The Haberdashers' Aske's Boys' School Elstree

11+ Entrance Examination 2013

MATHEMATICS
One Hour

Full Name..

Examination Number ....

INSTRUCTIONS

1. DO NOT OPEN THIS PAPER UNTIL YOU ARE TOLD TO DO SO.

2. There are 30 questions on this paper. DO NOT FORGET TO TURN OVER.

3. Work quickly but accurately. You are recommended to use pencil, but you can use pen or biro if you wish.

WRITE YOUR ANSWERS TO THE QUESTIONS IN THE SPACES PROVIDED.
YOU MAY USE THE SPACE AT THE BOTTOM OF EACH PAGE FOR WORKING.   Answer

1.   Add: $36 + 58$

2.   Subtract: $75 - 54$

3.   Multiply: 67×8

4.   Divide: $264 \div 11$

5.   If a dozen eggs cost £2.80, how much do 18 eggs cost?

6.   Find the difference between $43\frac{1}{3}$ and $51\frac{2}{3}$.

7.   A box holds 4 cakes. How many boxes are needed to store 75 cakes?

8.   Put a circle round the volume in the list below which gives the best
      estimate of the capacity of a tea cup:

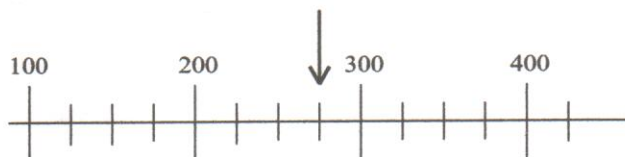   ⟨0.25 litres⟩   0.5 litres   0.75 litres   1 litre   1.25 litres

9.   Write down the number that the arrow is pointing to on the scale below:

10.   Put a circle round the biggest number and a square round the smallest
      number in this list:

      ⟨83%⟩ $\frac{4}{5}$ $\frac{1}{3}$ 0.333   0.825   30%   0.59   ☐0.29 $\frac{29}{90}$

Handwritten answers (right margin):

94

21

536

24

£4.20

$8\frac{1}{3}$

19 boxes

275

Handwritten working (top right):

① $+\begin{array}{r}58\\36\\\hline 94\end{array}$

② $\begin{array}{r}75\\-54\\\hline 21\end{array}$

③ $\begin{array}{r}67\\\times\ 8\\\hline 536\end{array}$

④ $264 \div 11$

$\begin{array}{r}24\\11\overline{)264}\\22\downarrow\\\hline 44\\44\\\hline 0\end{array}$

SPACE FOR WORKING

⑤ 12 eggs = dozen = 280p

6 = ½ of 12 , 6 eggs = 280 ÷ 2 = 140

$\begin{array}{r}280\\+140\\\hline 420\end{array}$ 420p = £4·20

⑥ $51\frac{2}{3} - 43\frac{1}{3}$

51 − 43 = 8

$\frac{2}{3} - \frac{1}{3} = \frac{1}{3}$

$8 + \frac{1}{3} = 8\frac{1}{3}$

⑦ $75 \div 4$

$\begin{array}{r}18\\4\overline{)75}\\-4\downarrow\\\hline 35\\32\\\hline 3\end{array}$

= 18 rem 3

so 19 needed

⑧ conventional cup
size is 250ml
or 0.25 litres

⑨ There are 4 divisions
for every 100, so
each division is 25.
Hence the third is 75.
Therefore 275.

11. Put a circle round the number which **cannot** be expressed as the sum or difference of two other numbers in the list.

2   5   7   10   12   15   (16)   19

12. Fiona buys:

  - 3 cans of coke @ 85p per can
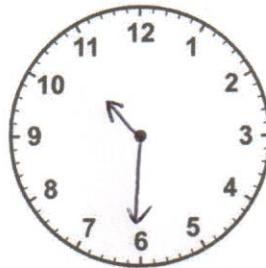 - 5 samosas @ 30p per samosa

  If Fiona pays with a £5 note, how much change does she get?

$$\begin{array}{r} 85 \\ \times\ 3 \\ \hline 255 \end{array} \qquad \begin{array}{r} 30 \\ \times 5 \\ \hline 150 \end{array} \qquad \begin{array}{r} 255 \\ +150 \\ \hline 405 \end{array}$$

$$95p \qquad \begin{array}{r} 500 \\ -405 \\ \hline 095 \end{array}$$

13. Draw the hour and minute hands on this clock to show the time 22:30.

22:30 = 10:30pm

14. Add together the following numbers giving your answer in figures:

    3 million
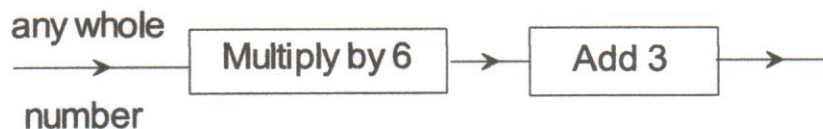   seventy thousand
    thirty-two thousand
    nineteen

    3,102,019

SPACE FOR WORKING

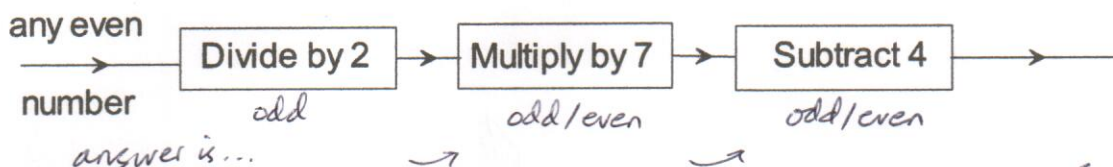$$\begin{array}{r} 3,000,000 \\ 70,000 \\ 32,000 \\ 19 \\ \hline 3,102,019 \end{array}$$

15. For each of the number machines below write down the letter:

   A   if the answer is always even
   B   if the answer is always odd
   C   if the answer is sometimes odd and sometimes even

Any number x 6 = EVEN
EVEN + 3 = ODD
∴ B

any whole number → | Multiply by 6 | → | Add 3 | →

_B_

any even number → | Divide by 2 | → | Multiply by 7 | → | Subtract 4 | →

answer is...   odd   odd/even   odd/even

_C_

16. An orange costs twice as much as an apple. Which one of the following does not cost the same as the other four?

   A   Two oranges and three apples
   B   Seven apples
   C   One orange and five apples
   D   Three oranges and one apple
   E   Four oranges

_E_

SPACE FOR WORKING

$O = 2a$

$A \rightarrow \quad 4a + 3a \quad = 7a$
$B \rightarrow \quad 7a \quad\quad\quad = 7a$
$C \rightarrow \quad 2a + 5a \quad = 7a$
$D \rightarrow \quad 6a + 1a \quad = 7a$
$E \rightarrow \quad 8a \quad\quad\quad = 8a$

4

17. Jonathan thinks of a **whole number**, rounds it to the nearest 100 and gets an answer of 700.

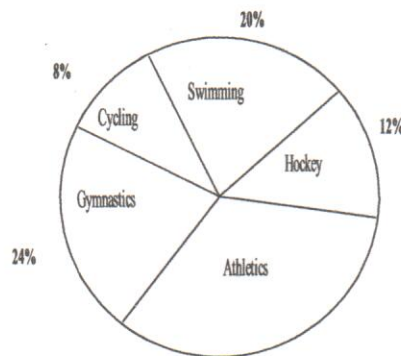   What is the smallest number that Jonathan might have thought of?   _650_

    What is the largest number that Jonathan might have thought of?   _749_

18. A group of people chose their preferred Olympic sport from a list of five: Athletics, Swimming, Cycling, Hockey and Gymnastics.

    The proportions choosing each sport are shown on the pie chart:

    $$24$$
    $$8$$
    $$20$$
    $$12$$
    $$\overline{64\%}$$

    $100 - 64 = 36\%$

    12% is ⅓ of 36%

    ⅓ of 45

    $3\overline{)45}$ = 15

    What percentage of people chose Athletics?   _36%_
    If 45 people chose Athletics, how many chose Hockey?   _15_

19. In the square below, every row, column and diagonal adds up to 15.
    What number must be put into the square labelled A?

2	7	6
9	5	1
4	A	8

    _3_

SPACE FOR WORKING

$8 + 4 = 12$
$15 - 12 = 3$

20. We say that there is an even chance of getting a head when a coin is thrown. Which one of the following statements is definitely true?

    A: There is an even chance that England will win the next football World Cup. ✗

    B: There is an even chance that I get one head and one tail when I toss a coin twice. ✓

    C: There is a greater than even chance that I get a 5 when I roll a single dice. ✗

    D: There is a less than even chance of picking a blue ball from a bag containing 3 blue and 2 red balls. ✗

    E: There is a less than even chance that a baby will be born somewhere in the world in the next minute. ✗

    _B_

21. It takes a team of four people six hours to paint my fence.

    How long would a team of eight people have taken?   _3 hours_

    2x as many people take ½ as much time. 6÷2=3

    One of my neighbours has a similar fence which is twice as long as mine.
    She would like the work to be completed in less than five hours.
    What is the minimum number of people that she should employ?   _10 people_

    ↓ twice the length, so
    4 people takes 12 hours
    8 people takes 6 hours
    10 people takes < 5 hours

22. Work out the following giving your answers in fractions.

    $\frac{1}{2}+\frac{1}{4}=$ _3/4_

    $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}=$ _7/8_

    $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}=$ _15/16_

    $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\frac{1}{64}+\frac{1}{128}+\frac{1}{256}+\frac{1}{512}+\frac{1}{1024}=$ _1023/1024_

    If this pattern is continued the sums get ever closer to a particular number.
    Write down this number.

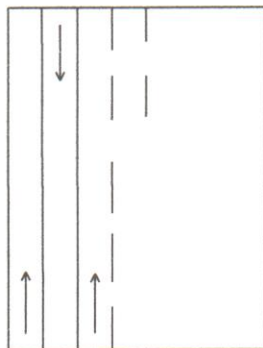   _1_

SPACE FOR WORKING

6

23. The average of a set of numbers is worked out by adding the numbers together and then dividing by the number of numbers.

The average number of runs scored by a cricket team in an innings is 17. What was the total number of runs scored by all eleven players? **187 runs**

In this innings the opening pair of batsmen scored an average of 39.5 runs. What was the average score of the remaining nine members of the team? **12 runs**

$$\begin{array}{r} 17 \\ \times\ 11 \\ \hline 17 \\ 170 \\ \hline 187 \end{array}$$

$$17\overline{)187}$$ runs

$$\begin{array}{r} 39.5 \\ \times\quad 2 \\ \hline 79.0 \end{array}$$

opening pair got 79.0 so the rest scored

$$\begin{array}{r} 187 - \\ -\ 79 \\ \hline 108 \end{array}$$

24. The diagram (not to scale) shows my back lawn which is 30 metres long and 20 metres wide. My lawnmower can cut strips 50 cm wide and I always mow the lawn by walking up and down in straight lines as shown.

50 cm × 2 = 100cm = 1m
20m , so 40 strips

9 players scored 108

$$9\overline{)10.8}\ \ 12$$

How many strips do I need in total? **40**

How far do I walk when I mow my lawn? Give the answer in metres. **1200**

I can push my lawnmower at a constant speed of 30 metres per minute and it takes me an extra 15 seconds to turn the mower round at the end of every strip. The mower itself takes 15 seconds to turn on. How long does it take me to mow my lawn? **50 mins**

$$\begin{array}{r} 40 \\ \times\ 30 \\ \hline 00 \\ 1200 \\ \hline 1200 \end{array}$$

SPACE FOR WORKING

30m per min
1200 ÷ 30 = 40 mins

15s to turn on and 15s at 1st turn
1 turn at every other strip
= 40 strips

40 strips × 15 seconds = 10 mins

10 mins + 40 mins

= 50 mins.

7

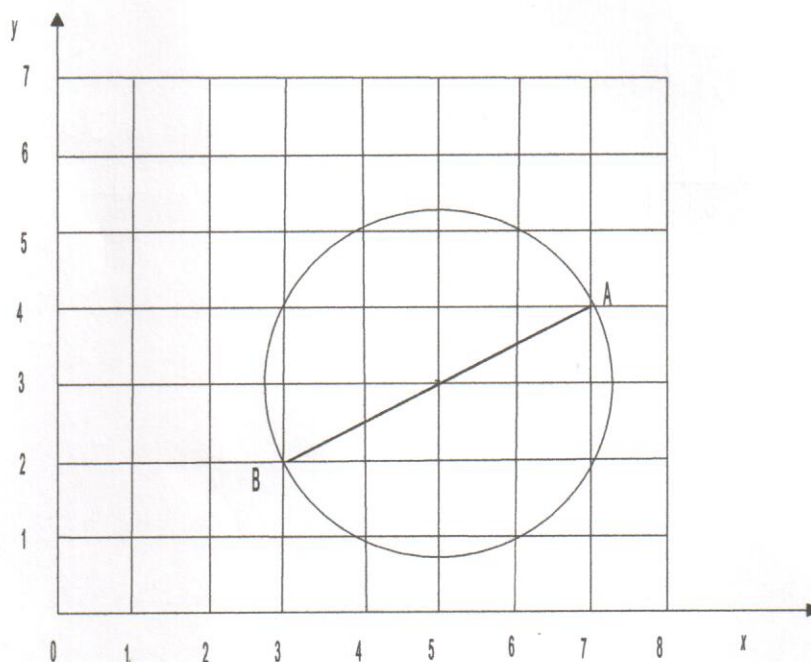25. The diagram shows a circle with a diameter, AB. The point A has coordinates (7, 4).

Write down the coordinates of the point B.

Write down the coordinates of the centre of the circle.

A second circle (not shown) has a diameter with end points A(6, 15) and B(12, 3).

Write down the coordinates of the centre of this circle.

A third circle (not shown) has centre (19, 27). If one end of a diameter has coordinates (17, 32), write down the coordinates of the point at the other end of the diameter.

$(3, 2)$

$(5, 3)$

$6 \rightarrow 12, \quad 3 \rightarrow 15$
middle =
$\qquad 9, 9$

$(9, 9)$

$(21, 22)$

$\qquad 19, 27$
$17, 32$

$17 \rightarrow 19 = 2$
$so \quad x = 21$

$32 \rightarrow 27 = 5$
$27 \rightarrow \boxed{22} = 5$

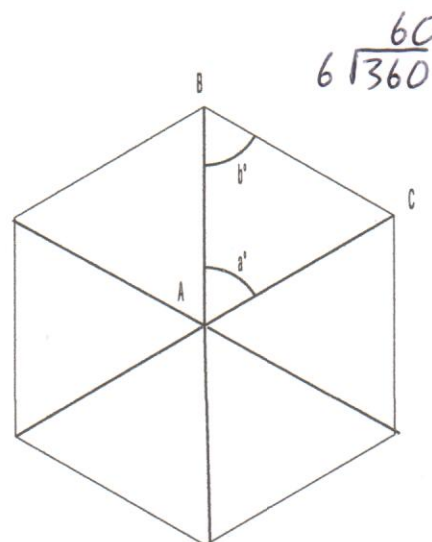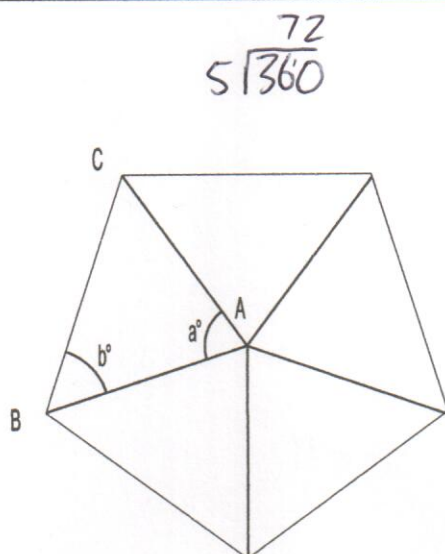$y = 22$

SPACE FOR WORKING

8

26. The diagram shows five and six sided polygons in which all sides have the same length.

Complete the table below.

The following facts may be useful:

- the angle in one complete turn is 360°
- the angles in a triangle add up to 180°

	Five Sided Polygon	Six Sided Polygon
Name of shape	PENTAGON	HEXAGON
Size of angle a	72°	60°
Size of angle b	54°	60°
Name of triangle ABC	ISOSCELES	EQUILATERAL

$$\begin{array}{r} 72 \\ 5\overline{)360} \end{array}$$

$$\begin{array}{r} 60 \\ 6\overline{)360} \end{array}$$

SPACE FOR WORKING

180 − 72

= 108

108 ÷ 2 = 54° → b.

180 − 60 = 120

120 ÷ 2 = 60° → b.

27. The notation 4! is used as an abbreviation for the product $4 \times 3 \times 2 \times 1$
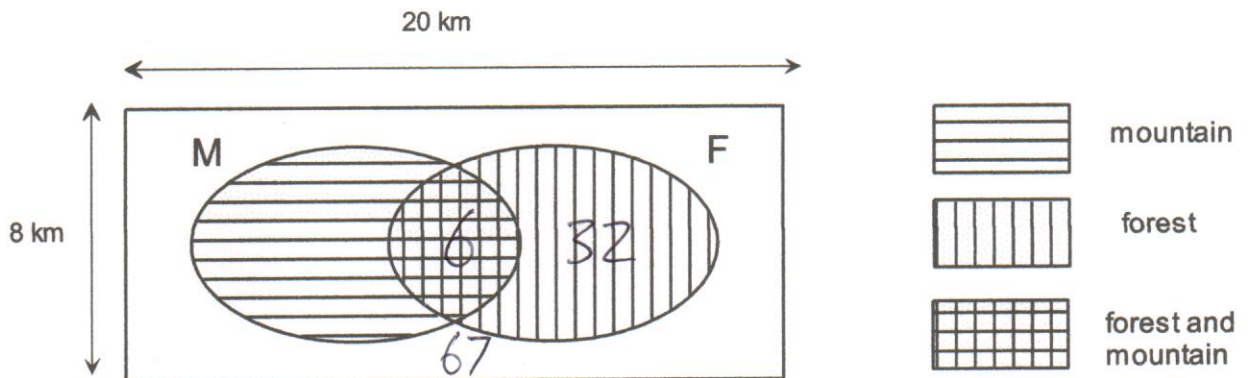so that 4! = 24. Similarly, $9! = 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 362880$.

Work out the value of

$3 \times 2 \times 1 = 6$

3! $\underline{6}$

10! $\underline{3628800}$
$= 9! \times 10 = 362880 \times 10$

$\dfrac{100!}{98!}$ $\underline{9900}$

(margin: 9900)

28. The land of Whasham consists of a rectangular lake with an island in the
centre. The island has three types of terrain as shown in the diagram
below which is not to scale.

20 km

8 km

mountain

forest

forest and
mountain

Work out the area of Whasham. $= 20 \times 8 = 160$

$\underline{160 \text{ km}^2}$

(ii) The area of land which consists of forest but no mountain is 32 km²
and the area which is both forest and mountain is 6 km². The area
of water is 67 km².

Work out the area of land which consists of mountain but no forest.

$\underline{55 \text{ km}^2}$

(iii) A total of 121 people live on the island. If 81 people live on land
which is mountainous and 48 people live on land which is forested,
how many live in the region which is both mountainous and forested?
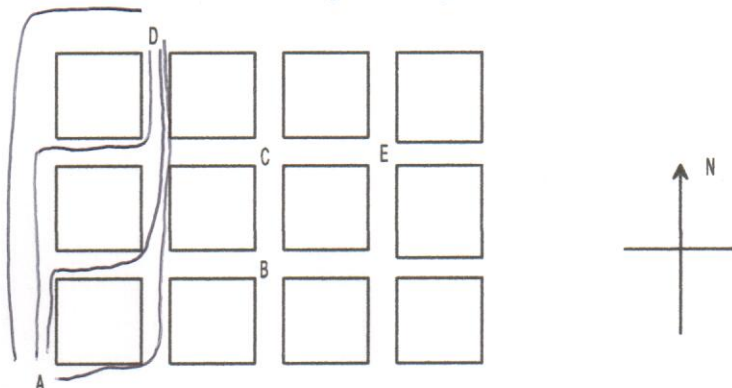
$\underline{8 \text{ people}}$

SPACE FOR WORKING

(ii) $160 - 67 - 6 - 32$
$= 55 \text{ km}^2$

(iii) $81 + 48$
$= 129$ so 8 must live in land of both mountain
and forest.

10

29. The streets of New York are arranged in a grid as shown in the diagram.

There are three direct ways of travelling from A to B.

- Travel one block North followed by two blocks East
- Travel one block East followed by one block North followed by one block East
- Travel two blocks East followed by one block North.

We write these as NEE, ENE and EEN respectively.

There are six direct routes from A to C. Four of these routes are NNEE, NENE, ENEN and EENN. Write down the remaining two routes.
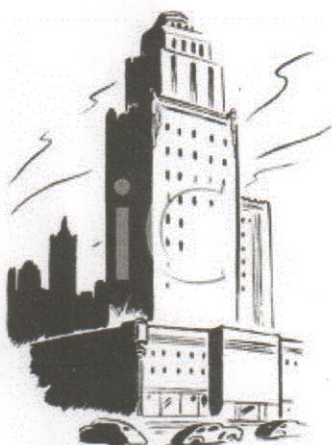
*NEEN*and *ENNE*

How many direct routes are there to travel from A to D?

4

How many direct routes are there to travel from A to E?

10

SPACE FOR WORKING

TURN OVER. THE LAST QUESTION IS ON THE BACK PAGE.

30. Ten runners, numbered 5 to 14 inclusive, take part in a race. There were no tied positions.

Winston watched the race but forgot to write down the positions of the runners. Fortunately Winston is a mathematician and he remembered one fact about the number of each competitor. List all possible numbers of the competitors in the spaces below. Hence complete the table showing the final positions in the race.

1st Prime number _____7_____

2nd Factor of 24 _____6_____

3rd Cube number _____8_____

4th Multiple of 5 _____5_____

5th Factor of 187 _____11_____

6th Two-digit even number in which the first digit is smaller than the second _____12_____

7th Two-digit number in which both digits are square numbers _____14_____

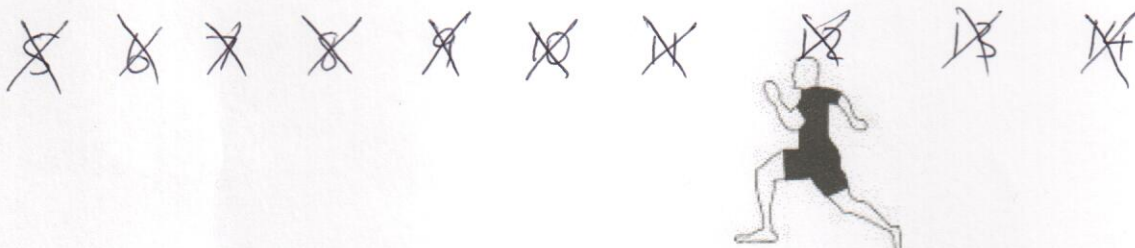8th Number which has exactly four factors _____10_____

9th A square number _____9_____

10th A number which is greater than 10 _____13_____

Position in race	1	2	3	4	5	6	7	8	9	10
Number of runner	7	6	8	5	11	12	14	10	9	13

SPACE FOR WORKING

Now go back and check all of your answers carefully