THE HARMONY SOUTH AFRICAN MATHEMATICS OLYMPIAD

Organised by the SOUTH AFRICAN MATHEMATICS FOUNDATION.
Sponsored by HARMONY GOLD MINING.

FIRST ROUND 2007
JUNIOR SECTION: GRADES 8 AND 9
20 MARCH 2007
TIME: 60 MINUTES
NUMBER OF QUESTIONS: 20

Instructions:

1. Do not open this booklet until told to do so by the invigilator.
2. This is a multiple choice question paper. Each question is followed by answers marked A, B, C, D and E. Only one of these is correct.
3. Scoring rules:
   Each correct answer is worth 5 marks. There is no penalty for an incorrect or an unanswered question.
4. You must use an HB pencil.
   Rough paper, a ruler and a rubber are permitted.
   Calculators and geometry instruments are not permitted.
5. Diagrams are not necessarily drawn to scale.
6. The centre page is an information and formula sheet. Please tear it out for your use.
7. Indicate your answers on the sheet provided.
8. Start when the invigilator tells you to do so.
   You have 60 minutes to complete the question paper.
9. 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

1. $1-\frac{1}{2}\times 2$ is equal to:

   A. $\frac{1}{4}$ B. $\frac{1}{2}$ C. 0 D. $\frac{3}{4}$ E. 1

2. Write down the units digit of 3^6-2^6

   A. 7 B. 5 C. 3 D. 2 E. 1

3. Green missed the 100 metre sprint record by 0,03 seconds. What is the record, in seconds, if Green's time was 9,81 seconds?

   A. 10,00 B. 10,31 C. 9,51 D. 9,84 E. 9,78

4. Which of the following numbers is the smallest?

   A. 0,125 B. $\frac{1}{4}$ C. $\frac{3}{8}$ D. $\frac{2}{11}$ E. 11%

5. During a 3-day festival, the number of visitors trebled each day. If the festival ended on day 3 with 3105 visitors on that day, then how many visitors attended on day 1?

   A. 315 B. 330 C. 345 D. 360 E. 375

6. Vusi invests R2500 at the beginning of the year. He is promised that his investment will grow by 5% of the original investment per year. After how many years will his investment have doubled?

   A. 10 B. 20 C. 30 D. 50 E. 60

7. A lady has 17 buttons in a bag. She has 8 green ones, 5 blue ones and 4 red ones. What is the minimum number of buttons she must take out of her bag, without replacing them, in order to ensure that she has one of each colour?

   A. 4 B. 8 C. 12 D. 14 E. 16

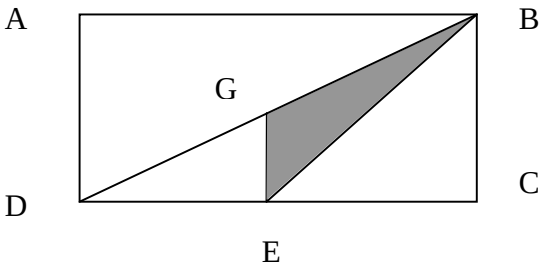
8. $(6y-10)(3y+4)$ and $(6y+2)(3y-4)$ are both even numbers on a number line with one even number between them. The larger of the two numbers is:

   A. 98 B. 100 C. 102 D. 104 E. 106

9. Dan bought a box of apples. While unpacking he found that 12 apples, which is the same as 15% of all bought apples, had gone bad. How many apples would represent 35% of all bought apples?

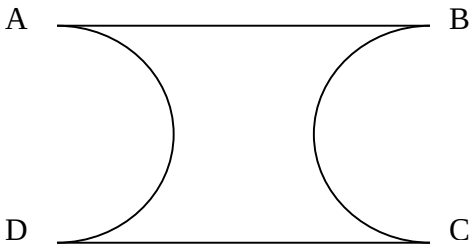
A. 5 B. 12 C. 28 D. 33 E. 62

10. ABCD is a rectangle with mid-point of DC at E, as shown. What fraction of the area of the rectangle does the area of ΔBEG (the shaded region) represent if GE $\|$ BC?



A. $\frac{1}{5}$ B. $\frac{1}{8}$ C. $\frac{1}{4}$ D. $\frac{2}{7}$ E. $\frac{2}{9}$

11. Semi-circles with diameter of 28cm are drawn on AD and BC, as shown. If AB=DC=77 cm, then the perimeter of the figure is:



A. 154 B. 154+14π C. 154+28π D. 182π E. 154+56π

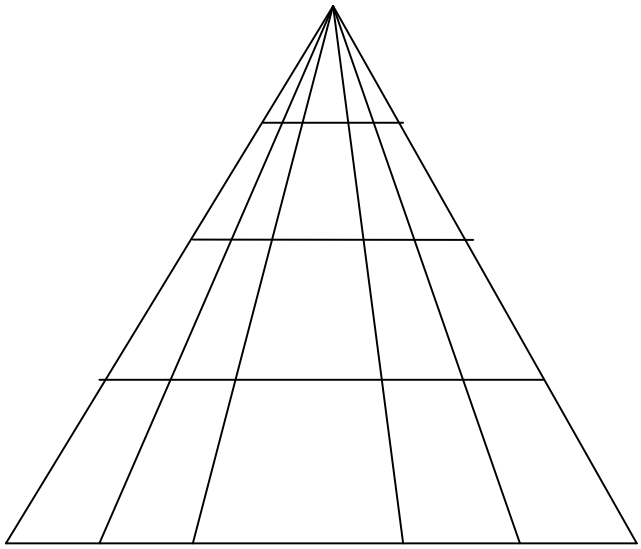
12. Joy found that two numbers added up to 20. Five times the one number is ten more than four times the other number. What is the product of the two numbers?

A. 84 B. 91 C. 96 D. 99. E. 100

13. If p=5q and 10q = 3t, then t =….

A. $\frac{1}{3}$ p B. $\frac{2}{3}$p C. p D. $\frac{3}{2}$p E. 3p

14. The total number of triangles in the diagram below is:



A. 54 B. 60 C. 66 D. 72 E. 78

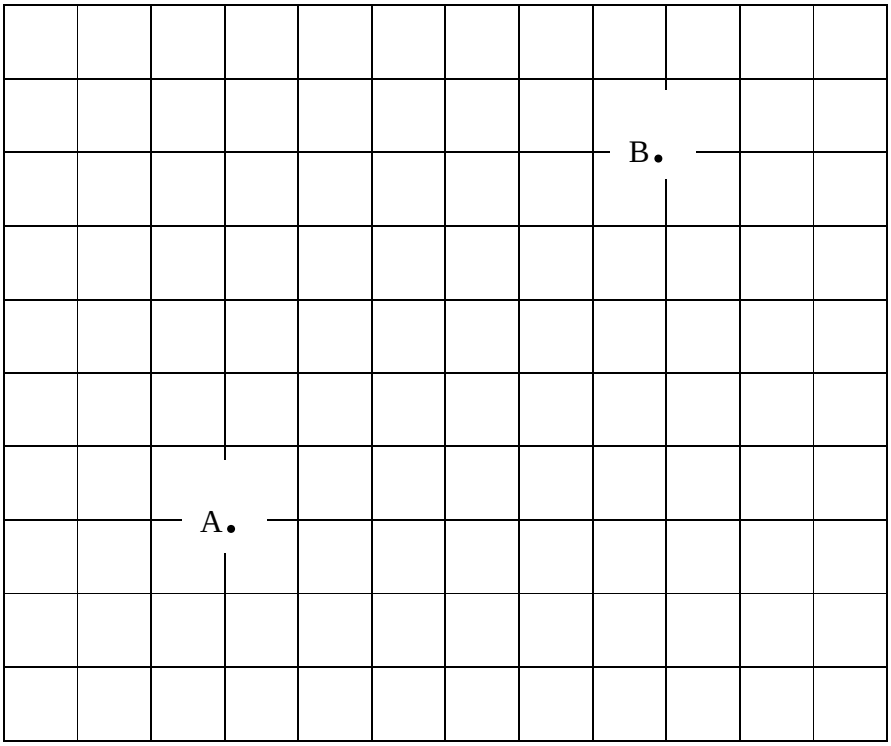
15. Linda works a 40-hour week (standard). The overtime wage rate is $1\frac{1}{2}$ times the standard wage rate. In the first week of the month she worked 10 hours overtime and received total wages of R2 750.
What amount does she earn in a week if she does not work overtime?

A. R1 000 B. R1 500 C. R2 000 D. R2 500 E. R3 000

16. A group of girls shared 54 red beads, 90 green beads and 108 blue beads such that each girl gets an equal number of beads of each colour.
What is the maximum number of girls in this group?

A. 6 B. 12 C. 15 D. 18 E. 21

17.



In the above Cartesian plane, 1 cm represents 1 unit on both axes, which are not shown. If B's co-ordinates are (9;4), then which of the following co-ordinates would represent point A?

A. (3;-1) B. (9;7) C. (5;9) D. (-9;4) E. (-1;6)

18. Sipho makes 33 straw hats in 4 days. Pretty makes 33 straw hats in 6 days. Abongile makes 33 straw hats in 3 days. If all 3 work together and at their usual rate, how many days will it take to make 99 straw hats?

A. 5 B. 4 C. 3 D. 2 E. 1

19. In a sports club 32 do not play soccer, 50 do not play volleyball and 40 play volleyball. How many play soccer?

A. 8 B. 32 C. 40 D. 50 E. 58

20. A large solid cube is built of identical smaller cubes such that more than half of the small cubes are not visible from outside. What is the smallest number of small cubes that are used to build the large cube?

A. 1728 B. 1331 C. 1000 D. 729 E. 125

Formula and Information Sheet

1.1 The natural numbers are 1; 2; 3; 4; 5; …

1.2 The whole numbers (counting 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:

$$2\times2\times2\times2\times2=2^5$$
$$3\times3\times3\times3\times3\times3=3^6$$
$$a\times a\times a\times a\times \ldots \times a=a^n \qquad (n \text{ factors of } a)$$
(a is the base and n is the index (exponent))

3.2 Factorial notation:

$$1\times2\times3\times4=4!$$
$$1\times2\times3\times \ldots \times n=n!$$

4 Area of a

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

4.2 rectangle is: length $\times$ width = lw
length $\times$ breadth = lb

4.3 square is: side $\times$ side = s^2

4.4 rhombus is: $\frac{1}{2}\times$ (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 × perpendicular height
or area of base × perpendicular height

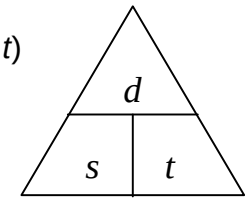
9.2 Surface area of a right prism is: (perimeter of base × h) + (2 × area of base)

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

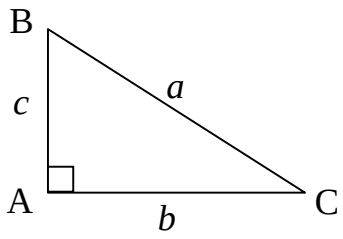


$d = s\times t$

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

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

12 Pythagoras:



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

13. Conversions:

1 cm^3 = 1 $m\ell$; 1000 cm^3 = 1 ℓ

1000 m = 1 km ; 1000 g = 1 kg ; 100 cm = 1 m