Mathematics Entrance Exam Syllabus for 13+ Entry to City of London School

There will be one paper, lasting 1¼ hours. Candidates can write in either pencil, blue or black ink. They will need a ruler. Calculators are not allowed.

The exam will be based on the topics below.

Using and applying mathematics

Ability to follow a chain of mathematical reasoning, spotting inconsistencies. Problem solving.

Number and algebra

Finding highest common factors (HCF's) and lowest common multiples (LCM's). Adding, subtracting, multiplying and dividing fractions and mixed numbers. Converting fractions to decimals or percentages, and vice versa. Ordering numbers such as 0.27, $\frac{2}{7}$, 30%. Finding fractional and percentage changes, and related questions. Estimating by rounding numbers to one significant figure. Understanding the effect of multiplying or dividing by numbers between 0 and 1. Solving problems using simple ratios.

Finding a formula for the nth term of a linear sequence. Substituting values into a formula.
Forming and solving linear equations. Solving simple inequalities.
Multiplying out expressions such as $(x - 3)(x + 5)$, and simplifying the answer.
Drawing graphs of equations such as $y = 3x - 5$ and $y = x^2 + 3x$.

Shape, space and measures

Solving problems using angle and symmetry properties of polygons, and angle properties of intersecting and parallel lines. Knowing and applying the formulas for; the circumference of circles; the area of parallelograms, trapeziums, triangles, and circles; and the volume of cylinders. Enlarging plane shapes by a positive scale factor from a given centre. Using Pythagoras's theorem. Compound measures such as (average) speed. Three-figure bearings.

Handling data

Problems involving mean, median and mode. Theoretical and experimental probability. Listing possible outcomes. Appreciating that the sum of the probabilities of all mutually exclusive outcomes of a simple experiment is 1.

CITY OF LONDON SCHOOL

City of London School

Specimen Entrance Examination

MATHEMATICS

Group 3

Name:_____ **Candidate No.**_____

Time allowed: $1\frac{1}{4}$ **hours**

Write your answers on the question paper.

Marks may be obtained for showing clear working, which should appear in the spaces provided.

CALCULATORS ARE NOT ALLOWED.

1. Work out

a) $1.21 - 13.31 + 146.41$

a).....

b) $6.991 - 1.996$

b).....

c) $(1.41)^2$

c).....

d) $2.009 \div 0.49$

d).....

2. Solve these equations.

a) $13 - 12x = 49$

a) $x =$ .....

b) $3(x-8)=12-6x$

b) $x =$ .....

c) $\frac{x}{15}-5=3$

c) $x =$ .....

3. Multiply out the brackets, simplifying where possible.

a) $3x(4x-y)$

a) .....

b) $(x-7)(x+7)$

b) .....

c) $(5x-4)^2$

c) .....

4. Solve the inequality $5-2x<1$.

.....

5. If $h = 8, m = -4, s = -6$, find the value of

a) $h - (m - s)$

a).....

b) $h - m - s$

b).....

c) $\dfrac{m - h}{s - m}$

c).....

6. $\sqrt{2009} = 44.821\ 869\ 662\ 029\ \ldots$

a) Round $\sqrt{2009}$ to the nearest whole number.

a) .....

b) Round $\sqrt{2009}$ to 6 decimal places

b).....(6 d.p.)

7.

a) Increase £4560 by 35%.

a) £.....

b) Convert $\frac{49}{140}$ to a percentage.

b) .....

8. Work out the following in their **simplest** form, and as mixed numbers if necessary.

a) $1\frac{2}{3}+\frac{4}{5}$

a).....

b) $11\frac{1}{13}\div 12$

b).....

c) $\frac{987\,789}{888\,888}-\frac{654\,456}{888\,888}$

c) .....

d) $24\div\left(5-\frac{24}{5}\right)$

d) .....

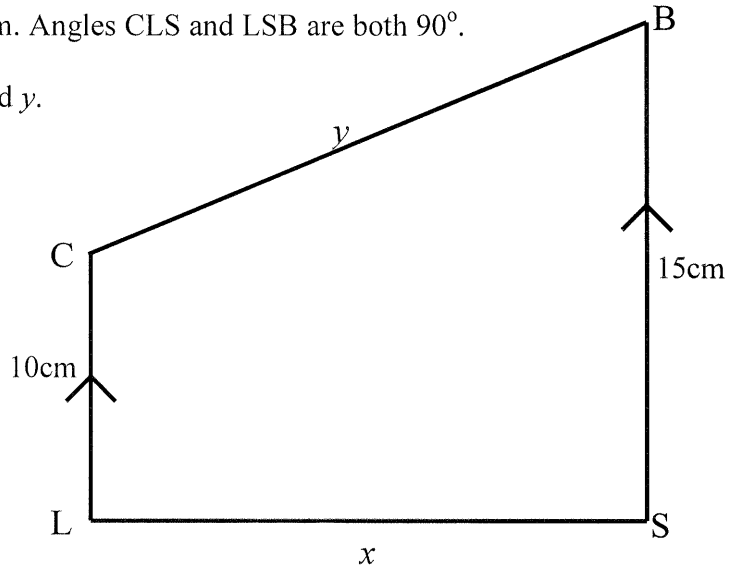
9. Abbott walks uphill at a rate of 400 metres in 6 minutes. Hale can do 500 metres in 10 minutes. They start together at the bottom of a 600m hill. How long must Abbott wait at the top for Hale to catch up?

.....minutes

10.

The area of the trapezium CLSB is 150 cm^2.
CL = 10cm, SB = 15cm. Angles CLS and LSB are both 90°.

Find the values of x and y.



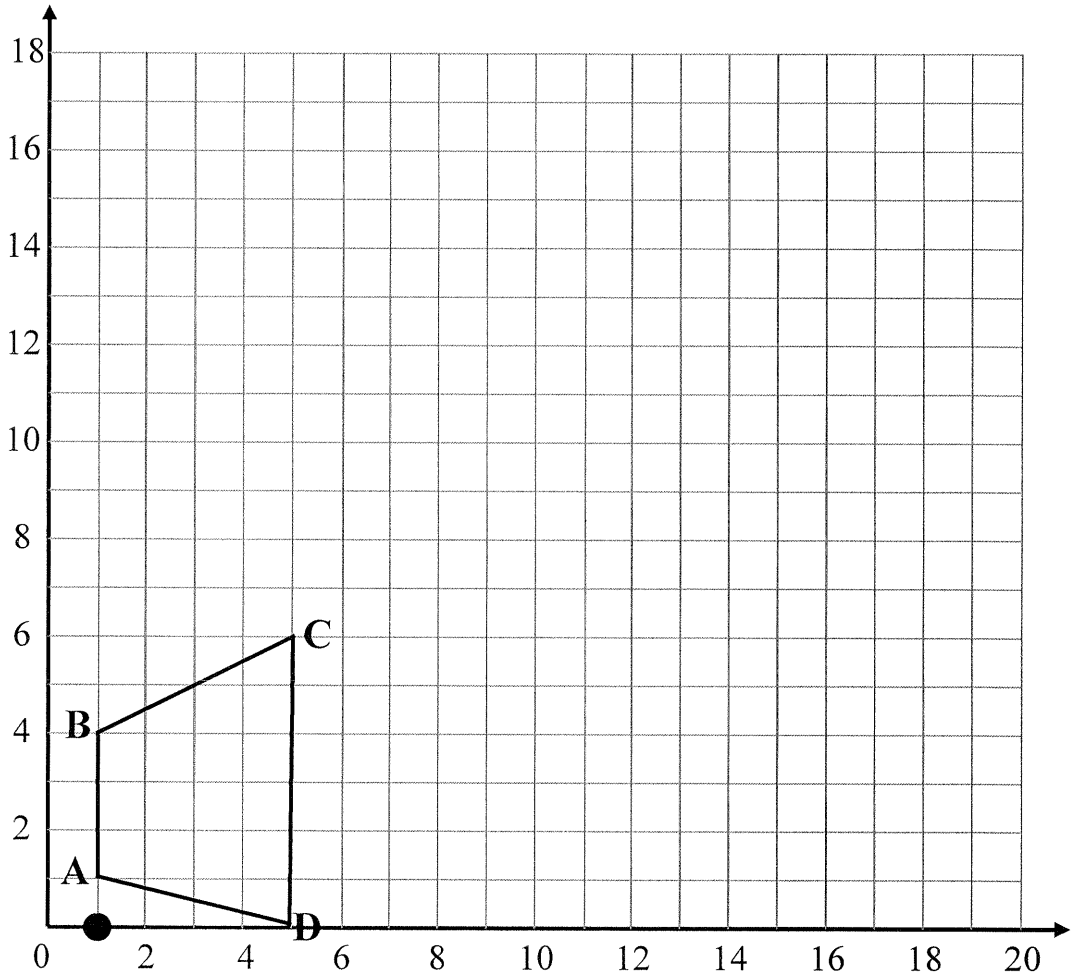
x = ... cm y = ...cm

11.

a) Write down the area of the trapezium ABCD.

a) .....units^2

b) Enlarge the trapezium ABCD using a scale factor of 3 and centre of enlargement (1,0).



c) Write down the area of the enlarged shape.

c) .....units^2

12.

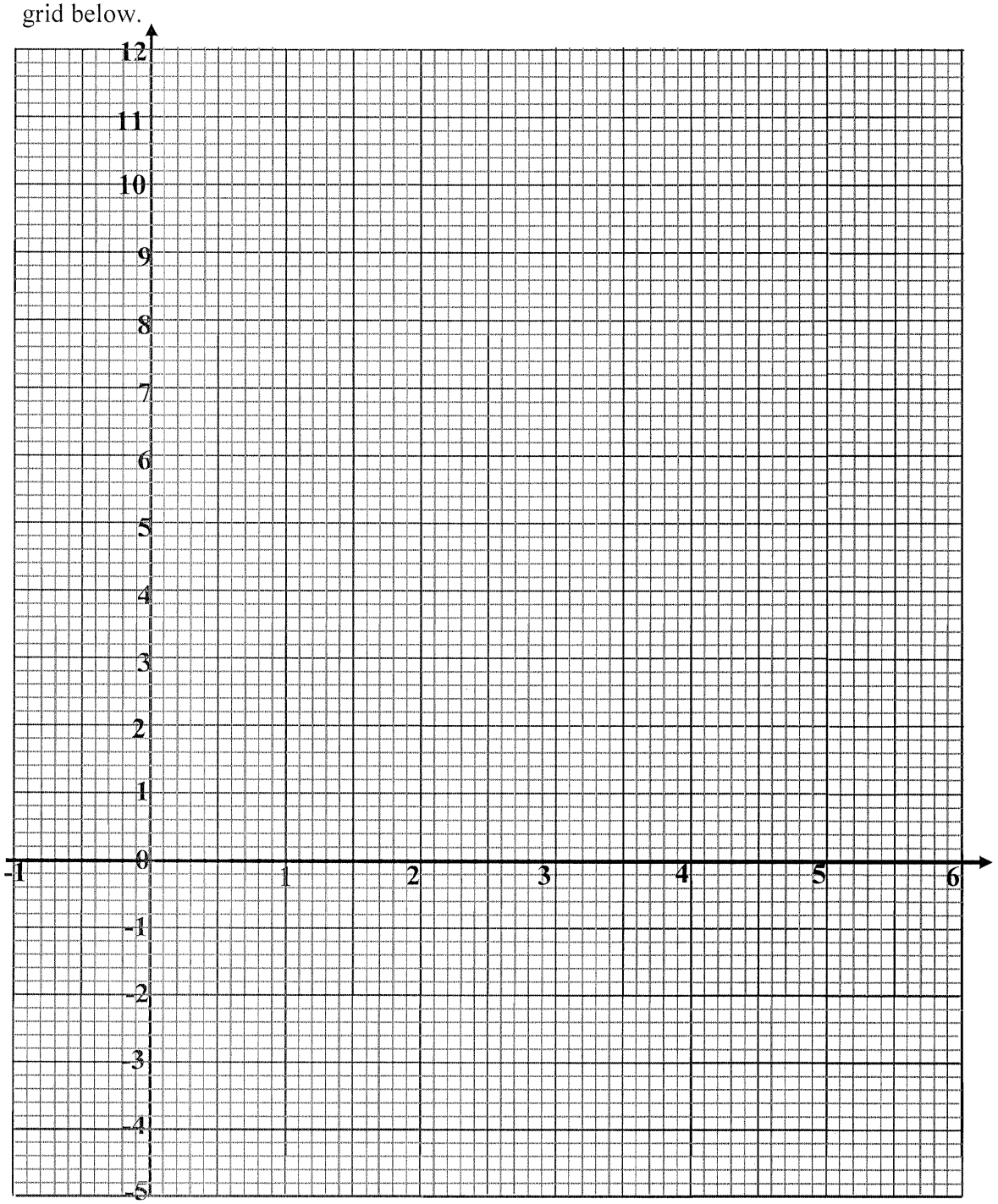
a) $y = 2x - 3$

Work out the value of y for each value of x in the coordinates below:

(–1 , ...) (0 , ...) (1 , ...) (2 , ...)

(3 , ...) (4 , ...) (5 , ...) (6 , ...)

b) Use your coordinates from **a)** to draw the straight line graph of $y = 2x - 3$ on the grid below.



c) Complete the table below for $y = x^2 - 4x$.

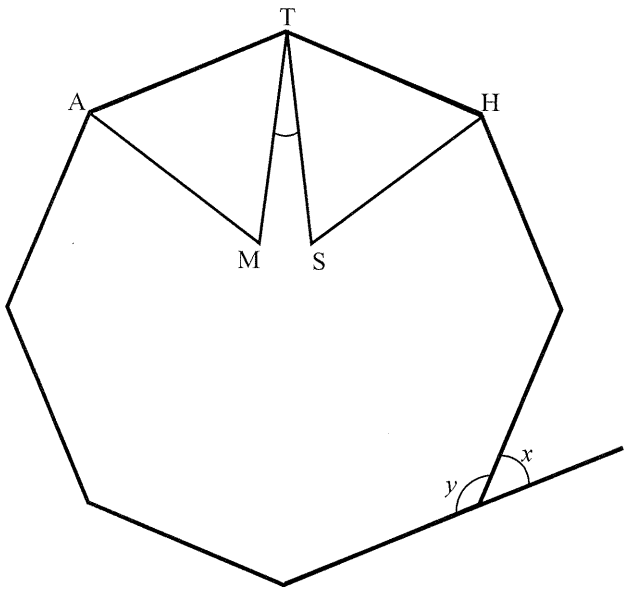
x	−1	0	1	2	3	4	5	6
y								

d) Hence draw the graph of $y = x^2 - 4x$ on the same axes.

e) Write down the co-ordinates of the points where the graphs intersect.
Give your answers correct to 1 d.p.

c) (....., ...) and (....., ...)

13. Two equilateral triangles MAT and THS are drawn on the sides of a regular octagon.



a) Calculate the exterior angle x and the interior angle y of the regular octagon.

a) exterior angle x = ... interior angle y = ...

b) Calculate angle MTS.

b) MTS = ...

14.

a) A 3 sided spinner is coloured red, yellow and blue. The probability it lands on red is 0.3 and on yellow is 0.45.
What is the probability it lands on blue?

a) .....

b) Another spinner is four sided and coloured red, yellow, blue and green. It is four times as likely to land on red as on yellow and twice as likely to land on yellow as on blue. Blue and green are equally likely.
Find the probability it lands on blue.

b) .....

15. Write $1\frac{3}{7}$, 1.4142, 141%, $1\frac{21}{50}$ in order of size, from the **smallest** to the largest.
[You **must** show your working]

smallest =....., ..., ..., largest = ...

16.

a) Express 2009 as a product of its prime factors.

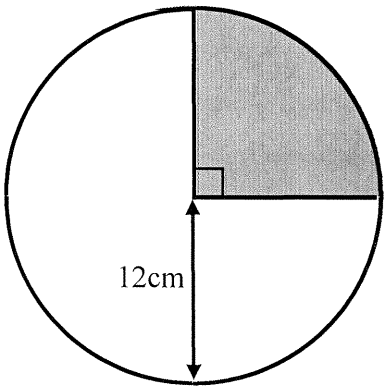
a) 2009 = ...

b) Given that $1996 = 2^2 \times 499$, use your answer to part (a) to work out in its simplest form $\dfrac{1996 \times 287 \times 42}{2009 \times 998}$.

b) $\dfrac{1996 \times 287 \times 42}{2009 \times 998}$ = ...

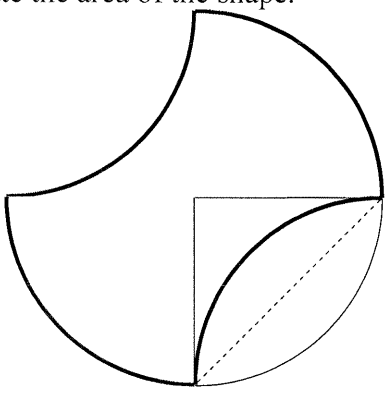
17. For a circle radius r, area $A = \pi r^2$.

a) A circle of radius 12cm is shown below.
Calculate the shaded area.
(leave your answer as a multiple of π)



a) ..... cm^2

b) Two quarter arcs are reflected to give the shape below..
Calculate the area of the shape.



b) ..... cm^2

END OF EXAM

SPECIMEN MATHEMATICS PAPER:

GROUP III

1. (a) 134.31 (b) 4.995
(c) 1.1881 (d) 4.1

2. (a) $13 - 12x = 49 \Rightarrow 12x = -36$
$\Rightarrow x = -3$

(b) $3(x-8) = 12 - 6x \Rightarrow 3x - 24 = 12 - 6x$
$\Rightarrow 9x = 36$
$\Rightarrow x = 4$

(c) $\frac{x}{15} - 5 = 3 \Rightarrow \frac{x}{15} = 8 \Rightarrow x = 120$

3. (a) $12x^2 - 3xy$ (b) $x^2 - 49$ (c) $25x^2 - 16$

4. $5 - 2x < 1 \Rightarrow 5 < 1 + 2x$
$\Rightarrow 2x > 4$
$\Rightarrow x > 2$

5. (a) 6 (b) 18 (c) 6

6. (a) 45 (b) 44.821870

7. (a) $(4560 \div 20) \times 7 + 4560 =$ £6,156
(b) $\frac{49}{140} = \frac{7}{20} = \frac{35}{100} =$ 35%

8. (a) $\frac{5}{3} + \frac{4}{5} = \frac{25+12}{15} = 2\frac{7}{15}$
(b) $\frac{144}{13} \div 12 = \frac{12}{13}$
(c) $\frac{333,333}{888,888} = \frac{3}{8}$
(d) $24 \div \frac{1}{5} = 120$

9. A: 9 mins H: 12 mins
Difference = 3 mins

10. $\frac{10+15}{2} \times x = 150 \Rightarrow x = 12$ cm
$y^2 = 12^2 + 5^2 \Rightarrow y = 13$ cm

11. (a) Area = 18 units^2
(b) Enlarged Trapezium has vertices:
A' = (1, 3) C' = (13, 18)
B' = (1, 12) D' = (13, 0)
(c) Area = $18 \times 3^2 = 162$ units^2

12. (a) (-1, -5) (0, -3)
(1, -1) (2, 1)
(3, 3) (4, 5)
(5, 7) (6, 9)

(b) Straight line through (-1, -5) and (6, 9).

(c)

x	-1	0	1	2	3	4	5	6
y	5	0	-3	-4	-3	0	5	12

(d) Smooth curve through points above.

(e) (0.5, -2.9) and (5.4, 7.8)
0.4–0.6 (-2.8)–(-2.9) 5.3–5.5 7.6–8.0

13. (a) Exterior angle $= \frac{360}{8} = 45°$
Interior angle $= 180 - 45 = 135°$
(b) Angle MTS $= 135 - 60 - 60 = 15°$

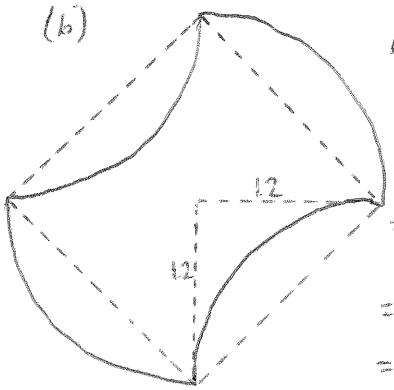
14. (a) $1 - (0.3 + 0.45) = 0.25$
(b) $\frac{1}{8}$

15. $1\frac{3}{7} = 1.428\ldots$
$141\% = 1.41$
$1\frac{21}{50} = 1.42$
So: $141\%, 1.4142, 1\frac{21}{50}, 1\frac{3}{7}$
Smallest, Largest

16. (a) $2009 = 7^2 \times 41$
(b) $\frac{1996 \times 287 \times 42}{2009 \times 918} = \frac{2^2 \times 499 \times 7 \times 41 \times 2 \times 3 \times 7}{7^2 \times 41 \times 499 \times 2}$
$= 12$

17. (a) $\frac{\pi \times 12^2}{4} = 36\pi$ cm^2

(b)



Area of shape
= Area of square
= 4 × (Area of triangle)
$= 4 \times \frac{1}{2} \times 12 \times 12$
$= 288$ cm^2