};$ $1 \text{ cm}^3 = 1 \text{ ml};$ $1000 \text{ cm}^3 = 1 \text{ l}$ $1000 \text{ g} = 1 \text{ kg};$ $100 \text{ cm} = 1 \text{ m}$

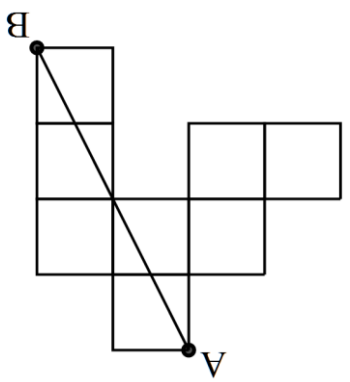
## Formule- en Inligtingblad

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:	$2 \times 2 \times 2 \times 2 \times 2 = 2^5$ $3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$ $a \times a \times a \times a \times a \times \dots \times a = a^n$ ( $n$ faktore van $a$ ) $(a$ is die grondtal en $n$ is die indeks (eksponent))
3.2	Fakultei notasie:	$2! = 2 \times 1 = 2$ $3! = 3 \times 2 \times 1 = 6$ $4! = 4 \times 3 \times 2 \times 1 = 24$ $1 \times 2 \times 3 \times \dots \times n = n!$
3.3		$1 + 2 + 3 + 4 \dots + n = n(n + 1)/2$
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.

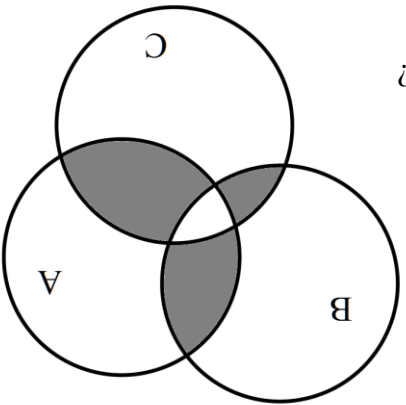
Die figuur bestaan uit 8 identiese vierkante. Indien  $AB = 15$  cm, bepaal die oppervlakte van die figuur in  $\text{cm}^2$ .



- (A) 95 (B) 90 (C) 85 (D) 80 (E) 75

18.

Elkeen van die sirkels het 'n oppervlakte van  $120 \text{ cm}^2$ .  $\frac{1}{4}$  van die oppervlakte van sirkel A is ingekleur,  $\frac{1}{5}$  van die oppervlakte van sirkel B is ingekleur, en  $\frac{1}{6}$  van die oppervlakte van sirkel C is ingekleur. Wat is die som van die ingekleurde oppervlakktes in  $\text{cm}^2$ ?



- (A) 33 (B) 34 (C) 35 (D) 36 (E) 37

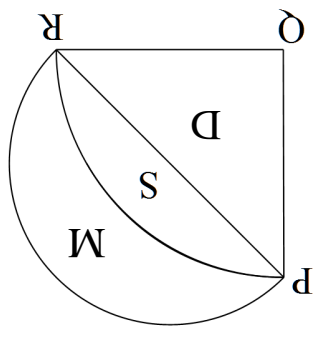
19.

12 vriende gaan na 'n pretpark. 8 van die vriende gaan ry op die Swaaië, 10 ry op die Waterwurm en 9 ry op die Mallemeeule. Wat is die minimum getal vriende wat al drie ritte gery het?

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

20.

$PQ = QR = 1$  wat die radii van 'n kwart sirkel is. 'n Semi-sirkel word geteken op PR. D, S en M verteenwoordig die oppervlakktes van die Driehoek, Segment en sekelMaan. Bepaal die verhouding  $\frac{D}{M}$ .



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

11. Watter getal moet die letter N vervang om die volgende stelling waar te maak?  
 $14 \times 14 \times 14 = 7 \times N \times 7$

- (A) 7 (B) 14 (C) 28 (D) 42 (E) 56

12. Twee verskillende syfers word vanuit die syfers 2, 0, 1 en 8 geneem. Wat is die waarskynlikheid dat hul som ewe is?

- (A) 30% (B) 40% (C) 50% (D) 60% (E) 70%

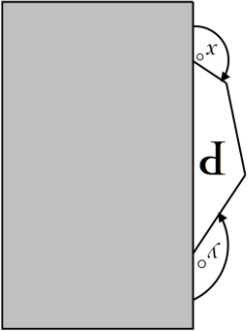
13. 'n Groep susters en hul ma is by 'n familie byeenkoms. Elke suster gee 'n geskenk aan haar ma sowel as aan elkeen van haar susters. Watter een van die volgende is 'n moontlike waarde vir die totale aantal geskenke wat uitgegee word?

- (A) 17 (B) 32 (C) 49 (D) 66 (E) 80

14. Het jy geweet:  $4! = 4 \times 3 \times 2 \times 1$  en  $5! = 5 \times 4 \times 3 \times 2 \times 1$ . Indien  $6! = p! \times q!$ , bepaal  $p + q$  indien beide  $p$  en  $q$  groter as 1 is.

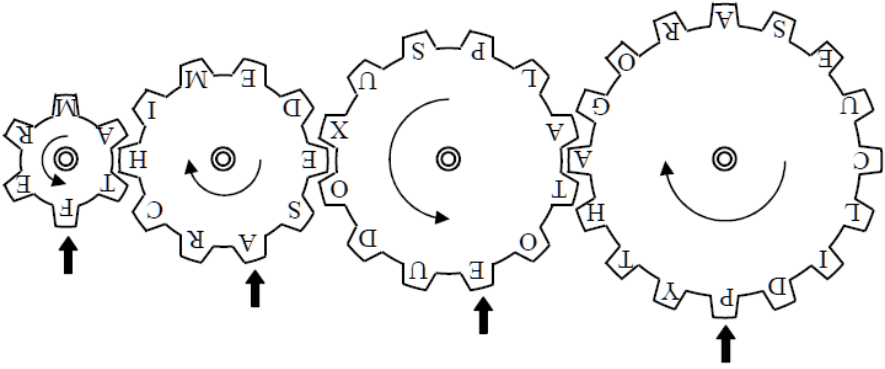
- (A) 8 (B) 9 (C) 10 (D) 11 (E) 12

15. P is 'n veelhoek met gelyke sye sowel as gelyke hoeke. Dit word gedeeltelik weggesteek deur 'n tydskrif. Indien  $x + y = 270^\circ$ , hoeveel sye het P?



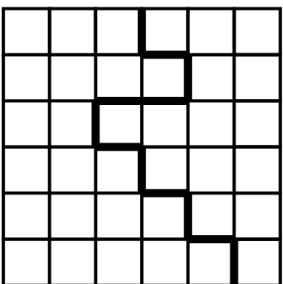
- (A) 5 (B) 6 (C) 7 (D) 8 (E) 9

16. Die diagram toon vier ratte wat inkam, met onderskeidelik 16, 12, 10 en 6 tande. Wanneer die grootste rat 5 volle omwentelings in 'n kloksgewyse rigting gemaak het, bepaal die vier letters in die posities wat met swart pyle aangedui word.



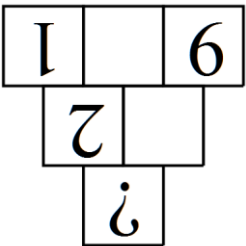
- (A) PLAR (B) PDMT (C) POAM (D) PPER (E) PXCR

Die diagram toon 'n 6 by 6 rooster wat uit kleiner vierkante bestaan. Die rooster word in twee dele deur 'n donker lyn verdeel. Indien elke klein vierkant sylengtes van 1 cm het, bepaal die verskil in die omtrek van die twee dele (in cm).



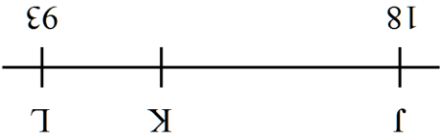
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

8. In die getalpiramide hiernaas, is elke getal die gemiddeld van die twee getalle onmiddellik onder dit. Wat is die getal heelbo in die piramide?



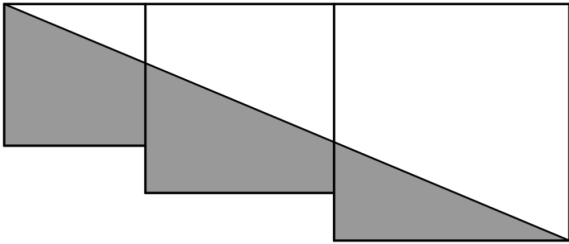
- (A) 4 (B) 5 (C) 6 (D) 7 (E) 8

9. Indien 'n punt K twee derdes ( $\frac{3}{2}$ ) van die afstand vanaf J na L op die getallelyn lê, wat is die getal wat deur K voorgestel word?

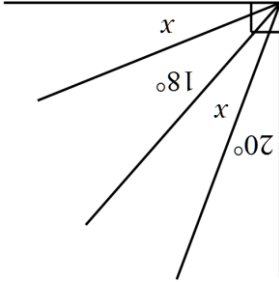
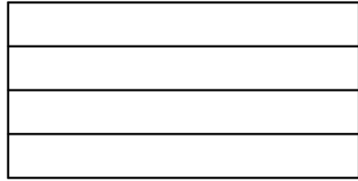


- (A) 50 (B) 56 (C) 62 (D) 66 (E) 68

10. Drie vierkante, met sylengtes 10 cm, 8 cm en 6 cm onderskeidelik, word sy aan sy gepak. Wat is die oppervlakte van die ingekleurde gedeelte?



- (A)  $80 \text{ cm}^2$  (B)  $90 \text{ cm}^2$  (C)  $100 \text{ cm}^2$  (D)  $120 \text{ cm}^2$  (E)  $140 \text{ cm}^2$

1. Bepaal die waarde van  $\sqrt[3]{20-1+8}$ .  
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5
2. Watter een van die volgende is die naaste aan  $\frac{2018}{8102}$ ?  
(A)  $\frac{5}{1}$  (B)  $\frac{4}{1}$  (C)  $\frac{3}{1}$  (D)  $\frac{2}{1}$  (E) 1
3. Die som van twee getalle is 20. Indien een van die getalle  $-18$  is, dan is die ander getal  
(A) 32 (B) 34 (C) 36 (D) 38 (E) 42
4. Bepaal die waarde van  $x$  in grade.  

5. Wat is die totale getal reghoeke in die diagram?  

6. Andrew dink aan 'n heelgetal, hy verdubbel dit, tel 1 by en kwadreer dit. Indien sy finale antwoord 81 is, wat is die getal waaraan hy gedink het?  
(A) 8 (B) 7 (C) 6 (D) 5 (E) 4

# SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die  
SOUTH AFRICAN MATHEMATICS FOUNDATION

## 2018 EERSTE RONDTE JUNIOR AFDELING: GRAAD 9

14 Maart 2018 Tyd: 60 minute Aantal vrae: 20

### Instrukties

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- of 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 omblaaï voordat dit aan jou gesê word nie.  
Turn the booklet over for the English paper.*

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