SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the
SOUTH AFRICAN MATHEMATICS FOUNDATION

2017 FIRST ROUND
JUNIOR SECTION: GRADE 8

15 March 2017 **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. Ravi leaves on a car trip at 10h15. If the trip takes 2 hours 10 minutes, at what time does he reach his destination?

(A) 12h15 (B) 12h25 (C) 12h45 (D) 12h55 (E) 13h00

2. The value of $\dfrac{2017-1017}{500}$ is

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

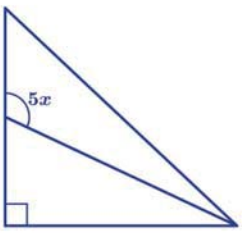
3. What fraction of the diagram is shaded?

(A) $\frac{1}{16}$ (B) $\frac{1}{8}$ (C) $\frac{1}{4}$ (D) $\frac{1}{3}$ (E) $\frac{1}{2}$

4. A certain tree grows $\frac{1}{2}$ m per year for 20 years and then $\frac{1}{3}$ m every year after that. If the tree is now 13 m high, how old is the tree in years?

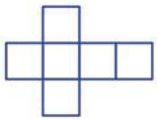
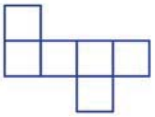
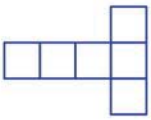
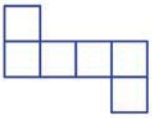
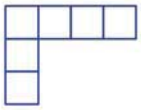
(A) 23 (B) 25 (C) 27 (D) 29 (E) 32

5. Which one of the following could be a value of x in degrees?



(A) 10 (B) 15 (C) 20 (D) 40 (E) 50

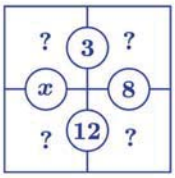
6. Which of the following figures cannot be folded into a closed cube?

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

7. $\frac{21}{20} + 7$ expressed as a decimal is

(A) 7,05 (B) 8,01 (C) 8,03 (D) 8,05 (E) 8,07

8. The four small squares shown each contain a number. The sum of any two adjacent squares is shown in the circle between them.



The value of x is

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

9. Every third visitor to a show is given a pen while every fifth visitor is given a bag. Of the first 200 visitors, how many receive a pen and a bag?

(A) 13 (B) 14 (C) 15 (D) 16 (E) 17

10. Consider the following repeating pattern:

Which of the following figures would be the 2017th shape in the sequence?

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

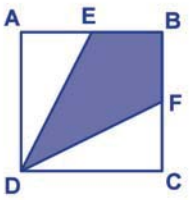
11. What percentage of natural numbers from 1 to 200 inclusive are perfect squares?

(A) 2% (B) 3% (C) 5% (D) 7% (E) 11%

12. Five sweets cost R12 more than one sweet. What is the cost of one sweet?

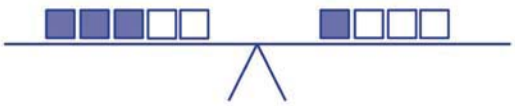
(A) R1 (B) R2 (C) R3 (D) R4 (E) R5

13. ABCD is a square of side 4, and E and F are the midpoints of sides AB and BC respectively. What is the area of the quadrilateral EBFD?



(A) 8 (B) 10 (C) 12 (D) 14 (E) 16

14. The diagram shows a perfectly balanced scale:



Which of the following could be placed on the right-hand side of the scale shown below to make it perfectly balanced?

(A) 
(B) 
(C) 

(D) 
(E) 

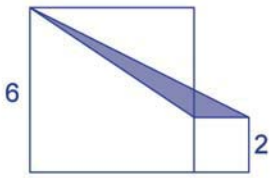
15. Xavier chooses a whole number between 1 and 100. Yandi and Zanele both try to guess Xavier's number. Yandi guesses 53 and Zanele guesses 71. If both Yandi's and Zanele's guess is off by no more than 10, which one of the following numbers could have been Xavier's number?

(A) 60 (B) 62 (C) 64 (D) 66 (E) 68

16. If $\sqrt{xy} = 4$ and $\sqrt[3]{xyz} = 2$ then find the value of z.

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

17. The diagram shows two squares with sides 6 cm and 2 cm. Find the area of the shaded triangle.



(A) 4 cm^2 (B) 6 cm^2 (C) 8 cm^2 (D) 10 cm^2 (E) 15 cm^2

18. PQRST is a 5-digit number. Each group of three adjacent digits has a sum of 12. Each group of four adjacent digits has a sum of 17. What is the sum of all five digits?

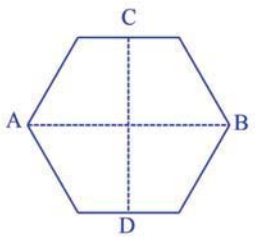
(A) 22 (B) 25 (C) 30 (D) 37 (E) 45

19. Andy and Betty both choose a whole number from 1 to 10. In how many ways can Andy's number be bigger than Betty's?

(A) 45 (B) 50 (C) 55 (D) 60 (E) 65

20. A and B are opposite vertices of regular hexagon. C and D are midpoints of opposite sides such that CD is perpendicular to AB.
The area of the hexagon is 123 cm^2.

What is the area of the rectangle with length AB and width CD?



(A) 112 cm^2 (B) 130 cm^2 (C) 142 cm^2 (D) 164 cm^2 (E) 180 cm^2

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:

$2! = 2 \times 1 = 2$

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

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

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

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

4 Area of a

4.1	triangle is:	$\frac{1}{2} \times$ (base × height) = $\frac{1}{2}(b.h)$
4.2	rectangle is:	length × width = lw length × breadth = lb
4.3	square is:	side × 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) × 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

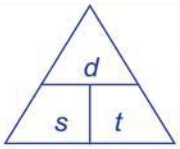
9.2 Surface area of a right prism is: (perimeter of base × h) + (2 × area of base)

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

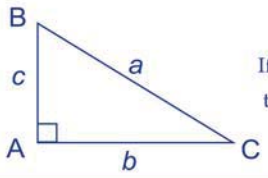


$d = s \times t$

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

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

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

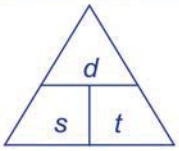
9.2 Buite-oppervlakte van 'n regte prisma is:
(omtrek van basis × h) + (2 × oppervlakte van basis)

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

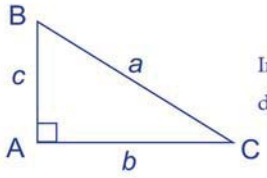


$d = s \times t$

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

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

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)

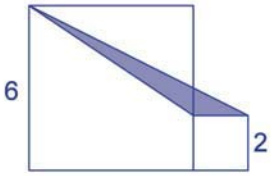
4.5 trapesium is: $\frac{1}{2}$(som van ewewydige sye)$\times$ hoogte

4.6 sirkel is: πr^2 (r = radius)

16. Indien $\sqrt{xy} = 4$ en $\sqrt[3]{xyz} = 2$ bepaal die waarde van z.

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

17. Die diagram toon twee vierkante met sylengtes 6 cm en 2 cm.
Bepaal die oppervlakte van die gearseerde driehoek.



(A) 4 cm^2 (B) 6 cm^2 (C) 8 cm^2 (D) 10 cm^2 (E) 15 cm^2

18. PQRST is 'n 5-syfer getal. Die som van elke groep van drie opeenvolgende syfers is 12. Die som van elke groep van vier opeenvolgende syfers is 17. Wat is die som van al vyf syfers?

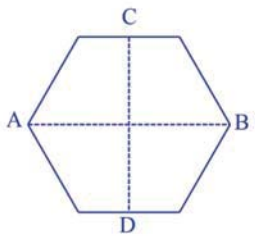
(A) 22 (B) 25 (C) 30 (D) 37 (E) 45

19. Andy en Betty kies elkeen 'n heelgetal tussen 1 en 10. Op hoeveel maniere kan Andy se getal groter as Betty s'n wees?

(A) 45 (B) 50 (C) 55 (D) 60 (E) 65

20. A en B is oorstaande hoekpunte van 'n reëlmatige heksagoon. C en D is middelpunte van oorstaande sye sodat CD loodreg op AB is. Die oppervlakte van die heksagoon is 123 cm^2.

Wat is die die oppervlakte van die reghoek met lengte AB en breedte CD?



(A) 112 cm^2 (B) 130 cm^2 (C) 142 cm^2 (D) 164 cm^2 (E) 180 cm^2

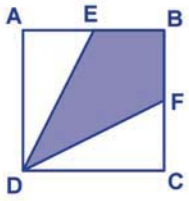
11. Watter persentasie van natuurlike getalle, tussen 1 en 200 inklusief, is perfekte vierkante?

(A) 2% (B) 3% (C) 5% (D) 7% (E) 11%

12. Vyf lekkers kos R12 meer as een lekker. Wat is die koste van een lekker?

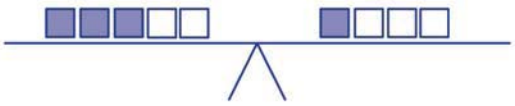
(A) R1 (B) R2 (C) R3 (D) R4 (E) R5

13. ABCD is 'n vierkant van sylengte 4. E en F is die middelpunte van sye AB en BC onderskeidelik. Wat is die grootte van die oppervlakte van vierhoek EBFD?



(A) 8 (B) 10 (C) 12 (D) 14 (E) 16

14. Die diagram stel 'n perfek gebalanseerde skaal voor:



Watter een van die volgende kan aan die regterkant van die skaal geplaas word om die skaal perfek te laat balanseer?

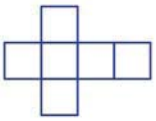
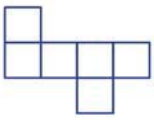
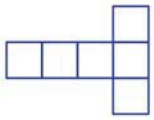
(A) 
(B) 
(C) 

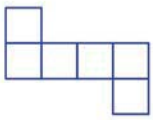
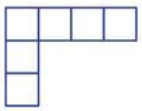
(D) 
(E) 

15. Xavier kies 'n heelgetal tussen 1 en 100. Yandi en Zanele probeer elkeen om Xavier se getal te raai. Yandi raai 53 terwyl Zanele 71 raai. Indien beide Yandi en Zanele se raaiskote met nie meer as 10 uit is nie, watter van die volgende kon Xavier se getal gewees het?

(A) 60 (B) 62 (C) 64 (D) 66 (E) 68

6. Watter een van die volgende figure kan nie in 'n geslote kubus ingevou word nie?

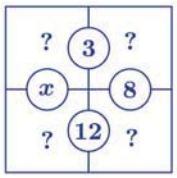
(A)  (B)  (C) 

(D)  (E) 

7. $\frac{21}{20}+7$ uitgebrei as 'n desimale getal is

(A) 7,05 (B) 8,01 (C) 8,03 (D) 8,05 (E) 8,07

8. Elkeen van die vier klein vierkante aangetoon in die figuur bevat 'n getal. Die som van enige twee aangrensende vierkante word vertoon in die sirkel tussen hulle.



Die waarde van x is

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

9. Aan elke derde besoeker by 'n vertoning word 'n pen gegee terwyl aan elke vyfde een 'n sak gegee word. Hoeveel van die eerste 200 besoekers kry beide 'n pen en 'n sak?

(A) 13 (B) 14 (C) 15 (D) 16 (E) 17

10. Beskou die volgende herhalende patroon:

Watter van die volgende sal die 2017de figuur in die ry wees?

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

1. Ravi vertrek op 'n reis om 10h15. Indien die reis 2 ure en 10 minute neem, hoe laat kom hy by sy bestemming aan?

(A) 12h15 (B) 12h25 (C) 12h45 (D) 12h55 (E) 13h00

2. Die waarde van $\frac{2017-1017}{500}$ is

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

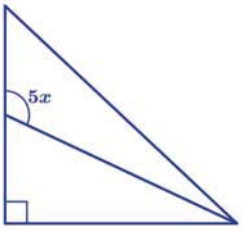
3. Watter breukdeel van die diagram is ingekleur?

(A) $\frac{1}{16}$ (B) $\frac{1}{8}$ (C) $\frac{1}{4}$ (D) $\frac{1}{3}$ (E) $\frac{1}{2}$

4. 'n Sekere boom groei $\frac{1}{2}$ m per jaar vir 20 jaar lank en $\frac{1}{3}$ m elke jaar daarna. Indien die boom tans 13 m hoog is, hoe oud is die boom in jare?

(A) 23 (B) 25 (C) 27 (D) 29 (E) 32

5. Watter een van die volgende kan x se grootte in grade wees?



(A) 10 (B) 15 (C) 20 (D) 40 (E) 50

SUID-AFRIKAANSE WISKUNDE-OLIMPIADE

Georganiseer deur die
SOUTH AFRICAN MATHEMATICS FOUNDATION

2017 EERSTE RONDTE
JUNIOR AFDELING: GRAAD 8

15 Maart 2017 **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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