# SOUTH AFRICAN MATHEMATICS OLYMPIAD

## Grade EIGHT First Round 2018

## Solutions

1. **A** $\sqrt{2 \times 0 + 1 + 8} = \sqrt{9} = 3$

2. **B** $\frac{8102}{2018} \approx \frac{8100}{2025} = 4$

3. **E** $20 - (-18) = 38$

4. **B** $90° - 20° - 18° = 52°$

5. **B** $2018 = 336 \times 6 + 2$

6. **D** There are four rectangles that are 1 unit wide. There are three that are 2 units wide, two that are 3 units wide and one that is 4 units wide. 4 + 3 + 2 + 1 = 10.

7. **D** The bold part of the perimeter is the same for both shapes. The larger shape has a total of 1 + 6 + 6 + 1 = 14 cm on the other edges, while the smaller one has 5 + 5 = 10 cm. The difference is 4 cm.

8. **A** The completed pyramid is:

| | | | |
|---|---|---|---|
| | | 4 | |
| | 6 | 2 | |
| 9 | 3 | 1 | |

9. **D** $90 - 30 = 60$ ; $60 \times \frac{2}{3} = 40$ ; $40 + 30 = 70$

10. **C** Working backwards, before he had 10 he must have had 9; before that 3, before that 7.

11. **E** Since $14 \times 14 \times 14 = 2^3 \times 7^3$, N must be $2^3 \times 7 = 56$.

12. **C** Each of the 20 seats, whether it is a stool or a chair, has at least three legs. This accounts for $20 \times 3 = 60$ legs. The remaining 8 legs must belong to chairs, so there are 8 chairs and 12 stools.

13. **C** The different options would be 2 + 0, 2 + 1, 2 + 8, 1 + 8, 8 + 0 and 1 + 0.
Only three out of these 6 options give an even sum, i.e. 50%

14. **B** The three squares have a total area of $10^2 + 8^2 + 6^2 = 200$ cm$^2$. The unshaded triangle has length $10 + 8 + 6 = 24$ cm and perpendicular height 10 cm and thus area 120 cm$^2$. The shaded area is thus $200 - 120 = 80$ cm$^2$.

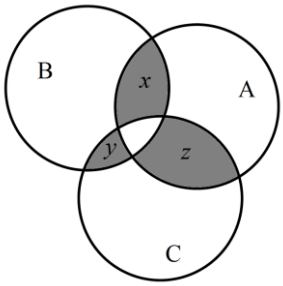
15. **C** If there are $x$ sisters the mother will get $x$ gifts. If each sister gives a gift to their other sisters there will be $x(x-1) = x^2 - x$ gifts between the sisters. The number of gifts in total will be $x + x^2 - x = x^2$, i.e. a perfect square. The only perfect square in the five options given is 49.

16. **A** $6! = 720$ ; $3! = 6$ and $5! = 120$ $\therefore$ $6! = 3! \times 5!$ $\therefore$ $p + q = 3 + 5 = 8$.

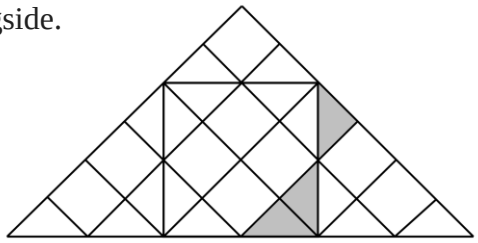
17. **D** Let the cost of the cellphone be $x$. After the discounts it will cost
$x(1-0,2)(1-0,1) = x \times \frac{80}{100} \times \frac{90}{100} = x \times \frac{8}{10} \times \frac{9}{10} = 0,72x$.
This represents a total discount of 28%

18. **A** The largest gear, moving in a clockwise direction, turning 5 times, means that the black arrow will pass a total of $16 \times 5 = 80$ teeth. The black arrow would then still point to P.
$80 = 12 \times 6 + 8 = 10 \times 8 = 6 \times 13 + 2$. The second gear, moving in an anti-clockwise direction turns 6 times and 8 teeth, the third largest gear moving in a clockwise direction turns 8 times exactly and the smallest gear moving in an anti-clockwise direction turns 13 times and 2 teeth. The arrows would then point to P, L, A and R respectively.

19. **E** $120 \times \frac{1}{4} = 30, 120 \times \frac{1}{5} = 24, 120 \times \frac{1}{6} = 20$
$x + z = 30,\ x + y = 24,\ \ y + z = 20$
$\therefore 2x + 2y + 2z = 74$
$\therefore x + y + z = 37$




20. **E** The triangle can be divided as shown alongside.
The total number of whole squares is 18.
The fraction of the triangle that is shaded is $\frac{\frac{3}{2}}{18} = \frac{1}{12}$.



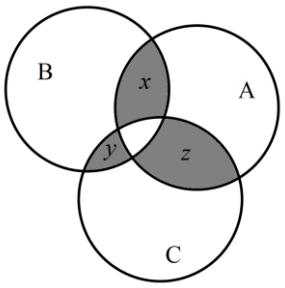
15. **C** Indien daar $x$ susters is, sal die ma $x$ geskenke ontvang. Daar sal $x(x-1)=x^2-x$ geskenke tussen die susters uigeruil word, so die totale getal geskenke is $x+x^2-x=x^2$, wat 'n volkome vierkant is. Die enigste volkome vierkant tussen die 5 opsies is 49.

16. **A** $6!=720\ ;\ 3!=6\ en\ 5!=120\ \therefore\ 6!=3!\times 5!\ \therefore\ p+q=3+5=8.$

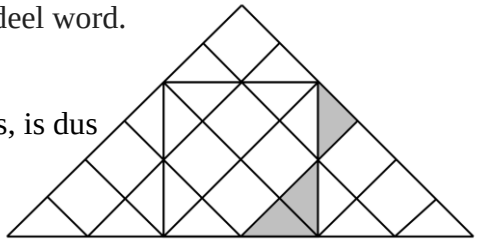
17. **D** Veronderstel die prys van die selfoon is $x$. Na die afslag, sal die prys $x(1-0,2)(1-0,1)=x\times\frac{80}{100}\times\frac{90}{100}=x\times\frac{8}{10}\times\frac{9}{10}=0,72x$ wees.
Dus is die totale afslag 28%

18. **A** Die grootste rat, wat kloksgewys draai, draai 5 omwentelinge, wat beteken dat die pyl 'n totaal van $16\times 5=80$ tande verbysteek, en dan weer na P wys.
$80=12\times 6+8=10\times 8=6\times 13+2$. Die tweede rat, wat antikloksgewys draai, draai deur 6 omwentelinge en 8 tande, en die derde rat, wat weer kloksgewys draai, draai deur presies 8 omwentelinge. Die kleinste rat, wat in 'n antikloksgewyse rigting draai, draai deur 13 omwentelinge en 2 tande. Die pyle wys dus na P, L, A en R onderskydelik.

19. **E** $120\times\frac{1}{4}=30, 120\times\frac{1}{5}=24, 120\times\frac{1}{6}=20$
$x+z=30,\ x+y=24,\ \ y+z=20$
$\therefore 2x+2y+2z=74$
$\therefore x+y+z=37$




20. **E** Die driehoek kan soos hiernaas getoon verdeel word.
Die totale getal vierkante is 18.
Die breuk van die driehoek wat ingekleur is, is dus $\frac{\frac{3}{2}}{18}=\frac{1}{12}$.



# SUID-AFRIKAANSE WISKUNDE OLIMPIADE

## Graad AGT Eerste Rondte 2018

## Oplossings

1. **A** $\sqrt{2 \times 0 + 1 + 8} = \sqrt{9} = 3$

2. **B** $\frac{8102}{2018} \approx \frac{8100}{2025} = 4$

3. **E** $20 - (-18) = 38$

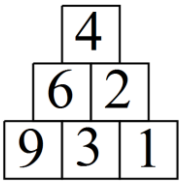
4. **B** $90° - 20° - 18° = 52°$

5. **B** $2018 = 336 \times 6 + 2$

6. **D** Daar is vier reghoeke wat elk 1 eenheid breed is. Daar is drie wat 2 eenhede breed is, twee wat 3 eenhede breed is, en een wat 4 eenhede breed is. 4 + 3 + 2 + 1 = 10.

7. **D** Die donker deel van die omtrek is dieselfde vir beide vorms. Die groter vorm het ‘n totale omtrek van 1 + 6 + 6 + 1 = 14 cm op die ander sye, terwyl die kleiner ene 5 + 5 = 10 cm het. Die verskil is dus 4 cm.

8. **A** Die voltooide piramiede is:




9. **D** $90 - 30 = 60$ ; $60 \times \frac{2}{3} = 40$ ; $40 + 30 = 70$

10. **C** Deur terugwaarts te werk, moes hy, voordat hy 10 gehad het, 9 gehad het; en voor dit 3, en voor dit 7.

11. **E** Omdat $14 \times 14 \times 14 = 2^3 \times 7^3$, moet N gelyk wees aan $2^3 \times 7 = 56$.

12. **C** Elkeen van die 20 sitplekke, ongeag of dit ‘n stoel of ‘n bank is, het ten minste drie pote. Hierdie gee ‘n totaal van $20 \times 3 = 60$ pote. Die oorblewende 8 pote moet aan banke behoort, so daar is 8 banke en 12 stoele.

13. **C** Die verskillende moontlikhede is 2 + 0, 2 + 1, 2 + 8, 1 + 8, 8 + 0 en 1 + 0.
Slegs drie van hierdie 6 moontlikhede het ‘n ewe som, d.w.s. 50%

14. **B** Die drie vierkante het ‘n totale oppervlakte van $10^2 + 8^2 + 6^2 = 200$ cm$^2$. Die driehoek wat nie ingekleur is nie het lengte $10 + 8 + 6 = 24$ cm en loodregte hoogte 10 cm. Die oppervlakte van die driehoek is dus $120$ cm$^2$. Die ingekleurde oppervlakte is dus $200 - 120 = 80$ cm$^2$.