Oundle School

Academic Scholarship 2007

Preliminary Examination

Mathematics

Time :   1½ Hours

No calculating aids may be used.

Solutions are to be written in this booklet. Please write your answers in the spaces provided. Any additional pieces of paper used in the examination must be stapled to this booklet.

Candidates are encouraged to answer questions 1 to 7 to the best of their ability before proceeding to questions 8 to 14.

Candidates should avoid spending too long on a single question. If a candidate is having difficulty with a particular question then they should move on and return to it at the end.

Different marks are awarded for different questions. The total mark for each question is given in square brackets at the end of the question.

This paper is intended to be challenging. Candidates should not expect to be able to answer all of the questions. Candidates are encouraged to show their working and their reasoning. Marks can be awarded for partial answers to questions.

There is a total of 100 marks on this paper. Candidates should not be disappointed if they only manage to score about half the marks.

1 Evaluate the following, writing your answers as fractions in their lowest terms:

(i) $\dfrac{5}{8} - \dfrac{1}{5}$

(ii) $\dfrac{3}{13} \times \dfrac{7}{9}$

(iii) $\dfrac{3}{7} \div \dfrac{6}{35}$

(iv) $\dfrac{8}{9} + \dfrac{2}{3} \times \dfrac{1}{6}$

[9]

2 Substitute $w = 4$, $x = -1$, $y = 3$ and $z = 2$ into the following expressions and work out their numerical value:

(i) $y + x$

(ii) $-wxyz$

2   **(continued)**

(iii) $(y + z)(y^2 - x)$

(iv) $\dfrac{w^2 + z^2}{y - 2x}$

[8]

3   Solve the following equations to find all possible values for *x*.

(i) $x + 6 = 8$

(ii) $12x = 72$

(iii) $18 = 4x - 10$

(iv) $2(x + 3) - x = 3(x - 4) + x$

3   *(continued)*
        Solve the following equation to find all possible values for *x*.
        (v) $x(x-5)=121-5x$

                                                                                    [10]

4   Find the next two terms in the following sequences
        *[There is no need to cancel fractions in this question but you
        may wish to do so]*
        (i)   18, 25, 32, 39,…..

        (ii)   81, 27, 9, 3, ….

        (iii)   0, 3, 8, 15, 24, ….

        (iv) $\dfrac{4}{1}, \dfrac{5}{2}, \dfrac{6}{6}, \dfrac{7}{24},$

                                                                                    [8]

5   *(i)*   Find the mean of the numbers
                  12, 13, 19, 21, 34, 37, 39.

5   *(continued)*
      (ii)   A different set of eleven numbers has a mean of 82.
          (a)   What do the eleven numbers add up to?

          (b)   One of the eleven numbers is 92. What is the
                    mean of the other ten numbers?

[7]

6   A card is picked out of a standard pack of 52 playing cards
(with no jokers). Writing your answers as fractions in their
simplest terms, find the probability that
      (i)   the card is a Queen

      (ii)   the card is either the Queen of Spades or the Queen
                of Clubs

As the card is picked up, a gambler manages to spot out of
the corner of his eye that the card is a picture card (Jack,
Queen or King) and that its suit is either Clubs or Spades.
      (iii)   Given this information, what is the probability that it
                is the Queen of Clubs?

[6]

7   Find the angle $B\hat{C}D$ in the diagram below (not drawn to scale).
        Explain which angles you have found to get the answer and which
        angle rules you have used at each stage.
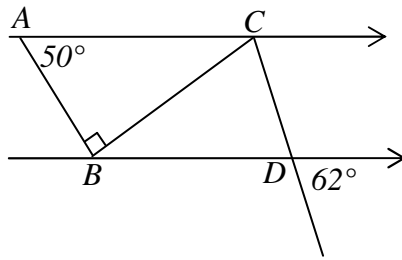
_____ [5]

***Remember: Candidates are encouraged to answer questions 1 to 7 to
the best of their ability before proceeding to questions 8 to 14.***

8   The numbers 1, 2, 3, …. up to the highest number are placed evenly
        around the circumference of a circle. If the number 7 is opposite the
        number 67, what is the highest number?

_____ [4]

9   At 9 o'clock the angle between the two hands of a clock is 90°. At 9:30 the angle between the hands of the clock is 105°. What is the angle at 9:20?

[4]

10   *(i)*   In a race over 36 miles a hare travels at an average of 6mph for the first 18 miles and 12mph for the next 18 miles. What is the hare's average speed over the journey?

          (ii)   In another race over the same course a tortoise travels at an average speed of 9mph. If the hare only manages to travel at 6mph for the first half of the journey, at what speed must the hare travel for the second half of the course in order to finish at the same time as the tortoise?

[8]

11 A crime has been committed by a person acting alone. The detective, Inspector Bodget, has narrowed down the suspects to four people, Alf, Ron, Reg and Jack. They give the following statements

Alf: "Ron did it"
Ron: "Jack did it"
Reg: "I did not do it"
Jack: "Ron lied when he said I did it"

(i) If exactly one of them is telling the truth, who did it?

*(ii)* If exactly one of them is lying, who did it?

[6]

12 In the picture of the flag below (shown in black and white and not drawn to scale) the breadth of the horizontal bar of the cross equals the breadth of the vertical bar of the cross and is a whole number. The dark area equals the white area. The flag measures 35cm wide and 12cm high. Find the breadth of the bars of the cross. Use any method to find the answer.
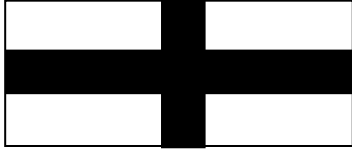

[6]

13 A man runs at constant speed once anticlockwise around a track starting at a point *S*. His coach stands at a fixed point *F*. A rough graph is drawn to show the shortest distance between the two men against time. Examples of such graphs are shown below
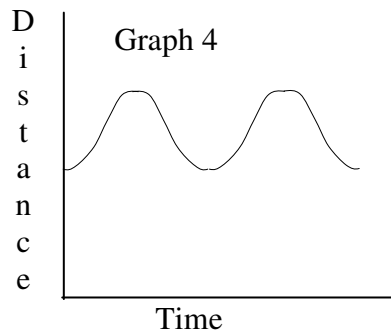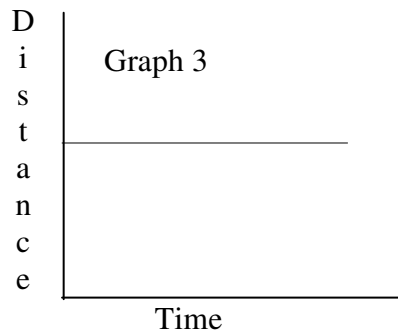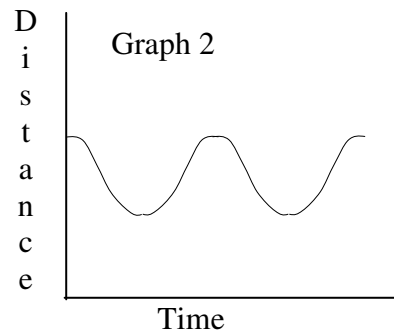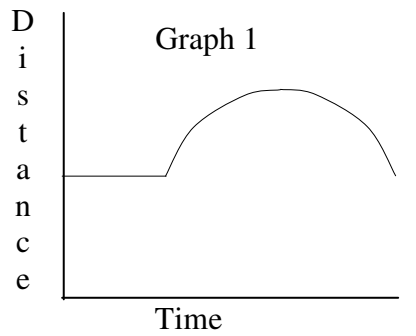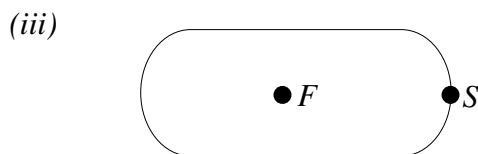

Identify, by writing down the graph number, which of the graphs goes best with which picture of the track, starting point *S* and fixed point *F* in each of the following diagrams.
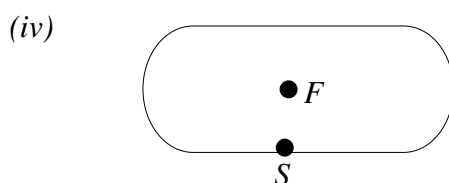
(i)

Graph _____

(ii)
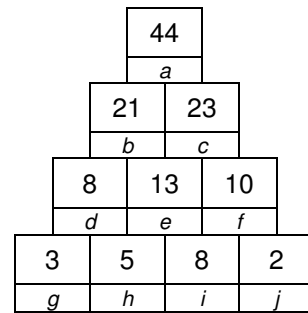

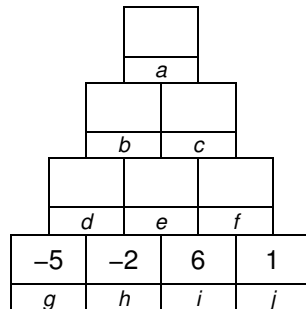*Graph* _____

(iii)

Graph _____

(iv)
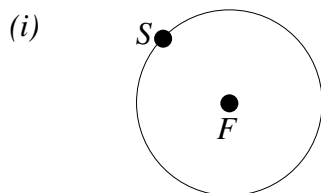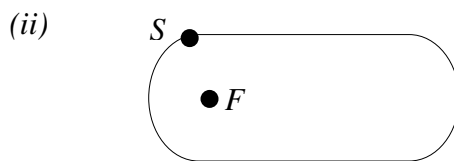
Graph _____

[8]

14 The diagram on the right is an example of a number pyramid. The number in each large rectangle is the sum of the two numbers directly below it. The letters are used to label the rectangles, so rectangle *f* contains the number 10.
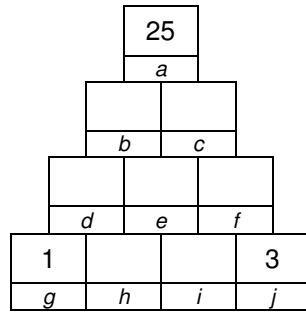
	44	
	a	

21	23
b	*c*

8	13	10
d	*e*	*f*

3	5	8	2
g	*h*	*i*	*j*

(i) Find the number which goes in rectangle *a* of this number pyramid

		a		

	b	*c*	

d	*e*	*f*

−5	−2	6	1
g	*h*	*i*	*j*

(ii) Find the number which goes in rectangle *e* of this number pyramid

	31	
	a	

b	*c*

5		8
d	*e*	*f*

11
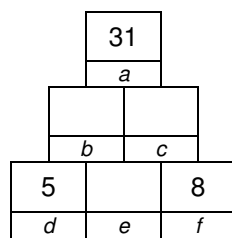
(iii)   In this number pyramid, the number in rectangle *b* is four times bigger than the number in rectangle *i*. Find the number which goes in rectangle *i*.

25
a

b	*c*

d	*e*	*f*

1			3
g	*h*	*i*	*j*

[11]