

HOW TO COMPLETE THE ANSWER SHEET

The answers to all questions are integers from 0 to 999. Consider the following example question:

21. If $3x - 216 = 0$, determine the value of x .

The answer is 72, so you must complete the block for question 21 on the answer sheet as follows: shade 0 in hundreds row, 7 in the tens row, and 2 in the units row:

21	H / H	0	<input checked="" type="radio"/>	1	2	3	4	5	6	7	8	9
	T / T	7	0	1	2	3	4	5	6	<input checked="" type="radio"/>	8	9
	U / E	2	0	1	<input checked="" type="radio"/>	3	4	5	6	7	8	9

Write the digits of your answer in the the blank blocks on the left of the respective rows, as shown in the example; hundreds, tens and units from top to bottom. The three digits that you wrote down will not be marked, since it is only for your convenience — only the shaded circles will be marked.

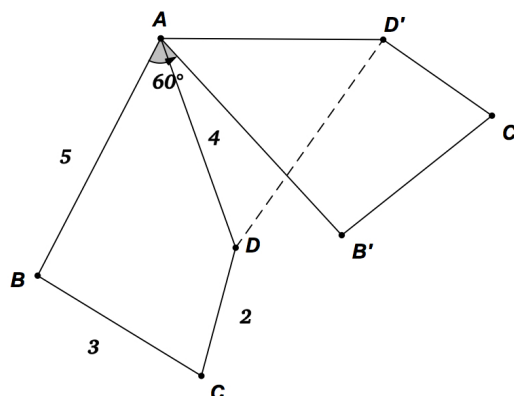
PLEASE DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO

Part A: Four marks each

1. If $\sqrt{(2 + \sqrt{x})} = 3$, what is the value of x ?
2. If x , y and z are real numbers such that $(x - 3)^2 + (y - 4)^2 + (z - 5)^2 = 0$, determine $x + y + z$.
3. Give the approximate value of $\frac{30}{\sqrt{\sqrt{24} - 1}}$ to the nearest integer.
4. The value of M is 3 and M is 30% of Q , Q is 20% of P , and N is 50% of P . What is the value of N ?
5. Six numbers from a list of nine integers are 7, 8, 3, 5, 9 and 5. What is the largest possible value of the median of the nine numbers in the list?

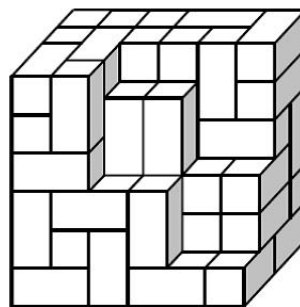
Part B: Five marks each

6. A quadrilateral $ABCD$ with side lengths as shown in the sketch is rotated through 60° counter-clockwise around A . What is the length of DD' ?



7. The product of a , b and c is 2 709, where a , b and c are different integers, all greater than 1 and less than 2 709. What is the maximum value of the sum of a , b and c ?
8. In the South African election each voter votes for only one party. In some other countries such as Switzerland and some Scandinavian countries, each voter ranks (orders) ALL the parties from most preferred to least preferred. If there are 6 parties in such an election, how many different rankings (orderings) are possible?

9. The unfinished cube is being built from identical blocks each of size 1 cm by 1 cm by 2 cm, as shown. How many more blocks are needed to complete the cube?

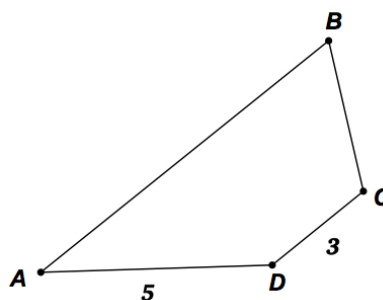


10. If a and b are real numbers such that $3(2^a) + 2^b = 7\sqrt{2}$ and $5(2^a) - 2^b = 9\sqrt{2}$, what is the value of $a + b$?
11. If a die is rolled once, the probability that a 4 shows up is $\frac{1}{6}$. If three dice are rolled the probability that a 4 shows up exactly once is $\frac{x}{72}$. What is the value of x ?
12. How many four-digit multiples of 9 are there in which all the digits are odd and distinct?
13. Leroy grouped the odd numbers in the following way:

$$\{1\}, \{3; 5\}, \{7; 9; 11\}, \{13; 15; 17; 19\}, \dots$$

What is the sum of the numbers in the ninth grouping?

14. In the figure, AB and CD are parallel, angle D is twice angle B , $AD = 5$ and $CD = 3$. Find AB .

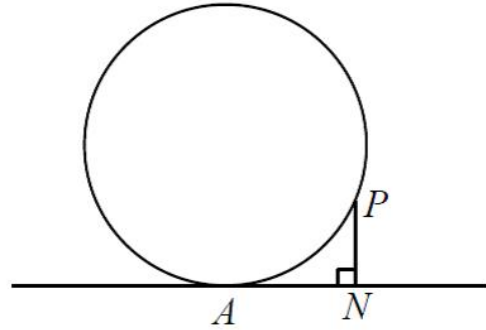


15. In which row will 2014 be if the pattern indicated by the arrows on the right is followed?

1 →	2 ↓	9 →	10	25	...
↓ 4	← 3	8 ↑	11	24	
5 →	6 →	7 ↑	12	23	
16	15	14	13	22	
17	18	19	20	21	
...					

Part C: Six marks each

16. A circle is tangent to a line at A . From a point P on the circle, a line is drawn such that PN is perpendicular to AN . If $PN = 9$ and $AN = 15$, determine the radius of the circle.

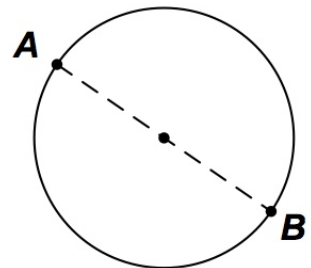


17. In the case of the Grand Hotel diamond theft, inspector Poirot knows that the thief is one or more of Miss Carlyle (room 23), Dr Richards (room 27) and Lady Windermere (room 36). He also knows that
- if Miss Carlyle or Dr Richards is guilty of the theft, then Lady Windermere is also guilty,
 - Lady Windermere and Dr Richards are not both guilty,
 - if Dr Richards is not guilty, then so is Miss Carlyle.

What is the sum of the room number(s) of the thief or thieves?

18. Consider distinct integers a_1, a_2, \dots, a_n between 1 and 14, both values included, such that $a_1 \times a_2 \times \dots \times a_n$ is a perfect square. What is the greatest possible value of n ?

19. A and B ride at constant speeds in opposite directions around a circular track, starting from diametrically opposite points. If they start at the same time, meet one another for the first time after B has ridden 100 metres, and meet a second time 60 metres before A completes one lap, what is the circumference of the track in metres?



20. There are 300 white boxes and n red boxes in storage. Each box contains the same number of soccer balls. The total number of soccer balls in all of the boxes is $n^2 + 290n - 2490$. Determine n .