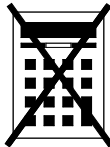# AQA

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.
- Fill in the boxes at the top of this page.
- 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.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
TOTAL	

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

1 Work out the distance between the points A $(-3, 7)$ and B $(5, 1)$

[2 marks]

Answer _____ units

2 $y = x(2x^4 - 7x^3)$

Work out an expression for the rate of change of y with respect to x.
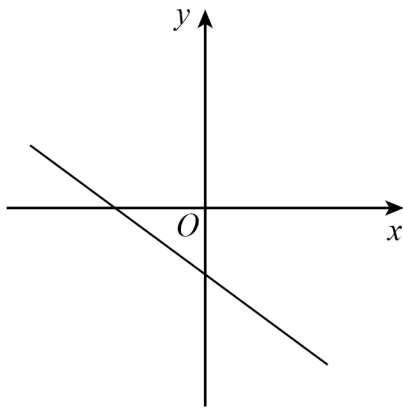
[3 marks]

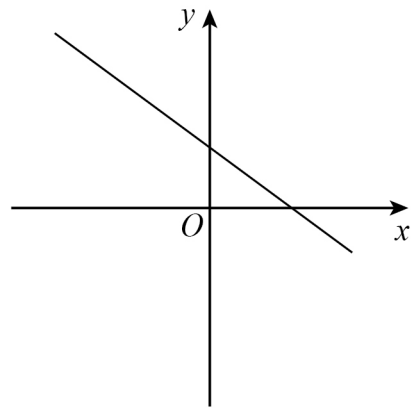Answer _____

3   Here are four sketch graphs.

Circle the letter of the sketch graph that represents $3x + 2y = 5$

[1 mark]

A
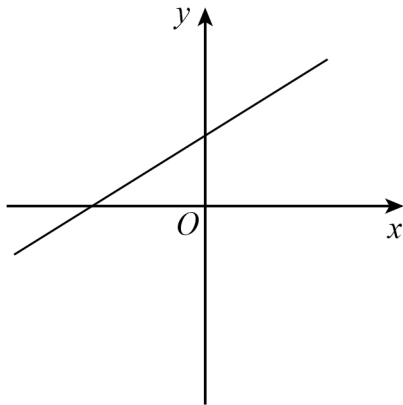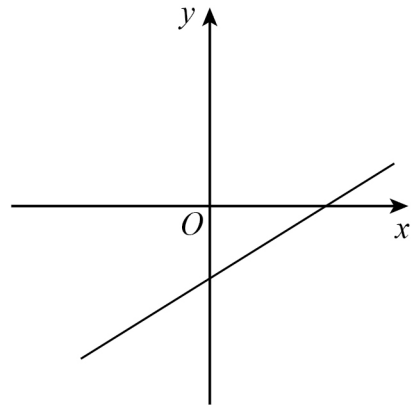

B

C

D

6

Turn over ▶

4 (a) The function f is given by $f(x) = 3x - 5$

The range is $13 < f(x) < 19$

Work out the domain of the function.

[1 mark]

Answer _____

4 (b) The function g is given by $g(x) = x^2 - 4$ with domain $-1 < x < 3$

Work out the range of the function.

[2 marks]

Answer _____

4 (c) The function h is given by $h(x) = \dfrac{3 + x}{2}$

Work out $h^{-1}(x)$

[2 marks]

$h^{-1}(x) = $ _____

5 The nth term of a sequence is $\dfrac{2n+47}{n+1}$

5 (a) A term of the sequence has a value of 5

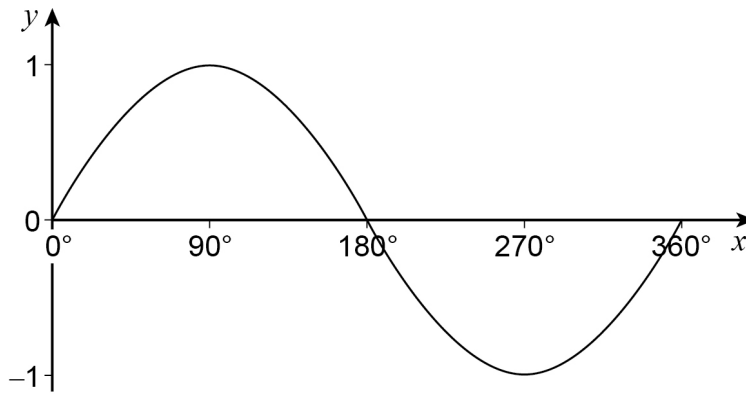Work out the value of n.

[2 marks]

Answer

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

[1 mark]

Answer

8

Turn over ▶

6 Here is a sketch of $y = \sin x$ for $0° \leqslant x \leqslant 360°$

You are given that $\sin 220° = -k$

Work out the two values of x for $0° \leqslant x \leqslant 360°$ for which $y = k$

[2 marks]

Answer _____ and _____

7 Solve $2x^2 + 4 > (2x - 3)(x + 1)$

[3 marks]

Answer _____

8   Simplify $\sqrt{3}\left(\sqrt{75}+\sqrt{48}\right)$ writing your answer as an integer.

[2 marks]

Answer _____

9   Expand and simplify fully $(2x-5)(3x-4)(x+2)$

[3 marks]

Answer _____

10

Turn over ►

10 The first four terms of a quadratic sequence are

$$0 \qquad 1 \qquad 0 \qquad -3$$

Work out an expression for the nth term.

[3 marks]

Answer _____

11 $\begin{pmatrix} 2 & 1 \\ 0 & 3 \end{pmatrix}\begin{pmatrix} a & b \\ 0 & 0.4 \end{pmatrix} = k\,\mathbf{I}$ where k is a constant and **I** is the identity matrix.

Work out the values of a and b.
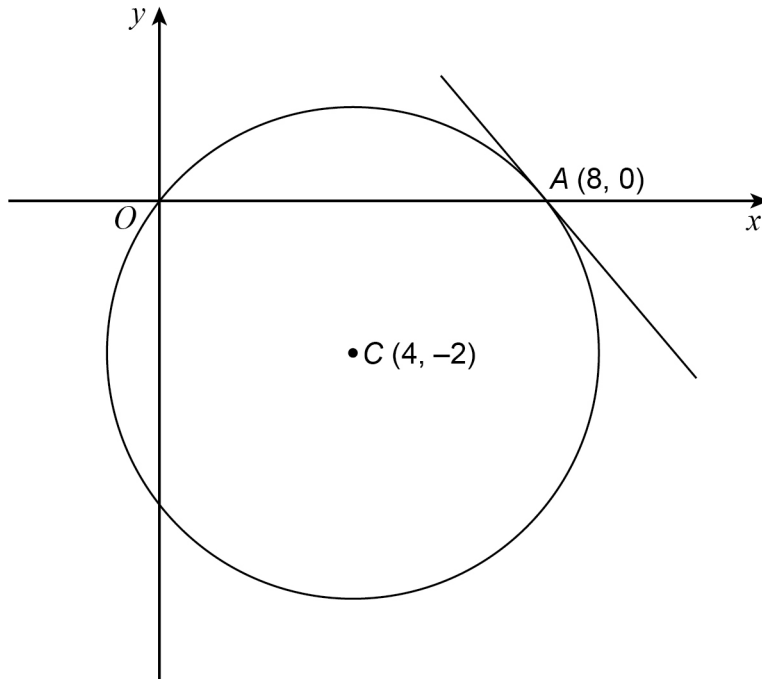
[4 marks]

Answer $a =$ _____ $b =$ _____

7

Turn over ►

12 A circle, centre C (4, −2), passes through the origin and point A (8, 0) on the x-axis.

The tangent at A is shown.

Not drawn accurately

12 (a) Work out the equation of the circle.

[2 marks]

Answer

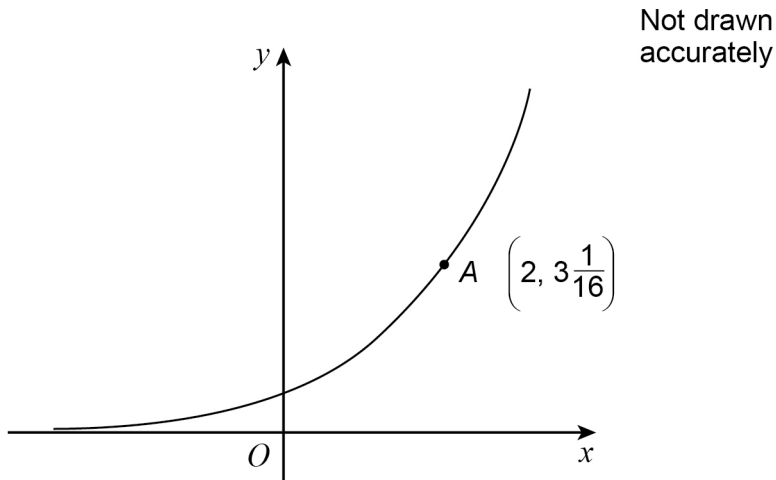**12 (b)** Work out the equation of the tangent to the circle at *A*.

[3 marks]

Answer _____

Turn over for the next question

Turn over ▶

13   Here is a sketch of $\quad y = k^x \quad$ where $\quad k > 0$

$A\left(2, 3\frac{1}{16}\right)$ is a point on the curve.

Not drawn accurately

13 (a)   Work out the value of k.

[2 marks]

Answer _____

13 (b) B is a point on the curve with x-coordinate -1

Work out the y-coordinate of B.

[1 mark]

Answer _____

14   Solve the simultaneous equations.

$$4a - b + 3c = 27$$
$$3a + 2b - c = 5$$
$$2a - 5c = -7$$

Do **not** use trial and improvement.

You **must** show your working.

[5 marks]

_a_ = _____   _b_ = _____   _c_ = _____

8

Turn over ▶

15 Work out the value of x where $0° \leqslant x \leqslant 90°$ for which $3 \tan^2 x = 1$

[2 marks]

Answer _____

16 $f(x) = 200x^3 + 100x^2 - 18x - 9$

16 (a)   Use the factor theorem to show that $(2x + 1)$ is a factor of $f(x)$.

[2 marks]

16 (b)   Hence solve $f(x) = 0$

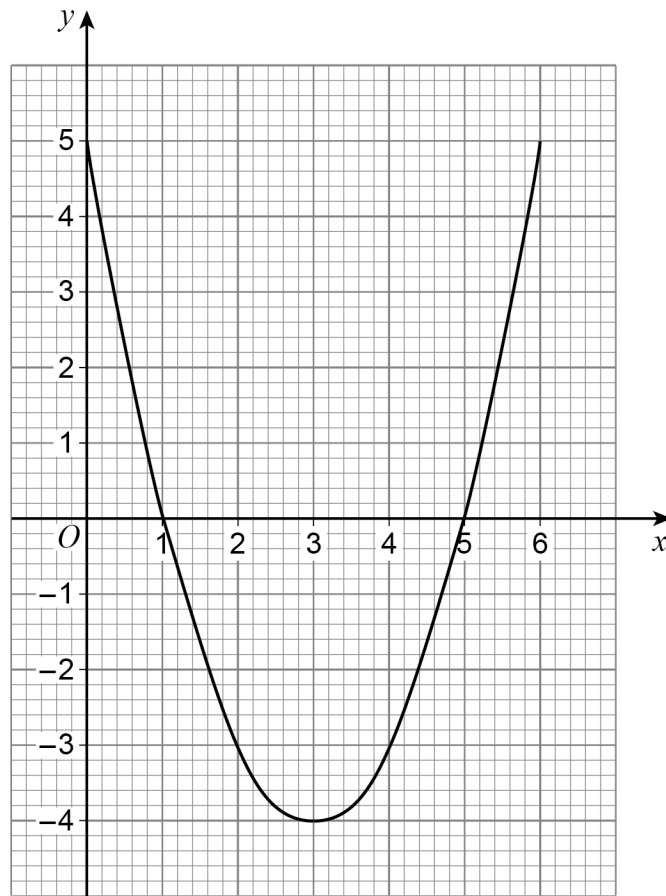**[3 marks]**

Answer _____

7

Turn over ▶

17   Here is the graph of $y = x^2 - 6x + 5$ for values of x between 0 and 6

By drawing a suitable **linear** graph on the grid, work out approximate solutions to
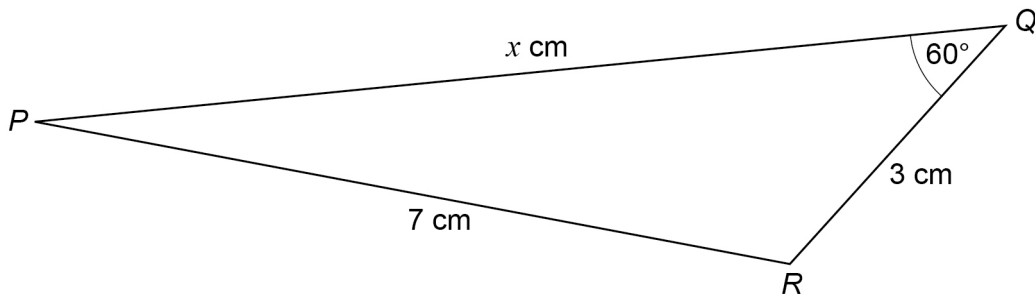
$$x^2 - 7x + 9 = 0$$

[3 marks]

Answer _____

18   Here is a triangle.

Not drawn accurately

Use the cosine rule to work out the value of x.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Answer _____

7

Turn over ►

19 $y = f(x)$ is the graph of a cubic function.

$y < 0$ for $x < 5$

$y \geqslant 0$ for $x \geqslant 5$

The function is
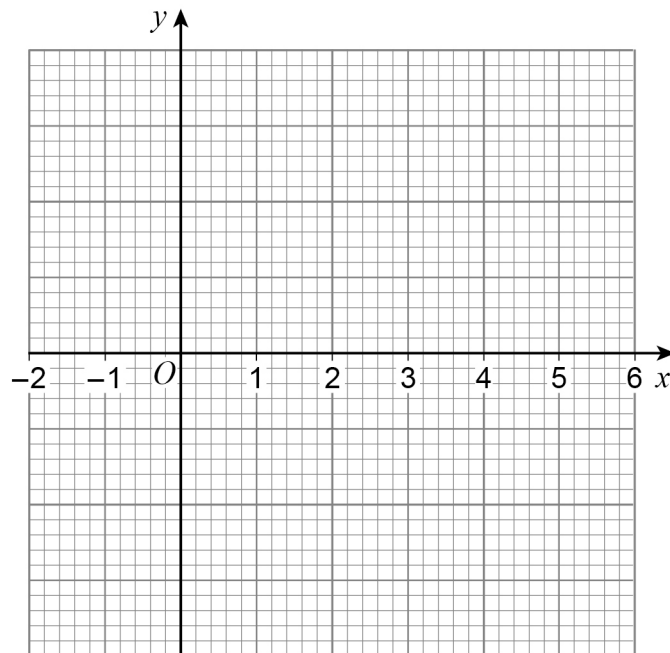
         increasing for $x < -1$

         decreasing for $-1 < x < 2$

         increasing for $x > 2$

Draw a possible sketch of $y = f(x)$ for values of x from -2 to 6

[4 marks]

Do not write outside the box

20 Miriam's date of birth is 14/09/2006

She makes a 4-digit number code using digits from her date of birth.

The 4-digit number she makes must

not start with 0

have all different digits.

How many codes can she make?
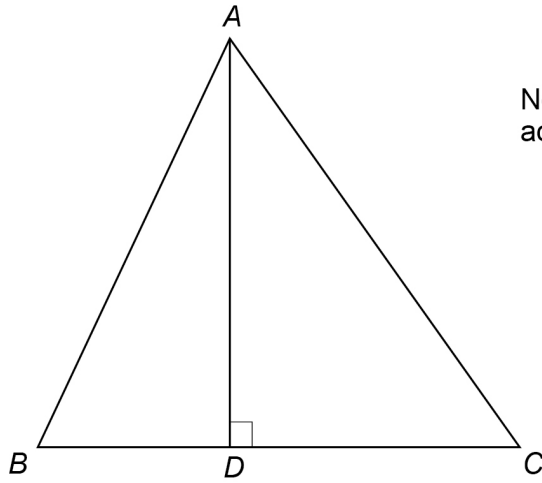
[3 marks]

Answer

Turn over for the next question

7

Turn over ▶

21 *ABC* is a triangle.

The perpendicular from *A* meets *BC* at *D*.

$BC = (6 + 2\sqrt{7})$ cm

Not drawn accurately

Area of triangle $ABC = (13 + 3\sqrt{7})$ cm^2

Work out the length, in cm, of *AD*.

Give your answer in the form $a + b\sqrt{c}$ where a, b and c are integers.

[5 marks]

Answer _____ cm

Do not write outside the box

22 Solve $8^x = \dfrac{2^{56} - 4^{26}}{30}$

[4 marks]

$x = $ _____

Turn over for the next question
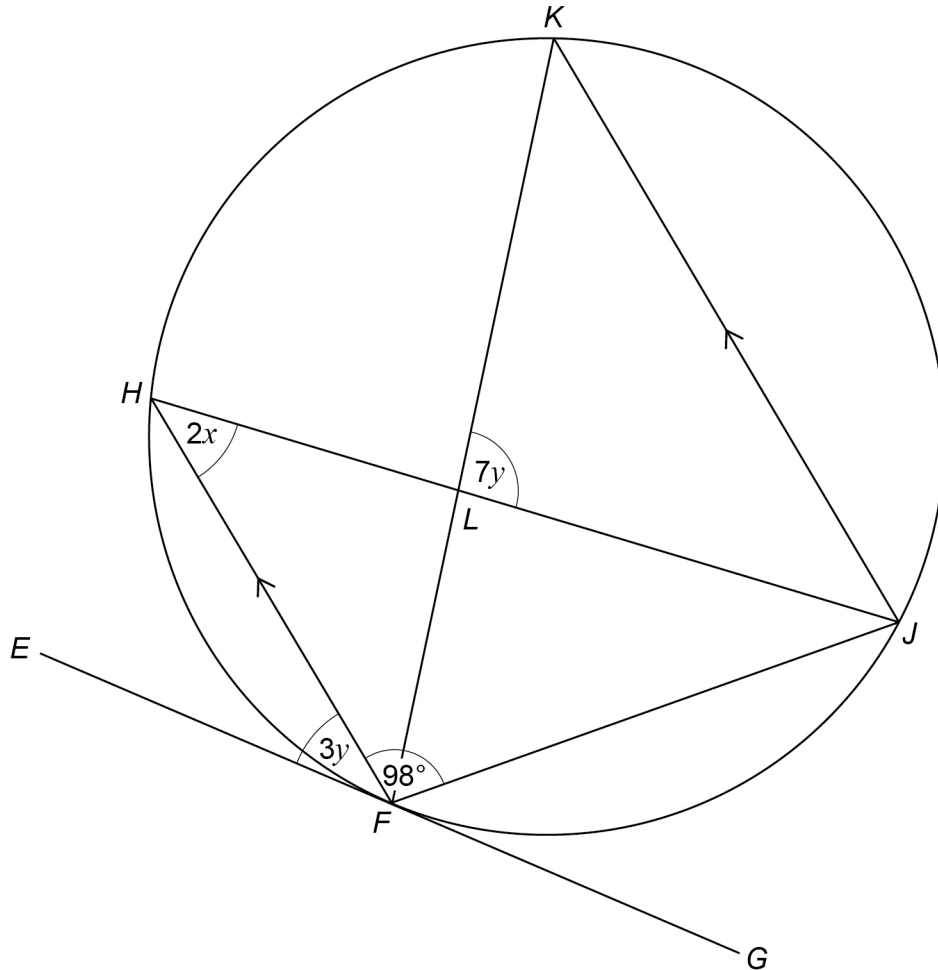
9

Turn over ▶

23   *F, H, K* and *J* are points on a circle.

Chords *HJ* and *KF* intersect at *L*.

EFG is a tangent to the circle.

FH and *JK* are parallel.

Not drawn
accurately

23 (a)   Angle *FHJ* = $2x$

Give reasons why angle *FKJ* and angle *HJK* are also equal to $2x$.

[2 marks]

Angle *FKJ* _____

Angle *HJK* _____

23 (b) Work out the values of x and y.

You **must** show your working.

Do **not** use trial and improvement.

[4 marks]

Answer $x = $ _____ $y = $ _____

END OF QUESTIONS

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED**

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

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