

## NMOS 2014 Special Round

Time Duration: 1.5 hour

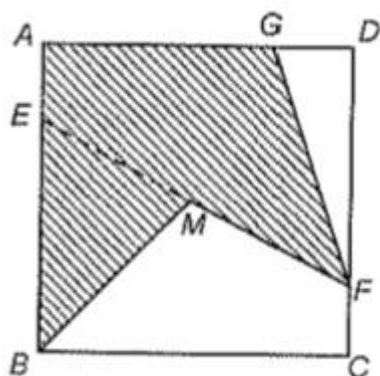
Name: \_\_\_\_\_

Marks: \_\_\_\_\_

- At first, in level P5 of a particular school, 40% of the students were boys. After 10 boys transfer out from and 20 girls transfer into the level, the boys made up 35% of the level. How many girls are there in the level now?

- Evaluate  $20\frac{1}{17} \times 50\frac{19}{20}$ . (Round off your answer to the nearest whole number.)

- The figure below shows a square  $ABCD$  of side length  $24\text{cm}$ . Given that  $AE = CF = DG = \frac{1}{4}AB$  and  $M$  is the midpoint of  $EF$ , find the area (in  $\text{cm}^2$ ) of the shaded region.



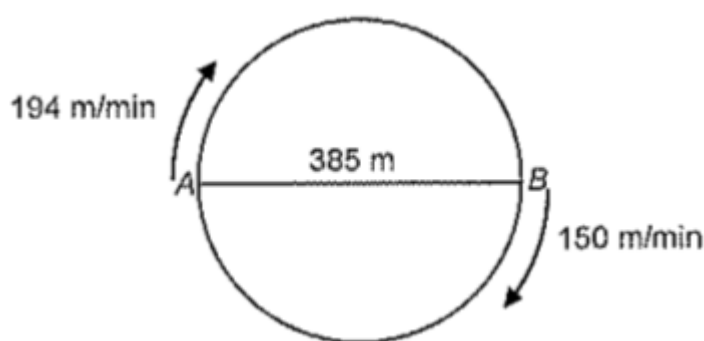
4. Each of the letters  $E, F, I, N, O, R, S, T, X$  and  $Y$  represents a different one of the digits 0,1,2,3,4,5,6,7,8 and 9 such that

$$\begin{array}{r}
 TEN \\
 TEN \\
 + FORTY \\
 \hline
 SIXTY
 \end{array}$$

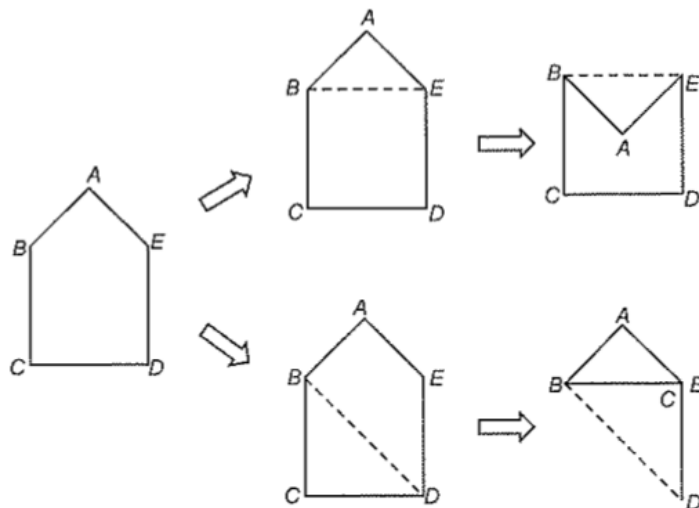
Given that  $N = 0$  and  $E = 5$ , find the 4-digit number “FORT”.

5. The diagram below shows a circular running route with diameter  $AB$ . Adam starts jogging in a clockwise manner at 194 m/min from point  $A$  while Bernard starts jogging in a clockwise manner from point  $B$  at 150 m/min. If diameter  $AB$  is 385 m, what is the total distance (in m) that both Adam and Bernard have jogged when Adam overtakes Bernard for the first time?

(It is known that the circumference of a circle is  $\pi d$ , where  $d$  is the diameter. We assume that  $\pi = \frac{22}{7}$ .)



6. The figure at the left below shows a pentagon  $ABCDE$ . If it is folded along the line  $BE$ , a square  $BCDE$  is obtained, the diagonal of which is 20 cm. If it is folded along the line  $BD$ , a quadrilateral  $ABDE$  is obtained with  $AE \parallel BD$  and  $AB \parallel AE$ . Find the area (in  $\text{cm}^2$ ) of the pentagon  $ABCDE$ .



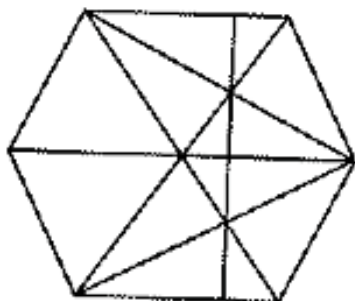
7. Mr. Lim is a stamp collector. At first, 75% of his stamps were from Singapore. After he gave some stamps from Singapore to his friends, 68% of his stamps are from Singapore. If Mr. Lim now has 325 stamps, how many stamps did he have at first?
8. In a school of 2014 students, 520 students wear both glasses and braces while 434 students wear neither. Given that the ratio of the number of students wearing glasses to the number of students wearing braces is 11:9, find the number of students wearing glasses but not braces.

9. Let  $S$  and  $R$  be the volumes of a big cube and a small cube respectively. The total surface area of the big cube is equal to  $\frac{49}{25}$  times the total surface area of the small cube. Find the value of  $\frac{1000S}{R}$ .

10. Given that the minute hand and the hour hand of a clock form an angle of  $p^\circ$  at 8:25 am, find the value of  $10p$ .



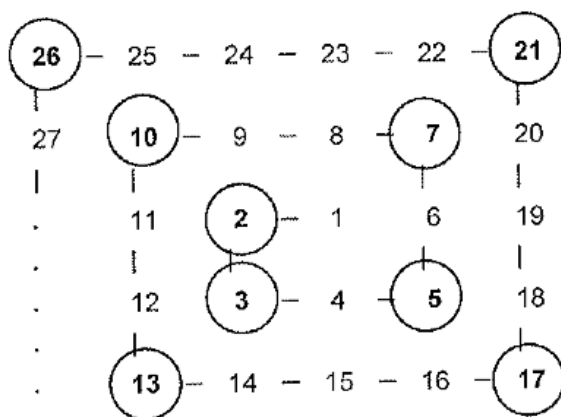
11. How many triangles are there in the figure below?



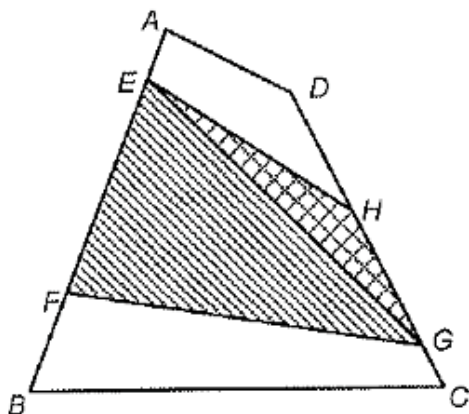
12. Given that  $x$  and  $y$  are whole numbers such that  $\frac{1}{x} - \frac{1}{y} = \frac{1}{6}$ , find the largest value of  $x + y$ .

13. Given that  $a, b, c$  and  $d$  are whole numbers such that  $a \times b \times c \times d = 2014$ , how many different solutions for  $a, b, c$  and  $d$  are there?

14. The numbers 1 to 2014 are placed in a spiral number pattern. The numbers at the  $1^{st}$ ,  $2^{nd}$ ,  $3^{rd}$ ,  $4^{th}$  and  $5^{th}$  corners are 2, 3, 5, 7 and 10 respectively. What is the number in the last corner?



15. The figure below shows a quadrilateral  $ABCD$ . It is known that the points  $E$  and  $F$  are on the side  $AB$  such that  $AE:EF:BF = 1:4:2$  and that the points  $G$  and  $H$  are on the same side  $CD$  such that  $CG:GH:DH = 1:3:3$ . If the area of triangle  $EFG$  is  $52 \text{ cm}^2$  and the area of the triangle  $EGH$  is  $12 \text{ cm}^2$ , find the area (in  $\text{cm}^2$ ) of the quadrilateral  $ABCD$ .



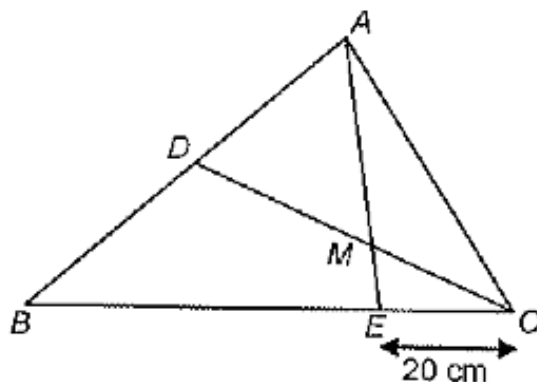
16. A sequence of 20 numbers is given as follows.

$$\left(\frac{4}{5} + \frac{5}{25}\right), \left(\frac{4}{6} + \frac{6}{25}\right), \left(\frac{4}{7} + \frac{7}{25}\right), \dots, \left(\frac{4}{23} + \frac{23}{25}\right), \left(\frac{4}{24} + \frac{24}{25}\right)$$

It is known that each of the numbers is of the form  $\left(\frac{4}{k} + \frac{k}{25}\right)$ , where  $k = 5, 6, \dots, 24$ .

Given that  $\frac{m}{n}$  is the smallest value among the 20 numbers in the sequence and that  $\frac{m}{n}$  is in its simplest form, determine the value of  $m + n$ .

17. The figure below shows a triangle  $ABC$  with a point  $D$  located on the side  $AB$  such that  $\frac{AD}{AC} = \frac{AC}{AB} = \frac{2}{3}$ . The point  $M$  is the midpoint of  $CD$  while  $AM$  extended intersects  $BC$  at  $E$ . If  $CE = 20$  cm, find the length (in cm) of  $BE$ .



18. Given that  $\frac{x}{9900} = 0.201414141414\dots$ , a repeated decimal where '14' keeps repeating, find the value of the whole number  $x$ .

19. The numbers 1 to 2014 are placed in the following table,

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	...	...	...	...
⋮	⋮	⋮	⋮	⋮	⋮	⋮
2010	2011	2012	2013	2014		

A type M rectangle

A type N rectangle

There are two different types of rectangles in the table. A type M rectangle includes 6 numbers in two consecutive rows, while a type N rectangle includes 6 numbers in two consecutive columns.

If the sum of numbers in a type M rectangle is the same as the sum of numbers in a type N rectangle, then these two rectangles are known as a friendly pair. The above examples of type M and type N rectangles form a friendly pair as they have the common sum of 123.

Find the number of friendly pairs in the table.



20. Four students A, B, C and D took a quiz last week. The students were required to indicate “T” (for True) or “F” (for False) for each question. There were 9 questions in total and each question carries 10 marks. Answers indicated by these four students and their scores were given as follows:

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Total
A	T	F	F	T	T	F	F	F	F	40
B	F	F	T	T	F	T	T	T	F	40
C	T	F	T	T	T	T	F	T	F	70
D	F	T	F	F	T	T	F	F	F	60

Which four questions did student A answer correctly?

If your answer is Q1, Q2, Q3 and Q4, write it as 1234 (The order should be from the smallest to the biggest).