HARMONY

THE HARMONY GOLD SOUTH AFRICAN MATHEMATICS OLYMPIAD

organised by the SOUTH AFRICAN ACADEMY OF SCIENCE AND ARTS
in collaboration with HARMONY GOLD MINING, AMESA and SAMS

SECOND ROUND 2002
JUNIOR SECTION: GRADES 8 AND 9
21 MAY 2002
TIME: 120 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:

For each correct answer	in Part A:	4 marks
	in Part B:	5 marks
	in Part C:	6 marks
For each wrong answer:		–1 mark
For no answer:		0 marks

4. You must use an HB pencil.
Rough paper, ruler and rubber are permitted.
Calculators and geometry instruments are not permitted.

5. Diagrams are not necessarily drawn to scale.

6. Indicate your answers on the sheet provided.

7. Start when the invigilator tells you to.
You will have 120 minutes working time for the question paper.

DO NOT TURN THE PAGE

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DRAAI DIE BOEKIE OM VIR DIE AFRIKAANSE VRAESTEL

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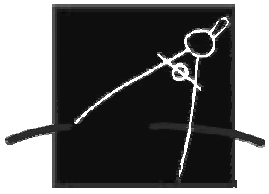

PRACTICE EXAMPLES

1. $23 + 6 - 4 =$

A) 6 B) 23 C) 25 D) 29 E) 33

2. $\frac{1}{5} + \frac{2}{3} \times \frac{1}{2}$ equals

A) $\frac{1}{15}$ B) $\frac{3}{11}$ C) $\frac{21}{50}$ D) $\frac{8}{15}$ E) $9\frac{4}{5}$

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PART A: (Each correct answer is worth 4 marks)

1. The value of $1\,001 \times 99 - 99$ is

A) 99 B) 990 C) 9 900 D) 99 000 E) 990 000

2. The value of $\frac{3}{4} - \frac{1}{2} \times \frac{1}{2}$ is

A) $\frac{1}{2}$ B) $\frac{1}{4}$ C) 0 D) $\frac{3}{4}$ E) $\frac{1}{8}$

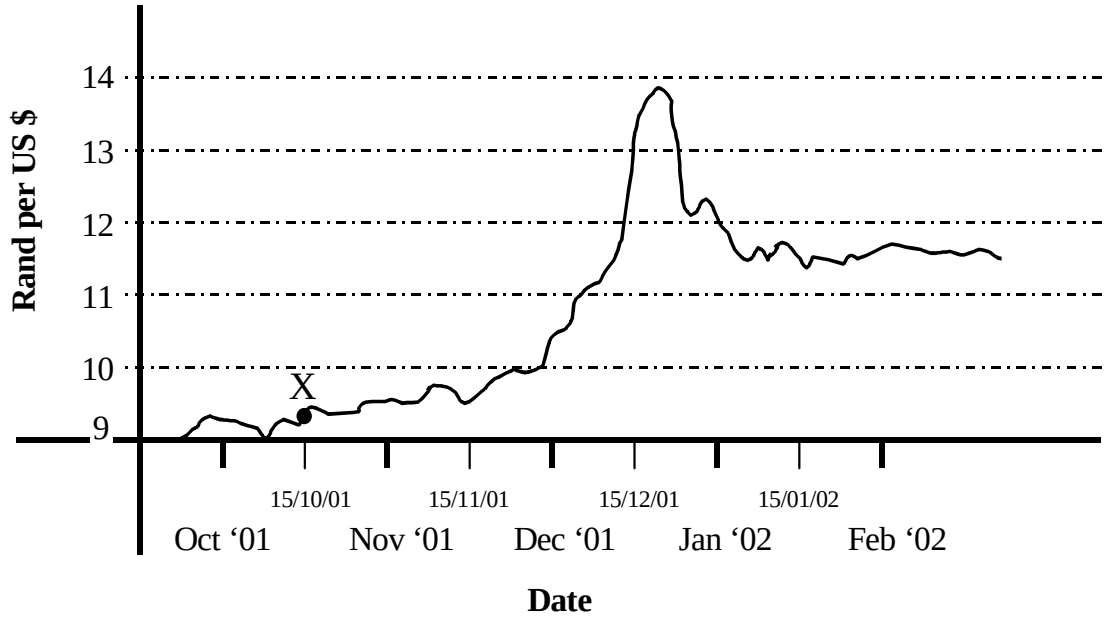
3. A truckload of books contains x cartons. Each carton contains y boxes and each box contains z books. The number of books in the truckload is

A) $x + y + z$ B) $x(y + z)$ C) $xy + xz + yz$ D) $\frac{xy}{z}$ E) xyz

4. The smallest integer x, for which $\frac{15}{x-1}$ is an integer, is

A) -29 B) -14 C) -4 D) 0 E) 2

5.



The above graph represents the value of one United States Dollar (US $) in South African Rand. At point X, on 15 October 2001 one US $ cost approximately R9,31. Use the graph to determine the approximate Rand value of one US $ on 15 January 2002.

A) less than R10
B) between R10 and R11
C) between R11 and R12
D) between R12 and R13
E) more than R13

PART B: (Each correct answer is worth 5 marks)

6. Of the 28 T–shirts in a drawer, six are red, five are blue, and the rest are white. If Bob selects T–shirts at random whilst packing for a holiday, what is the least number he must remove from the drawer to be sure that he has three T–shirts of the same colour?

A) 4 B) 13 C) 9 D) 19 E) 7

7. Virginia is making 5-digit arrangements from the digits 2 and 4. An example of such an arrangements is 22442. She was told that the first digit cannot be a 4. How many such arrangements are there?

A) 16 B) 24 C) 20 D) 8 E) 32

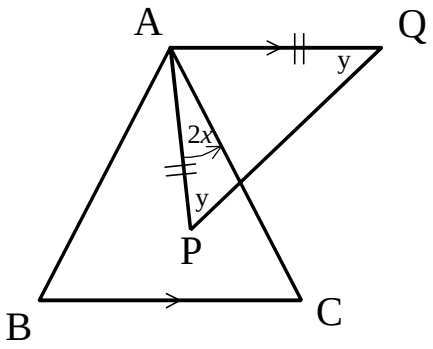
8. Two friends Petros and Sammy have pocket money in the ratio 3 : 5. Each one spends R30. The ratio changes to 1 : 2. The total amount the two friends started off with is

A) R210 B) R240 C) R270 D) R300 E) R330

9. There are ten learners in an environmental club. They have decided to go on shell collection trips. The vehicle with which they undertake the trips, can only take eight learners at a time. Each learner goes at least once. What is the minimum number of trips the vehicle must make so that each learner goes on the same number of trips?

A) 2 B) 3 C) 4 D) 5 E) 6

10.



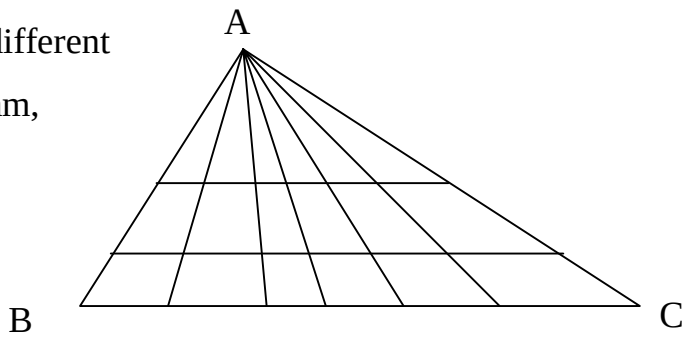
In the above diagram, ΔABC is equilateral. ΔAPQ is isosceles with AQ = AP and AQ || BC. If $P\hat{A}C = 2x$, then the size of $\hat{Q}$ in terms of x is

A) $60^\circ + x$ B) $180^\circ + 3x$ C) $120^\circ - x$
D) $2x$ E) $60^\circ - x$

11. The units digit of $2^{2000} + 2^{2001} + 2^{2002}$ is

A) 0 B) 2 C) 4 D) 6 E) 8

12. The total number of different triangles in the diagram, including ΔABC, is



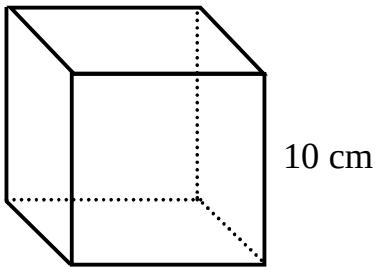
A) 21 B) 42 C) 63 D) 84 E) 105

13. A 3-digit number has x as its units digit; $(x-1)$ as the tens digit and $\frac{1}{2}x$ as its hundreds digit. The number in terms of x is

A) $5x-1$ B) $7x-1$ C) $111x-1$

D) $61x-10$ E) $\frac{5}{2}x-1$

14. A company makes solid blocks with square bases. The volume of this block is 640 cm^3. Its height is 10 cm. The cost of painting all the faces of this block at 15c per cm^2 is



A) R64,00 B) R67,20 C) R70,40 D) R73,60 E) R60,20

15. In an alien language, ***jalez borg farn*** means "**good maths skills**". ***Nurf klar borg*** means "**maths in harmony**" and ***darko klar farn*** means "**good in gold**". What is "**harmony gold**" in this language?

A) ***klar darko***

B) ***borg nurf***

C) ***jalez klar***

D) ***darko nurf***

E) ***farn borg***

PART C: (Each correct answer is worth 6 marks)

16. As a result of poor attendance at soccer matches it was decided to decrease the ticket price by 20%. At the next match the number of tickets sold increased by 20%. Compared to the previous match, the income from the sale of tickets

A) increased by 20%

B) decreased by 20%

C) increased by 4%

D) decreased by 4%

E) remained the same

17. The mean (average) of n numbers is p. When the number q is removed from the list of numbers averaged, then the mean (average) increases by 2. The value of q is

A) $p-2n$

B) $p-n+2$

C) $2p-n$

D) $2p-n+2$

E) $p-2n+2$

18.

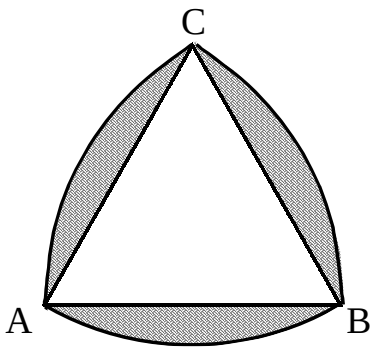
^{1}R	^{2}B	^{3}X	^{4}S	^{5}O	^{6}P	^{7}E	^{8}D	^{9}M	^{10}Z	^{11}L	^{12}K	^{13}A
^{14}G	^{15}C	^{16}T	^{17}N	^{18}J	^{19}F	^{20}U	^{21}H	^{22}V	^{23}W	^{24}Q	^{25}Y	^{26}I

In the above table each letter of the alphabet is given a value.

The algebraic expression $4x-3$ is used as a key to convert the letters **P S R X B O E** into the word **H A R M O N Y**. Which one of the following keys is used to convert **S R X B** into **G O L D** ?

A) $x+2$ B) $2x-1$ C) $3x+2$ D) $5x+1$ E) $2x+1$

19. ABC is an equilateral triangle with sides of 2 units. Using A, B and C as centres of circles, arcs BC, AC and AB are drawn.



The shaded area is

A) $2\pi-3\sqrt{3}$ B) $\pi-\sqrt{3}$ C) $\frac{\pi}{2}$ D) $2\sqrt{3}-\pi$ E) π

20. Five children, Amelia, Bongani, Charles, Devine and Edwina, were in the classroom when one of them broke a window. The teacher asked each of them to make a statement about the event, knowing that three of them always lie and two always tell the truth. Their statements were as follows:

Amelia: "Charles did not break it, nor did Devine."
Bongani: "I didn't break it, nor did Devine."
Charles: "I didn't break it, but Edwina did."
Devine: "Amelia or Edwina broke it."
Edwina: "Charles broke it."

Who broke the window?

A) Amelia B) Bongani C) Charles
D) Devine E) Edwina