2021 Wits Mathematics Competition
Qualifying Round
Grade 4 and 5

Instructions

This exam consists of 20 multiple choice questions. There is one correct answer to each question. There is no penalty for incorrect answers. The mark allocation is as follows:

Questions 1-5 are each worth 3 points,
Questions 6-10 are each worth 4 points,
Questions 11-15 are each worth 5 points,
Questions 16-20 are each worth 6 points.
The total number of points available is 90.

The time limit on this exam is 75 minutes, calculators and geometric implements may NOT be used. If you are using the computer-friendly answer sheet you should fill it in in BLACK pen (other colours do not scan well). Time may be given for filling in name, school and other personal details.

"Always try the problems that matter most to you". — Andrew Wiles

A. 3 point questions

1. What is the value of $123 + 321$?

   A. 345

   B. 354

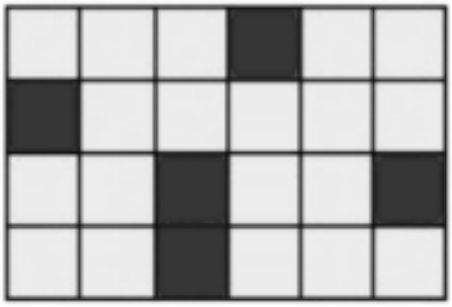
   C. 444

   D. 543

   E. 999

   C.

2. In the picture below, how many light squares must you paint dark so that the number of dark squares is exactly half the number of light squares?



   A. 2

   B. 3

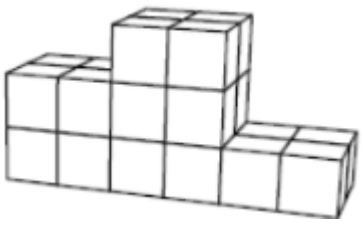
   C. 4

   D. 6

   E. This is impossible

   B. There are 19 light squares and 5 dark squares. We need to get to 16 light squares and 8 dark ones. Therefore we must paint 3 more squares dark.

3. Siya built a podium, as in the picture below. How many cubes did he use?



   A. 12

   B. 18

C. 19

D. 22

E. 24

E. $(6 \times 2) + (4 \times 2) + (2 \times 2) = 24$

4. Iminathi added two 2-digit numbers correctly on paper. Then he painted out two cells, as shown below.

What is the sum of values of the two digits in the painted cells?

A. 5

B. 7

C. 8

D. 9

E. 13

B. The only solution is $22 + 35 = 57$ and therefore $2 + 5 = 7$. To see this first observe that the second blank must be a 5 to get a units digit of 7. Then the first blank must be a 2.

5. Annie fell asleep at 9 : 30 pm and woke up at 6 : 45 am the next morning. Her brother Martin had been sleeping 1 hour 50 minutes longer. How many hours and minutes had Martin been sleeping?

A. 30 hours 5 minutes

B. 11 hours 35 minutes

C. 11 hours 5 minutes

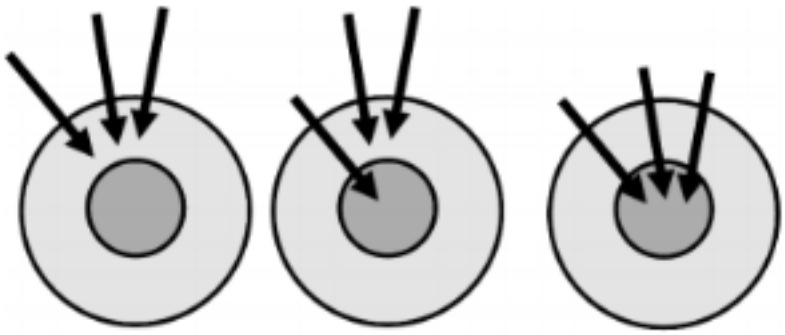
D. 9 hours 5 minutes

E. 8 hours 35 minutes

C. 9 hours 15 min plus 1 hour 50 min is 11 hours 5 minutes in total.

B. 4 point questions

6. Samantha plays a game where she throws three arrows at a board and gets points depending on where they land. In her first attempt she scores 12 points in total. On her second turn she scores 15 points.



How many points does she score on her third turn?

A. 18
B. 19
C. 20
D. 21
E. 22

D. $\frac{12}{3} = 4$ points on the outer ring. $2 \times 4 + x = 15$ points means the inner ring is worth 7 points. So on the final throw she gets $3 \times 7 = 21$.

7. How many of the five words shown below can be placed in the gap to make the sentence in the box true?

Seven
Eight
Nine
Ten
Eleven

This sentence contains the letter 'e' _____ times.

A. 0
B. 1
C. 2
D. 3
E. 4

C. The letter e appears 8 times without counting the appearances in the number. Nine and Eleven both leave the sentence true.

8. In a class there are 29 children. 12 children have a sister and 18 children have a brother. Tina, Bert, and Anne have no brother and no sister. How many children in that class have both a brother and a sister?

   A. no one

   B. 1

   C. 3

   D. 4

   E. 6

   D. There are 3 children without brothers or sisters, 12 with brothers and 18 with sisters. Adding these together gives a total of 33 children but there are only 29 in the class, so 4 have been counted twice.

9. The number of digits used to write all the page numbers in a book is 35. How many pages are there in the book?

   A. 12

   B. 15

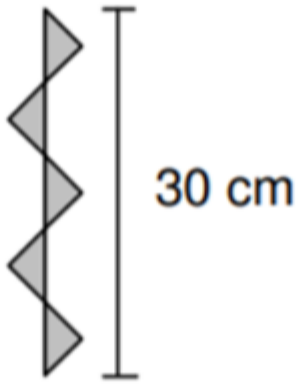
   C. 22

   D. 28

   E. 35

   C. This can be solved by writing out numbers 1, 2, 3 and so on until you get to 22 (at which point you'll have used 35 digits. Alternatively notice that the first 9 numbers "cost" a digit each and you'd have 26 digits over. From there on each page "costs" 2-digits so you'll get another 13, giving a final answer of $9 + 13 = 22$.

10. The figure in the drawing below consists of five triangles. Each side of each triangle is of equal length. Find the perimeter of the shaded figure, that is, the total length of all sides of all triangles.



A. $30\,cm$

B. $60\,cm$

C. $75\,cm$

D. $90\,cm$

E. $120\,cm$

D. Each triangle has 3 times the perimeter of a single side. As you can add up 1 side of each triangle to get $30cm$ the total length is $90cm$.

C. 5 point questions

11. The length of the sides of each little square in the picture below is 1 cm. What is the area of the letter N?

A. 14

B. 15

C. 16

D. 17

E. 18

E. The two vertical stripes are each 6 units. As is the middle diagonal.

12. A bar code is formed using 17 black and white bars (the first and last bars are black). The black bars are two types: wide and narrow. The number of white bars is 3 more than the number of wide black bars. The number of narrow black bars is:

A. 1

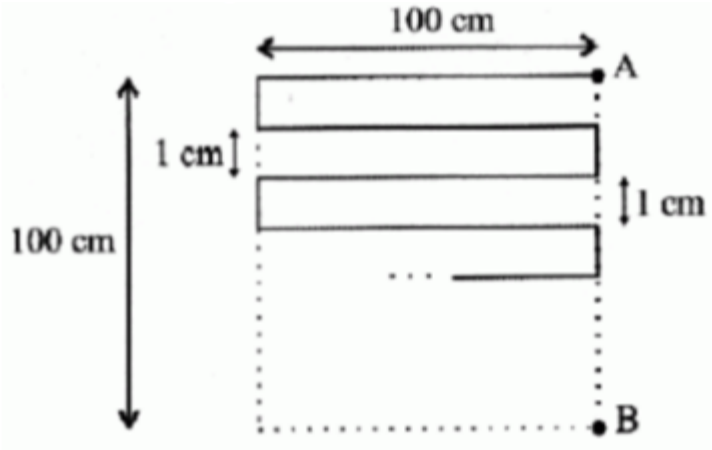
B. 2

C. 3

D. 4

E. 5

13. In the diagram below, what is the length of the broken line from A to B?



A. 10200 cm

B. 2500 cm

C. 909 cm

D. 10100 cm

E. 9900 cm

14. There are 17 trees along the road from Basil's home to the pool. Basil marked some trees with a red strip as follows. On his way to swim he marked the first tree, and then every second tree, and on his way back he marked the first tree, and then every third tree. How many trees have no mark on them after that?

A. 4

B. 5

C. 6

D. 7

E. 8

15. Manto and Sihle travelled by train from Johannesburg to Cape Town. Manto sat in the 7th carriage from the front and Sihle sat in front of her, in the 6th carriage from the back. There was one carriage between Manto's and Sihle's. How many carriages were there in the train?

A. 15

B. 14

C. 13

D. less than 13

E. more than 15

D. 6 point questions

16. The picture below contains each of the numbers 1, 2, 3 and 4 in each row and column. Find the number in the square marked x.

	1		
4			x
	3	2	
3			

A. 1

B. 2

C. 3

D. 4

E. Impossible to say

A. This must be done by figuring out the unmarked squares one by one.

17. A cycle shop has 50 cycles for sale. Some are bicycles (2 wheels each) and some are tricycles (3 wheels each). The total number of wheels in the shop is 120. How many bicycles are in the shop?

A. 0

B. 20

C. 25

D. 30

E. 50

18. An ant starts at the bottom left corner of a 10 m by 10 m square field. It walks for 7 m in a straight line towards the top right corner then walks 2 m directly upwards and stops. From the ant's final location, find the sum of the four shortest distances to the top, right, bottom and left boundaries of the field.

A. 10 m

B. 16 m

C. 18 m

D. 20 m

E. 26 m

19. How many paths from top to bottom in the diagram below spell the word "PATHS". At each stage you may only move from the current letter to one of the two immediately below it.

P

A A

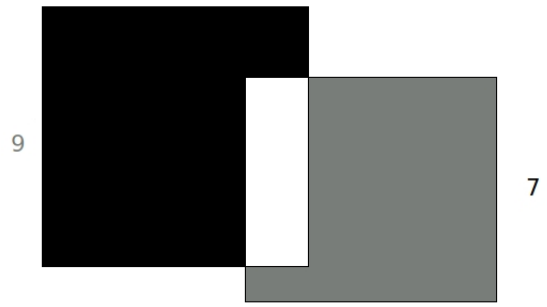
T T T

H H

S

A. 4
B. 6
C. 8
D. 10
E. 24

20. Two squares with side lengths seven and nine are pictured below. How much greater is the larger (darker) shaded region than the smaller shaded region?



A. 16
B. 32
C. 49
D. 81
E. Impossible to tell

B. 32 The darkly shaded region has area 81 minus the intersection. The lightly shaded region has area 49 minus the intersection. Thus the difference is $81 - 49 = 32$.