Name:

Practice Paper for AQA Level 2 Certificate
FURTHER MATHEMATICS
Paper 1 Non-Calculator

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- mathematical instruments.

You must **not** use a calculator.

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information
- The marks for questions are shown in brackets
- The maximum mark for this paper is 80.
- You may ask for more graph paper and tracing paper. These must be tagged securely to this answer book.

Copies of this paper and worked solutions can be found at bossmaths.com/level2fmpractice, also accessible via this QR code.

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Answer **all** questions in the spaces provided.

1 Factorise fully $6a^4b - 15ab^3$

[2 marks]

Answer _____

2 Work out the values of p, q and r such that $2x^2 - 8x + p \equiv q(x + r)^2 + 19$

[3 marks]

$p =$ _____ $q =$ _____ $r =$ _____

3 Work out $\begin{pmatrix} 2 & 6 \\ 4 & 5 \end{pmatrix}\begin{pmatrix} 8 & 1 \\ 10 & 3 \end{pmatrix}$

[2 marks]

Answer _____

4 How many numbers satisfy **all** of the following conditions?

- The number is a four-digit integer..
- The second digit is 8.
- The other digits are all odd numbers.

[3 marks]

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Answer _____

5 Simplify $\sqrt{8}(\sqrt{98}+\sqrt{32}-\sqrt{50})$ writing your answer as an integer.

[3 marks]

Answer _____

6 Solve $x^2 - x < 12$

[2 marks]

Answer _____

7 Use **matrix multiplication** to show that, in the $x-y$ plane,

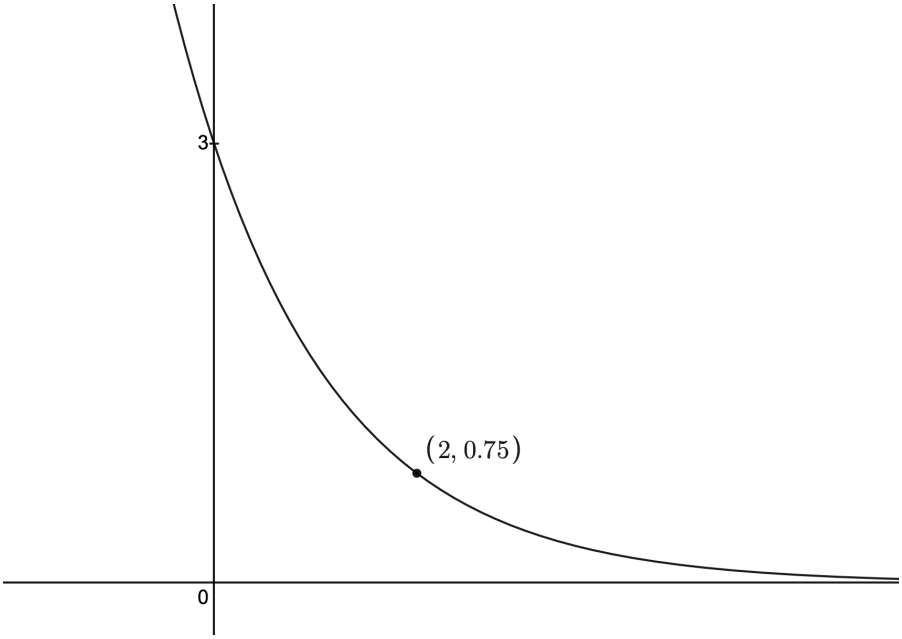
- a reflection in the line $y = x$, followed by
- a reflection in the line $y = -x$

is equivalent to a rotation of 180º about the origin.

[3 marks]

8 The curve shown has equation $y = ab^{-x}$ where a and b are positive integers. The point $(2, 0.75)$ lies on the curve. Find the values of a and b.

[2 marks]



$a =$ _____ $b =$ _____

9 The curve with equation $y = x^5 + 4x^3 - 6x^2 - 5x + 13$ has a turning point at $(1,7)$.
Determine whether this point is a maximum or a minimum.

[2 marks]

Answer _____

10 $f(x) = 2x - 1$
$g(x) = x^2 + 3$

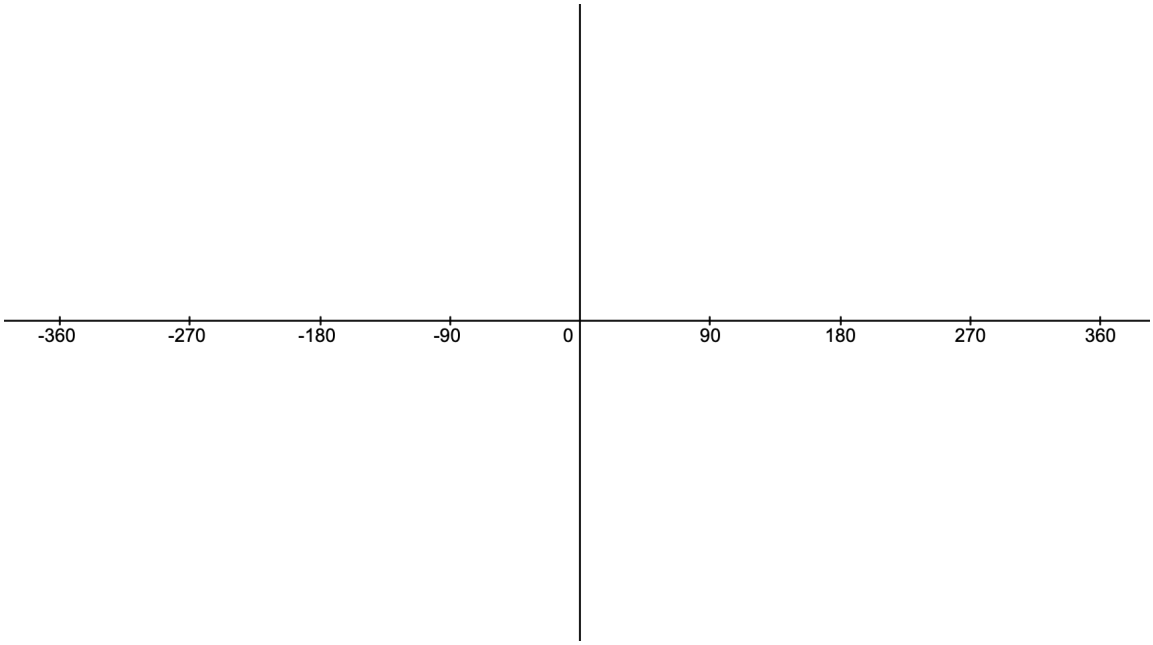
Work out $fg(x)$

[2 marks]

Answer _____

11 **(a)** On the axes, sketch $y = \cos x$ for $-360° \leqslant x \leqslant 360°$

[3 marks]



(b) You are given that $180° < u < 360°$ and that $\tan u = 1$
Find the value of u.

[1 mark]

Answer _____

12 The nth term of a sequence is U_n

$$U_n = \frac{4n - 11}{5n}$$

(a) Work out the least value of n for which $U_n \geq 0.7$

[3 marks]

Answer _____

(b) Write down the limiting value of U_n as $n \to \infty$

[1 mark]

Answer _____

13 **(a)** Show that $(2\sin\theta + \cos\theta)(\cos\theta - 2\sin\theta) + 2 \equiv 5\cos^2\theta - 2$

[3 marks]

(b) Hence, or otherwise, find the value of $(2\sin 60° + \cos 60°)(\cos 60° - 2\sin 60°)$

[3 marks]

Answer _____

14 The table lists the equations of three straight lines.

Equation of line	Gradient	y-intercept
$y = 7 - 3x$		
$5x + 2y = 20$		
$\frac{y - 21}{x - 5} = 3$		

Fill in the gradients and y-intercepts of each line.

[6 marks]

15 **(a)** The circle with equation $(x + 5)^2 + (y - 3)^2 = 25$ has three points of intersection with the coordinate axes. Find the coordinates of the these three points.

[3 marks]

Answer _____, _____, _____

(b) The three points of intersection are joined to form a triangle. Work out the ratio of the length of this triangle's shortest side to its longest side. Write your answer in the form 1: n, where n is an integer.

[4 marks]

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Answer _____

16 **(a)** The point *P* has coordinates $(2, a)$. *P* lies on the curve with equation $y = x^3 + 5x^2 - 4x - 20$. Find the value of a.

[1 mark]

Answer _____

(b) Find the equation of the normal to the curve at point *P*, writing your answer in the form $y = mx + c$

[4 marks]

Answer _____

17 $\mathrm{f}(x) = x^3 + ax^2 + bx + c$

You are given that $x^2 - x - 12$ is a factor of $\mathrm{f}(x)$.
You are also given that $x^2 - 9x + 20$ is a factor of $\mathrm{f}(x)$.

Find a, b, and c.

[5 marks]

$a =$ _____ $b =$ _____ $c =$ _____

18 Solve the simultaneous equations.

$$3x + 3y + 6z = 9$$
$$x - y + 2z = -1$$
$$5x - 2z = 2$$

Do **not** use trial and improvement.
You **must** show your working.

[5 marks]

$x =$ _____ $y =$ _____ $z =$ _____

19 This circle has radius 7 cm.
You are given that $a : b : c : d = 6 : 2 : 3 : 1$

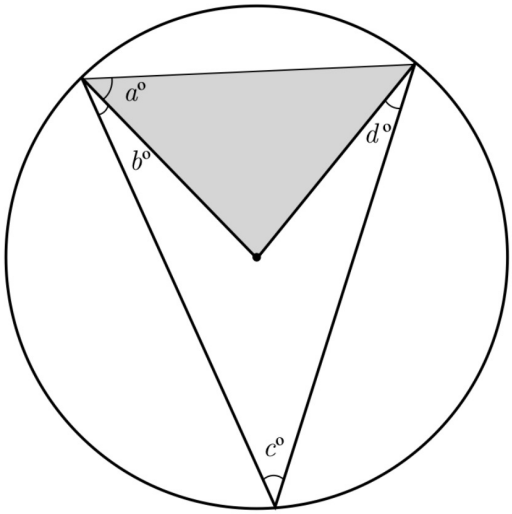

Diagram not drawn accurately.

Find the shaded area in cm^2, giving your answer in the form $\frac{u\sqrt{v}}{w}$, where u, v, and w are integers.

[5 marks]

Answer _____

20 You are given that $10 \times 5^{17} + 23 \times 5^{18} = 5^n$
Find the value of n.

[4 marks]

$n =$ _____

21 Prove that the difference between the squares of two different odd numbers is always a multiple of 8.

[5 marks]