

SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2018 FIRST ROUND JUNIOR SECTION: GRADE 8

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

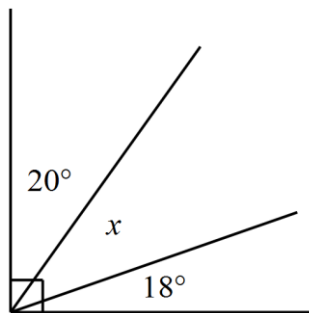
***Do not turn the page until you are told to do so.
Draai die boekie om vir die Afrikaanse vraestel.***

PRIVATE BAG X173, PRETORIA, 0001
TEL: (012) 392-9372 Email: info@samf.ac.za

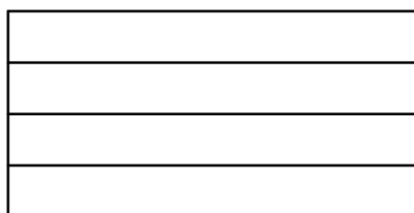
Organisations involved: AMESA, SA Mathematical Society,
SA Akademie vir Wetenskap en Kuns, ASTEMI



1. Determine the value of $\sqrt{2 \times 0 + 1 + 8}$.
- (A) 3 (B) 4 (C) 5 (D) 6 (E) 7
2. Which one of the following is closest to $\frac{8102}{2018}$?
- (A) 5 (B) 4 (C) 3 (D) 2 (E) 1
3. Two numbers have a sum of 20. If one of the numbers is -18 , determine the other number.
- (A) 30 (B) 32 (C) 34 (D) 36 (E) 38
4. Determine the value of x in degrees.

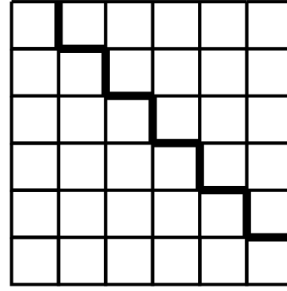


- (A) 50° (B) 52° (C) 55° (D) 62° (E) 65°
5. What is the remainder when 2018 is divided by 6?
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5
6. What is the total number of rectangles in the diagram?



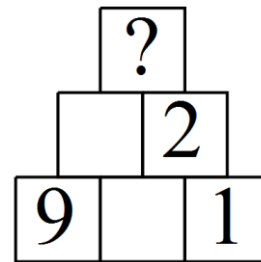
- (A) 5 (B) 6 (C) 8 (D) 10 (E) 12

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).



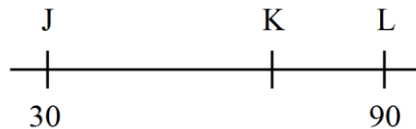
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

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 $\frac{2}{3}$ of the way from J to L on the number line, what is the number at K?



- (A) 50 (B) 56 (C) 62 (D) 70 (E) 80
10. Andrew thinks of a whole number, subtracts 4, squares the result and then adds 1. If he ends up with 10, what was the number he thought of?
- (A) 5 (B) 6 (C) 7 (D) 8 (E) 9

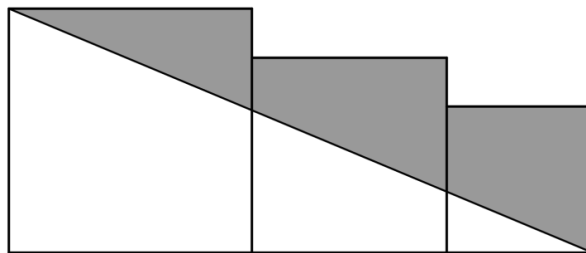
11. What number should replace the letter N to make the following statement true?

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

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

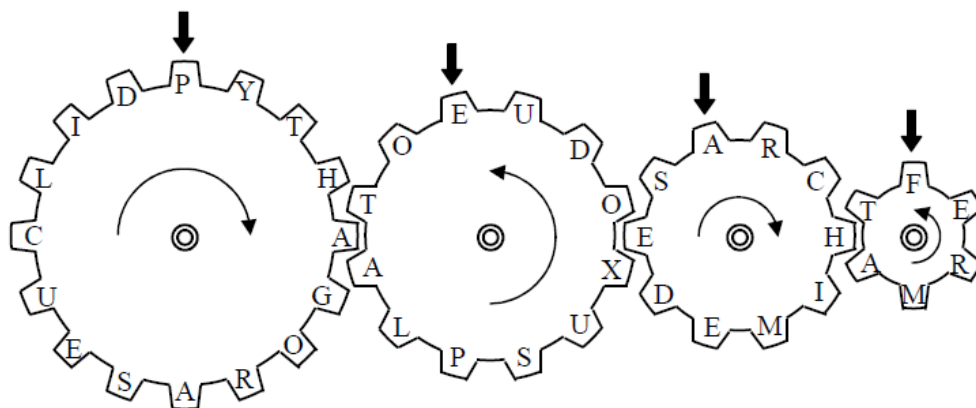
12. A room has 20 seats – some are stools and some are chairs. Each stool has 3 legs and each chair has 4 legs. Altogether there are 68 legs. How many stools are there?
- (A) 6 (B) 10 (C) 12 (D) 14 (E) 16
13. From 2, 0, 1 and 8, two different digits are chosen. What is the probability that their sum is even?
- (A) 30% (B) 40% (C) 50% (D) 60% (E) 70%

14. 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) 60 cm^2 (B) 80 cm^2 (C) 100 cm^2 (D) 120 cm^2 (E) 140 cm^2
15. 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
16. 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
17. A cellphone is on sale for 20% less than its normal price. For paying cash, Joseph is given a further 10% off the sale price. What is the total discount Joseph received?
- (A) 25% (B) 26% (C) 27% (D) 28% (E) 29%

18. 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.

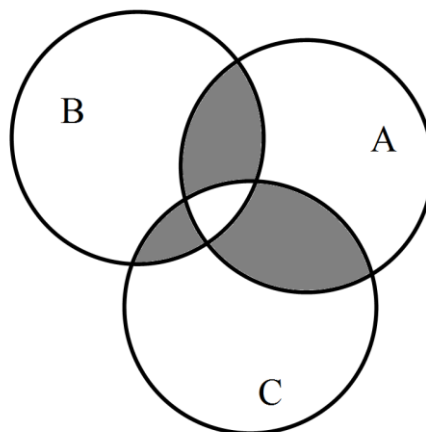


- (A) PLAR (B) PDMT (C) POAM (D) PPER (E) PXCR

19. Each of the circles shown has an area of 120 cm^2 .

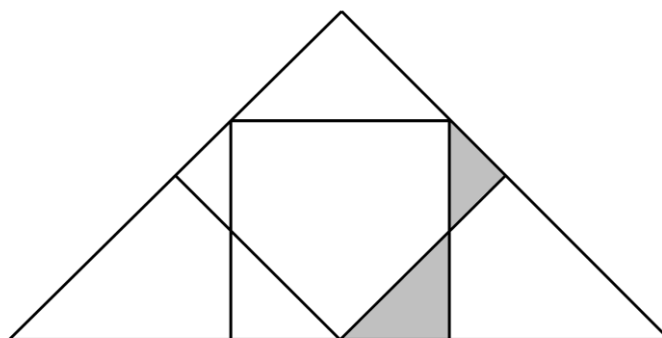
$\frac{1}{4}$ of the area of circle A is shaded,
 $\frac{1}{5}$ of the area of circle B is shaded, and
 $\frac{1}{6}$ of the area of circle C is shaded.

What is the sum of the shaded areas in cm^2 ?



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

20. Two squares are drawn inside a right-angled isosceles triangle. What fraction of the triangle is shaded?



- (A) $\frac{1}{8}$ (B) $\frac{1}{9}$ (C) $\frac{1}{10}$ (D) $\frac{1}{11}$ (E) $\frac{1}{12}$

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:

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

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

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

(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: 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 \times perpendicular height
or area of base \times perpendicular height

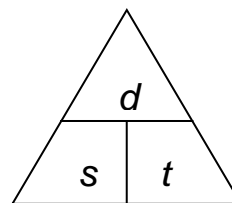
9.2 Surface area of a right prism is: (perimeter of base $\times h$) + ($2 \times$ area of base)

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

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

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

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

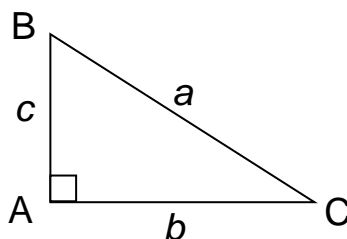


$$d = s \times t$$

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

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

12. Pythagoras:



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

13. Conversions:

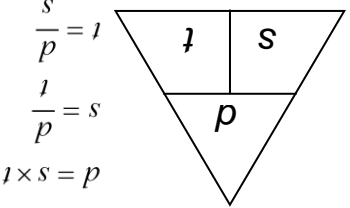
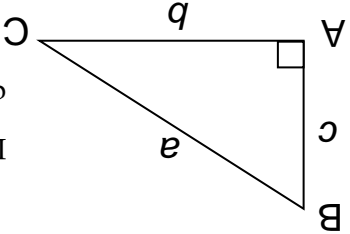
$$1 \text{ cm}^3 = 1 \text{ ml} ;$$

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

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

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

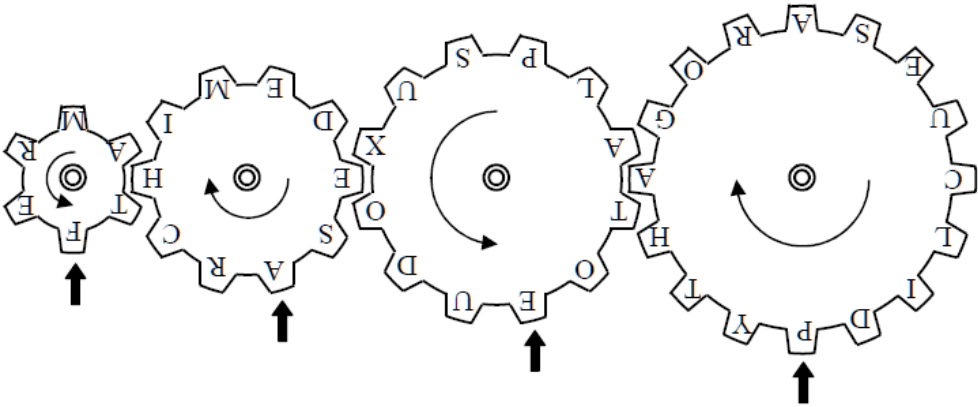
$$100 \text{ cm} = 1 \text{ m}$$

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)
	Spood =	afstand \div tyd (s = $\frac{d}{t}$)
	Tyd =	afstand \div spoed (t = $\frac{s}{d}$)
		 $d = s \times t$ $s = \frac{d}{t}$ $t = \frac{s}{d}$
12.	Pythagoras:	 <p>Indien $\triangle ABC$ 'n reghoekige driehoek is, dan sal $a^2 = b^2 + c^2$</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 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	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:	πr^2 (r = radius)

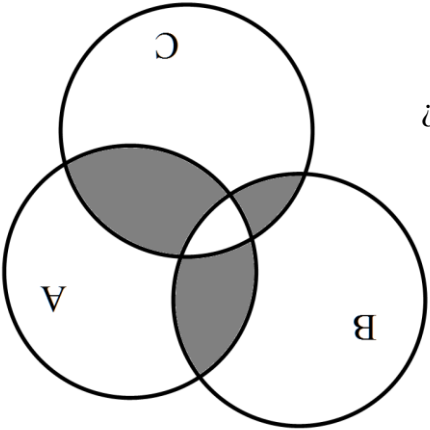
18. Die diagram toon vier ratte wat inkam, met onderskeidelik 16, 12, 10 en 6 tande. Wanneer die grootste rat 5 volle omwentelings, in 'n kloksgewyse rigting, gemaak het, bepaal die vier letters in die posies wat met swart pyle aangedui word.



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

19.

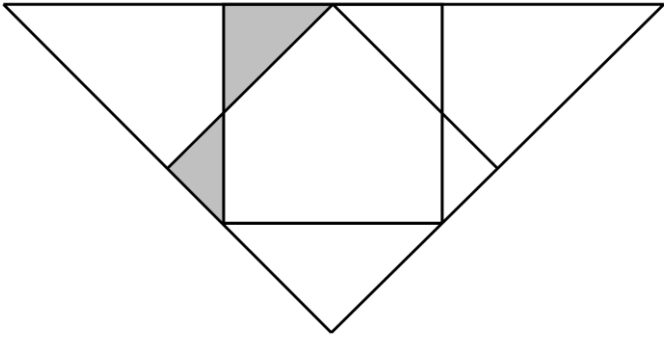
Elkeen van die sirkels het 'n oppervlakte van 120 cm^2 .
 $\frac{1}{4}$ van die oppervlakte van sirkel A is ingekleur,
 $\frac{1}{5}$ van die oppervlakte van sirkel B is ingekleur, en
 $\frac{1}{6}$ van die oppervlakte van sirkel C is ingekleur.
 Wat is die som van die ingekleurde oppervlakte in cm^2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



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

20.

Twee vierkante word binne 'n reghoekige, gelykbenige driehoek, getrek, soos aangetoon. Wat is die breukdeel van die driehoek wat ingekleur is?



- (A) $\frac{8}{1}$ (B) $\frac{9}{1}$ (C) $\frac{10}{1}$ (D) $\frac{11}{1}$ (E) $\frac{1}{12}$

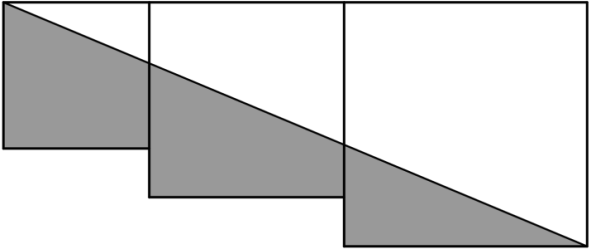
12. 'n Kamer het 20 sitplekke – sommige is stoele en ander is banke. Elke stoel het 3 pote en elke bank het 4 pote. In totaal is daar 68 pote. Hoeveel stoele is daar?

- (A) 6 (B) 10 (C) 12 (D) 14 (E) 16

13. 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%

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



- (A) 60 cm^2 (B) 80 cm^2 (C) 100 cm^2 (D) 120 cm^2 (E) 140 cm^2

15. '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 geskenke wat uitgegee word?

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

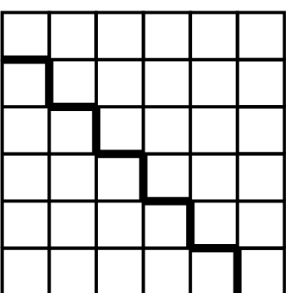
16. Het jy geweet: $4! = 4 \times 3 \times 2 \times 1$ en $5! = 5 \times 4 \times 3 \times 2 \times 1$. Indien $6! = p! \times q!$, bepaal $p + q$ indien beide p en q groter as 1 is.

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

17. 'n Selfoon is op afslag vir 20% minder as sy normale prys. Omdat Joseph met kontant koop, ontvang hy 'n verdere 10% afslag op die afgemerkde prys. Wat is die totale afslag wat Joseph gekry het?

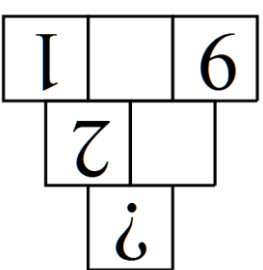
- (A) 25% (B) 26% (C) 27% (D) 28% (E) 29%

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



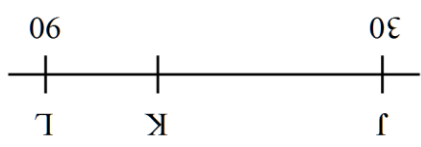
- (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

8. In die getalpiramide hieraas, 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 K 'n punt $\frac{3}{2}$ des 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) 70 (E) 80

10. Andrew dink aan 'n heelgetal, trek 4 af, kwadreer die resultaat en tel 1 by, Indien sy finale antwoord 10 is, wat is die getal waaraan hy gedink het?

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

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

1. Bepaal die waarde van $\sqrt{2 \times 0 + 1 + 8}$.

- (A) 3 (B) 4 (C) 5 (D) 6 (E) 7

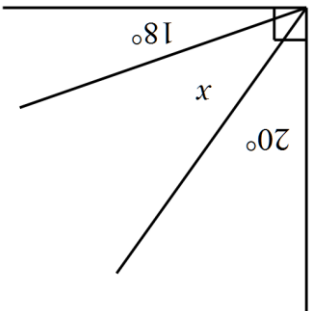
2. Watter een van die volgende is die naaste aan $\frac{8102}{2018}$?

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

3. Twee getalle tel op na 20. Indien een van die getalle -18 is, dan is die ander getal

- (A) 30 (B) 32 (C) 34 (D) 36 (E) 38

4. Bepaal die waarde van x in grade.

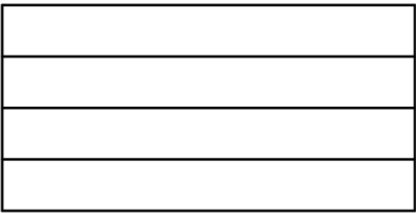


- (A) 50° (B) 52° (C) 55° (D) 62° (E) 65°

5. Wat is die res as 2018 deur 6 gedeel word?

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

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

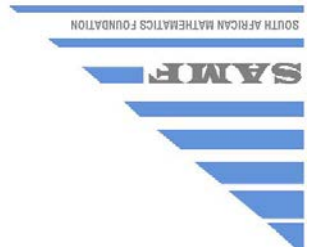


- (A) 5 (B) 6 (C) 8 (D) 10 (E) 12



SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION



2018 EERSTE RONDTE JUNIOR AFDELING: GRAAD 8

14 Maart 2018 Tyd: 60 minute Aantal vrae: 20

Instrukties

1. Hierdie is 'n veelvuldige-keuse vraag. Na elke vraag is vyf antwoorde, genummer A, B, C, D en E. Net een van hulle is reg.
2. Punttoekenning:
 - 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 linaal en nitveër 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 toetsigheuer 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.**

PRIVAATSAK X173, PRETORIA, 0001
TEL: (012) 392-9372 E-pos: info@samf.ac.za

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



LIBERTY