St Mary's School
CAMBRIDGE

Lower Sixth Maths

Sample Entrance Examination

Time allowed: 60 minutes

Name: _____

Total : 60 marks

INSTRUCTIONS

1. You may **NOT** use a calculator.
2. Work through as many questions as you can.
3. Full marks will be given to solutions that show a complete method.
4. If you do not understand a question, miss it out and go on to the next one.
5. When you have done all that you can, return to the question(s) that you have missed.

Examiner's comments

Percentage achieved

1.

The nth term of a sequence is $2n^2$

(i) Find the 4th term of the sequence.

.....

(ii) Is the number 400 a term of the sequence?

.....

Give reasons for your answer.

(Total for Question 1 = 3 marks)

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2 (a) Simplify

(i) $a^5 \div a^2$

.....

(ii) $2x^2 \times 3x^2 y^2$

.....

(b) Expand and simplify $(x + 3)(x + 7)$

.....

(c) Factorise fully $3pq - 12p^2$

.....

(d) (i) Factorise $3y^2 - 10y + 3$

.....

Hence, or otherwise

(ii) Factorise $3(x + 2)^2 - 10(x + 2) + 3$

.....

(Total for Question 2 = 11 marks)

3. Solve the simultaneous equations

$$4x - 3y = 11$$

$$10x + 2y = -1$$

$x =$ ……

$y =$ ……

(Total for Question 3 = 4 marks)

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4. Work out the value of

(a) $(2^2)^3$

.....

(b) $(\sqrt{3})^2$

.....

(c) $\sqrt{2^4 \times 9}$

.....

(d) 4^{-2}

.....

(Total for Question 4 = 5 marks)

5. Simplify $\dfrac{3x^2 - 16x - 35}{9x^2 - 25}$

.....

(Total for Question 5 = 3 marks)

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6. The point A has coordinates $(-5, 1)$.

The point B has coordinates $(7, y)$.

The point $(x, 6)$ is the midpoint of the line segment AB.

Find the value of x and the value of y.

x = ...

y = ...

(Total for Question 6 = 2 marks)

7. $\sqrt{3} = 3^k$

(a) Write down the value of k

.....

(b) Expand and simplify $(2 + \sqrt{3})(1 + \sqrt{3})$

Give your answer in the form $a + b\sqrt{3}$

where a and b are integers

.....

(Total for Question 7 = 3 marks)

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8. Prove that the difference between the squares of consecutive odd numbers is a multiple of 8

(Total for Question 8 = 6 marks)

9.

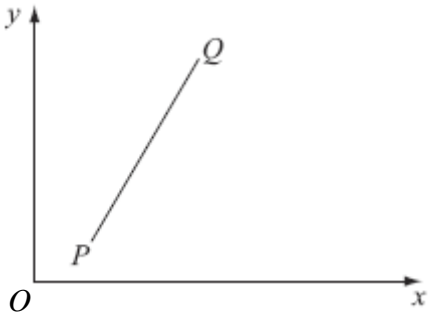


Diagram **NOT** accurately drawn

P is the point with coordinates (2, 1).
Q is the point with coordinates (14, *k*).

The gradient of *PQ* is $\frac{3}{2}$

Work out the value of *k*.

k = ...

(Total for Question 9 = 3 marks)

Please turn over for the rest of the examination questions

10.

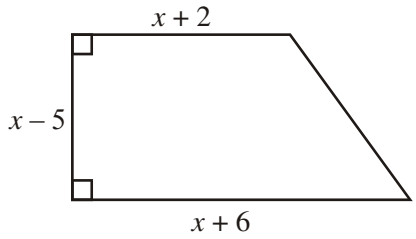


Diagram **NOT** accurately drawn

The diagram shows a trapezium.

The lengths of three of the sides of the trapezium are $x - 5$, $x + 2$ and $x + 6$.
All measurements are given in centimetres.

The area of the trapezium is 36 cm^2.

(a) Show that $x^2 - x - 56 = 0$

(4)

(b) (i) Solve the equation $x^2 - x - 56 = 0$

.....

(ii) Hence find the length of the shortest side of the trapezium.

..... cm

(4)

(Total for Question 10 = 8 marks)

Please turn over for question 11

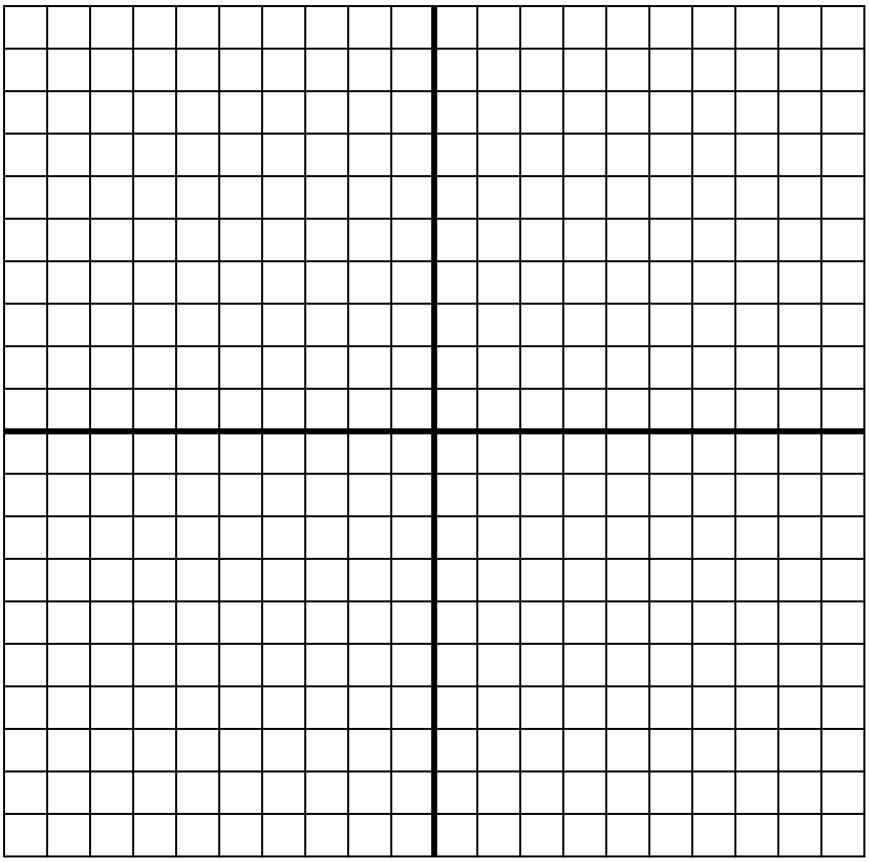
11. Solve $\frac{3}{x-2}+\frac{8}{x+3}=2$

.....

(Total for Question 11 = 5 marks)

Please turn over for question 12

12 (a) On the grid draw the graph of $y = x(x - 3)$



(b) Using your result for (a), or otherwise,
solve the simultaneous equations

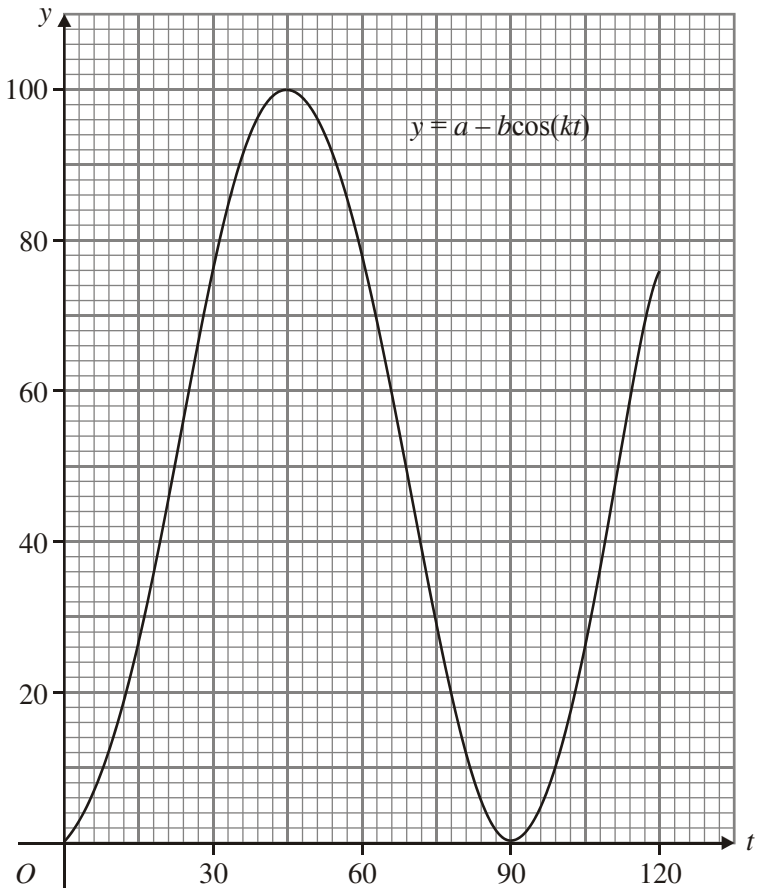
$y = x(x - 3)$

$x^2 + y^2 = 9$

(Total for Question 12 = 5 marks)

Please turn over for question 13

13.



The graph of $y = a - b\cos(kt)$, for values of t between 0° and 120°, is drawn on the grid.

Use the graph to find an estimate for the value of

(i) a,

.....

(ii) b,

.....

(iii) k.

.....

(Total for Question 13 = 3 marks)

END OF EXAMINATION, PLEASE GO BACK AND CHECK YOUR WORK