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.

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Examiner's comments

Percentage achieved

**1.**

The $n$th 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.**

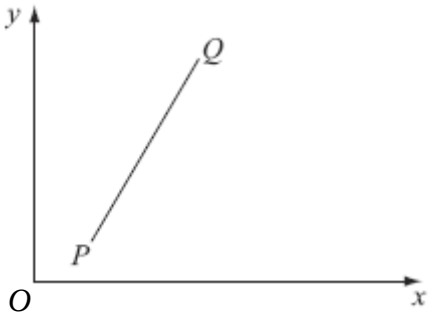


Diagram **NOT** accurately drawn

*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)**

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**Please turn over for the rest of the examination questions**

**10.**

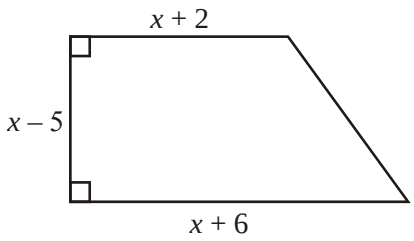



Diagram **NOT** accurately drawn

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**

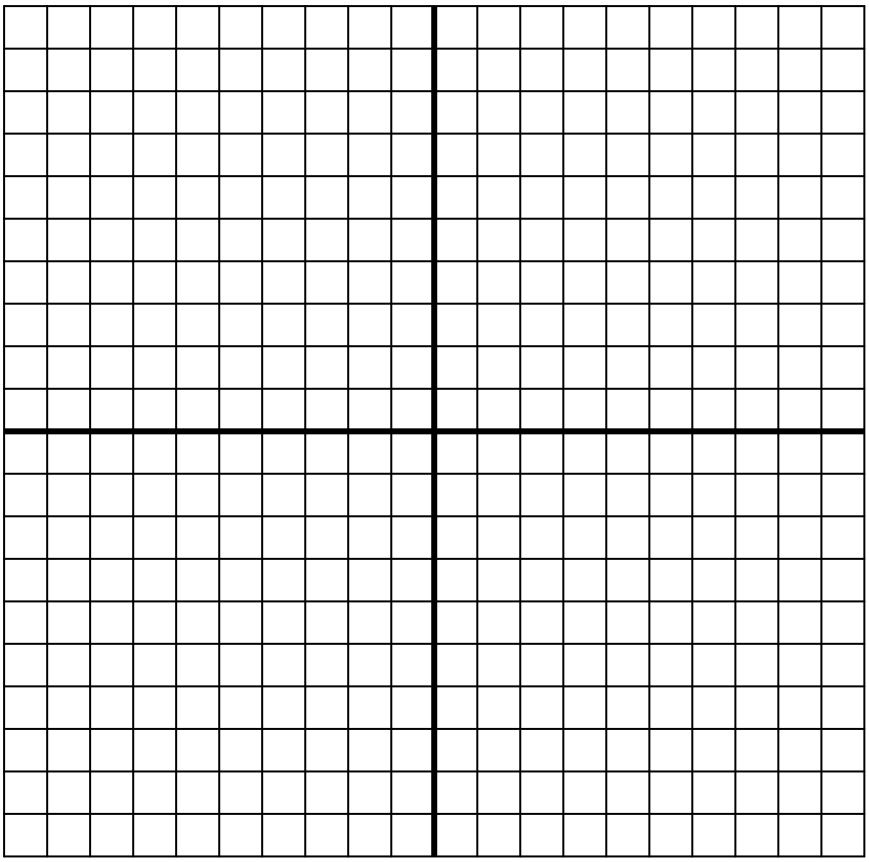
**11.** Solve $\frac{3}{x-2}+\frac{8}{x+3}=2$

.....

**(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

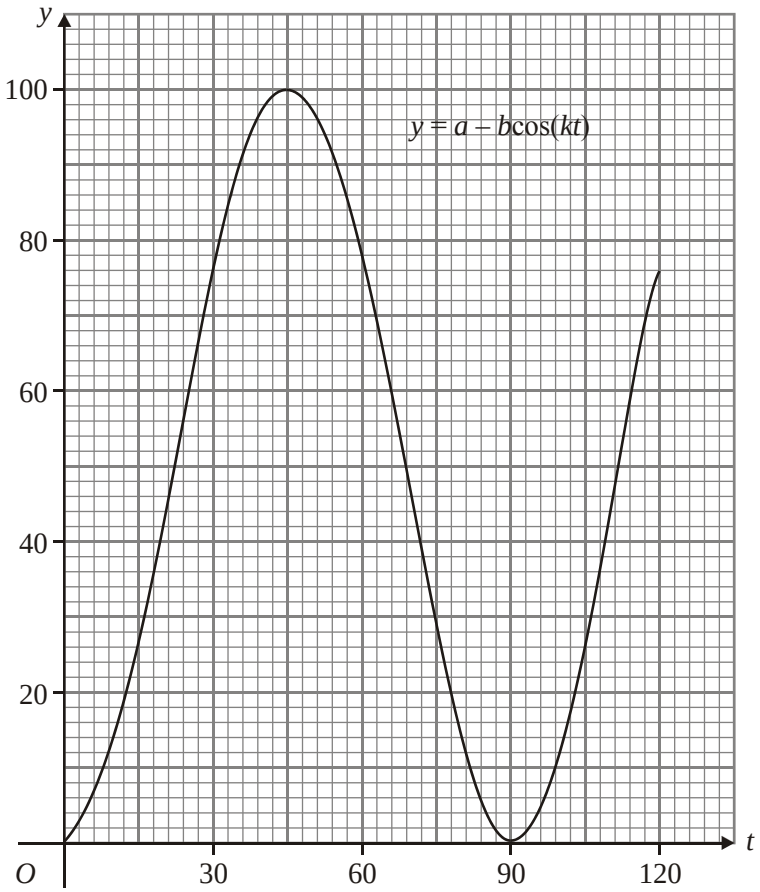
$y = x(x - 3)$

$x^2 + y^2 = 9$

**(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)**

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**END OF EXAMINATION, PLEASE GO BACK AND CHECK YOUR WORK**