OUNDLE

School

2017 Academic Scholarship

Mathematics

Paper II

Time Allowed: **2 hours**

Calculators may NOT be used for this paper

Instructions to candidates:

- You are not expected to have time to do all the questions.
- You may answer the questions in any order.
- Choose those questions which you think you can answer best.
- **Remember to show your working and clearly show the method you are using**.
- Answers should be given to 3 significant figures where appropriate.
- π may be taken as 3.14.
- **The number of marks for each question is show in square brackets**

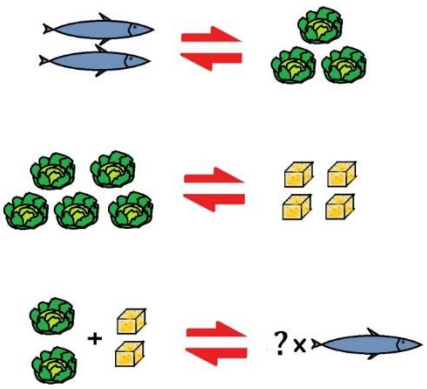
1. I played the Oundle Top Trumps game against my brother 150 times and won 54% of the games. If my brother wins every game from now on, after how many more games will my success rate be down to 50%? [2]

2. Before the invention of money, people satisfied their needs through barter trades, where goods were exchanged between two parties who would want one another's things.

As shown in the top image, a fisherman would like to exchange his fish for some vegetables from a farmer, and they agreed on a barter trade of 2 fish for 3 cabbages.

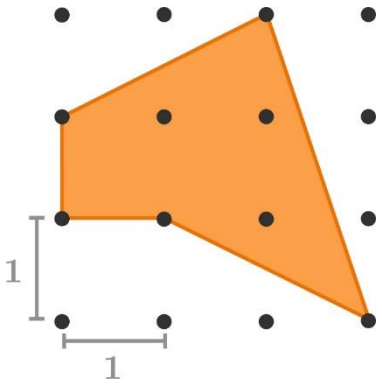
Then a farmer would like to exchange his cabbages for some soaps from a soap maker, and they agreed to trade 5 cabbages for 4 soaps.

Now if the soap maker would like to trade her 2 soaps and 2 cabbages for some fish from the fisherman, according to this barter, how many fish would the fisherman give her? [4]



3. A certain number has exactly eight factors including 1 and itself. Two of its factors are 33 and 15. What is the number? [3]

4. What is the area of the irregular orange polygon in this grid of equally spaced dots? [3]



5. I wrote down all of the numbers that can be produced by changing just one digit of the number 465. How many of the numbers on my list will be prime? Justify your answer.[4]

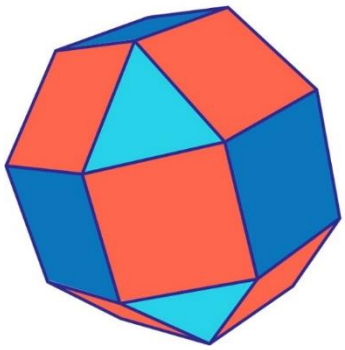
6. Simon is three times as old as Dave was 6 years ago. At that time, Dave was 1 ½ times Matt's age. Now Simon is 1 ½ times as old as Dave. How old are Simon, Dave and Matt now? [4]

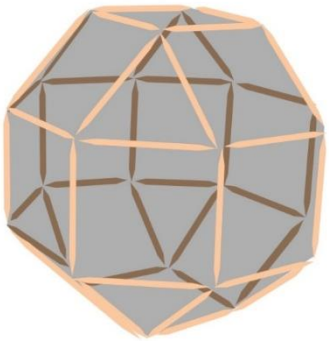
7. Richard takes part in an adventure race. He walks the first tenth of the distance at 3 km/h, runs the next one sixth at 6 km/h, cycles one fifth at 12 km/h and rides a horse the remaining 16 kilometres at a speed of 24 km/h.

Find the total distance that he covers during the race and how long the whole race takes him. [4]

8. If I write 5! this means 5 x 4 x 3 x 2 x 1 which is 120. If I calculated the value of 50!, how many zeroes would it end with? [6]

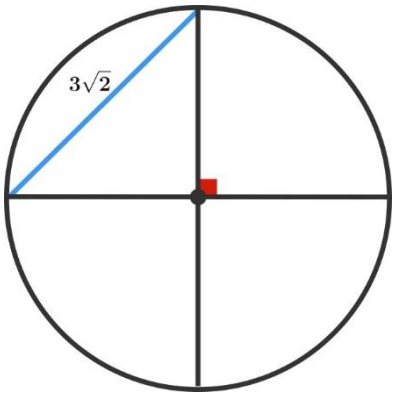
9. A rhombicuboctahedron is a 3D solid that has 18 square faces and 8 triangular faces. How many toothpicks were used to the model rhombicuboctahedron pictured below on the right?





[4]

10. In the diagram below, two chords that are diameters of a circle intersect at right angles. What is the area of the circle? (Leave your answer in terms of π)

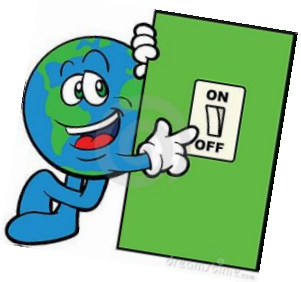


[4]

11. I have a bottle of solution A which contains 150ml of solution with an acidity of 16%. I add this together with a different solution B. The resulting solution made by combining solution A and B is a total volume of 1 litre and has acidity of 50%.

    What is the acidity level of solution B before they are mixed? [4]

12. A factory has a test line of 50 light switches which are all in the OFF position and a group of 50 staff. The first member of staff goes along the line and turns every switch on, the next member of staff goes and switches every second switch OFF. The third member of staff goes to every third switch and, if it is OFF turns it ON but if it is ON turns it OFF. The fourth member of staff goes to every fourth switch and does the same followed by each of the other staff until the 50^{th} member (who goes only to switch 50).



    Once each staff member has done their part, which of the switches are ON? [6]

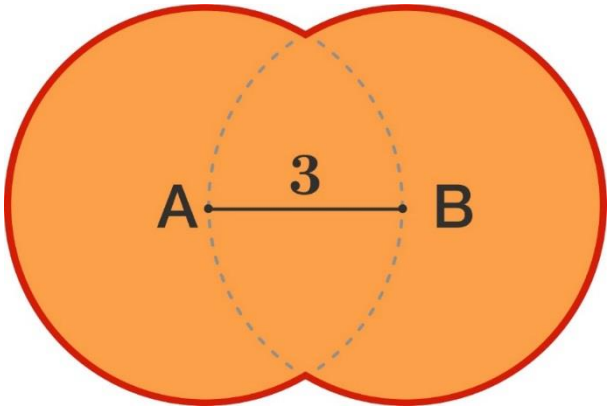
13 Ellen likes the moving walkways in airports. If she walks all of the way along in the correct direction, it takes 15 seconds to get to the end. When she goes the wrong way, it takes 105 seconds to get to the end. If she walks at 2 m/s, how fast is the walkway going? [4]

14. A garden has the shape of a right-angled triangle with sides of length 30, 40 and 50. A straight fence goes from the corner with the right-angle to a point on the opposite side, dividing the garden into two sections which have the same **perimeter**.

    How long is the fence? [6]

15. Find a rule which predicts when the sum of 5 consecutive integers will be divisible by 15. [4]

16. Two overlapping circles, with centres A and B form the figure below. Line segment AB is a radius of both circles. Find the perimeter of the resulting shape. (Leave your answer in terms of π)



[4]

17. How many numbers are there between 1 and 2017 which have an odd number of even digits? [6]