

Teach Me Maths

Please write clearly in block capitals.

Name _____

Date _____

Level 2 Certificate

FURTHER MATHEMATICS

Paper 1 Non-Calculator

Mock Set C

For AQA Level 2 Certificate in Further Mathematics (8365)

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- mathematical instruments
- the Formulae Sheet (the last page of this paper).

You must **not** use a calculator.

Instructions

- Write in black ink or black ball-point pen. Use a pencil for diagrams.
- Write your name and the date at the top of this page.
- Answer **all** questions.
- Write your answers in the spaces provided. If you need more room, use extra paper and write the question number next to your answer.
- Do all your rough work on this paper. Cross out 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 use extra answer paper, graph paper and tracing paper.

For the marker
TOTAL (out of 80)

Practice paper written by Teach Me Maths in the style of AQA Level 2 Certificate in Further Mathematics (8365). Not an official AQA paper.

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

1 $p = 2.5 \times 10^5$ and $q = 3.6 \times 10^{-3}$

Work out the value of

$$\sqrt{pq}$$

[2 marks]

Answer _____

2 (a) $f(x) = 7 - 3x$ and $g(x) = x^2 - 2$

Work out $fg(x)$

Give your answer in its simplest form.

[2 marks]

$$fg(x) = \underline{\hspace{10cm}}$$

(b) The function h is given by

$$h(x) = \frac{5}{x-2} \quad x > 2$$

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

[2 marks]

$$h^{-1}(x) = \underline{\hspace{10cm}}$$

3 Line L has equation $y + 2x = 5$

Line M passes through the points $(-1, 3)$ and $(2, -3)$

Show that L and M are parallel.

[2 marks]

4 Factorise fully $12x^2y - 14xy - 6y$

[2 marks]

Answer _____

- 5 (a) Which matrix represents a rotation of 270° anticlockwise about the origin?

Circle your answer.

[1 mark]

$$\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$$

$$\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$$

$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

- (b) The point P is rotated 270° anticlockwise about the origin.

The image is then transformed by the matrix $\begin{pmatrix} 2 & 3 \\ 1 & -2 \end{pmatrix}$

The final image is the point $(-4, 5)$

Work out the coordinates of P .

[3 marks]

Answer (_____ , _____)

- 6** Here are the first five terms of a quadratic sequence.

18 29 34 33 26

Work out an expression for the n th term.

[3 marks]

Answer _____

- 7** Expand and simplify

$$(3 - 2\sqrt{7})^2 - (5 + \sqrt{7})(5 - \sqrt{7})$$

Give your answer in the form $a + b\sqrt{7}$ where a and b are integers.

[3 marks]

Answer _____

- 8 A curve has equation

$$y = \frac{3}{4}x^4 + 5x$$

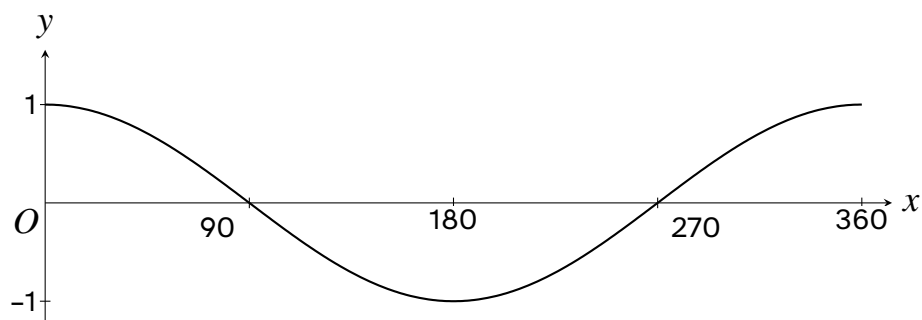
The rate of change of y with respect to x is -19

Work out the value of x .

[3 marks]

$x =$ _____

- 9 The graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$ is sketched below.



$$\cos 35^\circ = k$$

Use the graph to find the two angles x , in the range $0^\circ \leq x \leq 360^\circ$, where $\cos x = -k$
[2 marks]

Answer _____ and _____

10 A circle has its centre at the origin, O .

The circle passes through the point $P(6, -1)$.

(a) Write down the equation of the circle.

[1 mark]

Answer _____

(b) Work out the equation of the tangent to the circle at P .

Write it in the form $ax + by = c$, where a , b and c are integers.

[3 marks]

Answer _____

11 Write

$$\frac{2}{x-5} - \frac{3x+19}{3x^2-13x-10}$$

as a single fraction in its simplest form.

[3 marks]

Answer _____

12 a is a constant.

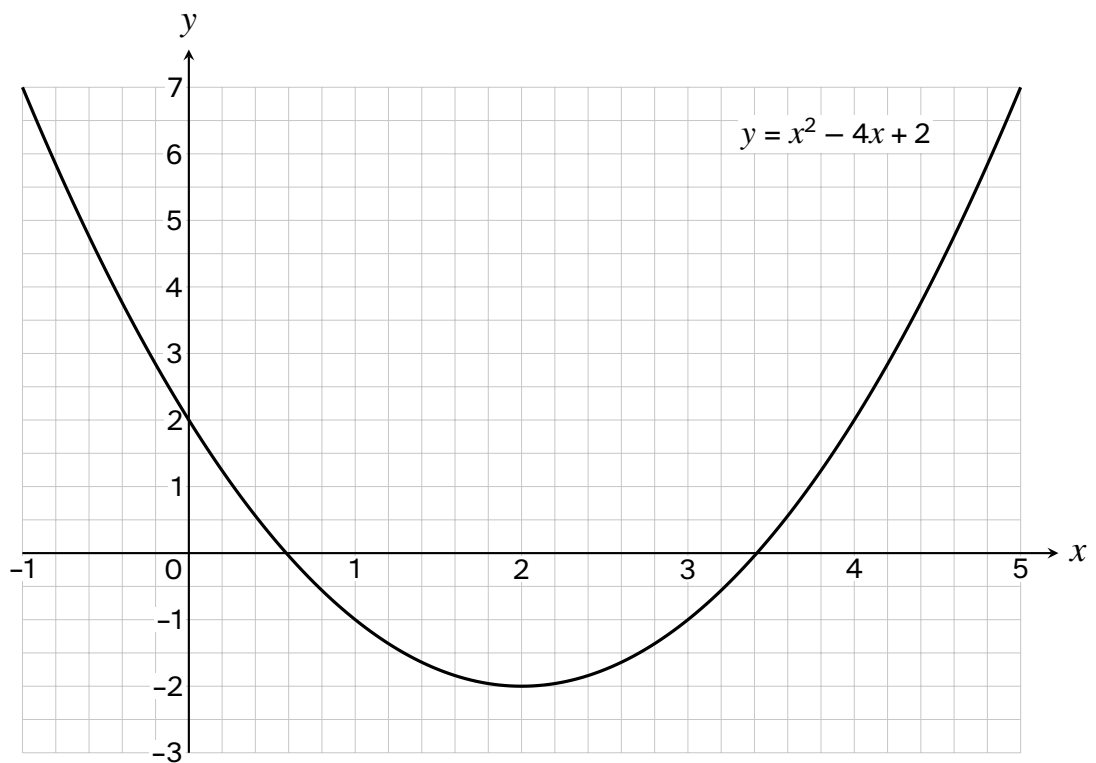
When $(2+ax)^3$ and $(3-x)^4$ are expanded, the two terms in x^2 are the same.

Work out the possible values of a .

[3 marks]

$a =$ _____

- 13 Here is the graph of $y = x^2 - 4x + 2$ for values of x from -1 to 5



By drawing a suitable straight line on the grid, work out approximate solutions to

$$2x^2 - 7x + 2 = 0$$

Give your answers to 1 decimal place.

[4 marks]

Answer _____ and _____

14 x is negative.

Solve

$$2x + \frac{12}{x} \geq -11$$

You must show your working.

[4 marks]

Answer _____

15 Solve

$$16^{x-1} = \frac{8^{2x+1}}{64}$$

You must show your working.

[3 marks]

$x =$ _____

16 A curve has equation

$$y = 2x^5 - \frac{6}{x}$$

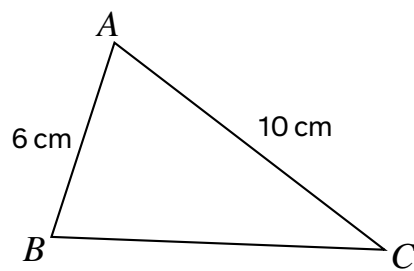
The tangent to the curve at the point where $x = -1$ has equation $y = mx + c$

Work out the values of m and c .

[4 marks]

$m =$ _____ $c =$ _____

17 Here is triangle ABC .



Not drawn accurately

$$\cos A = \frac{1}{3}$$

Work out the length BC .

Give your answer as a surd in its simplest form.

[3 marks]

Answer _____ cm

18 Solve the simultaneous equations

$$2x + 4y - z = 2$$

$$3x - 2y + 2z = 14$$

$$4x - 2y = 13$$

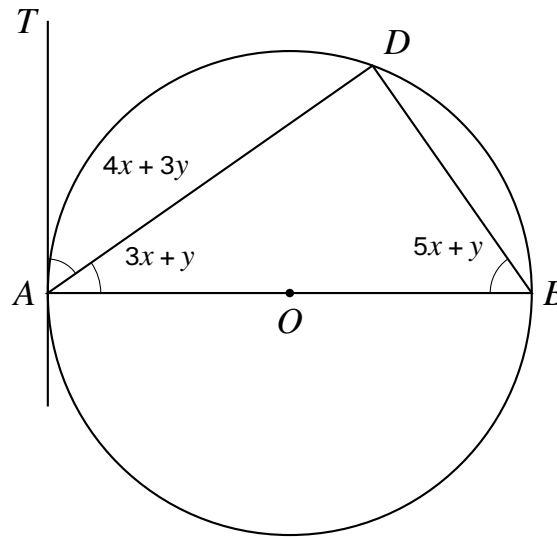
Do not use trial and improvement.

You must show your working.

[5 marks]

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

- 19** A, B and D are points on a circle, centre O .
 AB is a diameter of the circle.
 TA is the tangent to the circle at A .
 All angles are in degrees.



Not drawn accurately

- (a) Give a reason why angle $ADB = 90^\circ$
 Give a reason why angle $TAB = 90^\circ$

[2 marks]

- (b) Work out the value of x and the value of y .
 You must show your working.

[3 marks]

$x =$ _____ $y =$ _____

20 n is a positive integer.

Prove that

$$(4n + 2)^2 - (2n - 5)(2n + 4)$$

is a multiple of 6

[3 marks]

- 21** The cost of running a delivery van is C pence per mile when the van travels at a steady speed of v miles per hour, where

$$C = \frac{v}{5} + \frac{720}{v} \quad 20 \leq v \leq 70$$

Use calculus to work out the minimum cost per mile.

You must show that your answer is a minimum.

[5 marks]

Answer _____ pence

22 A curve has equation $y = 2x^2 - 7x - 5$

A straight line has equation $4x + y = 4$

Work out the coordinates of the points where the curve and the line intersect.

Do not use trial and improvement.

You must show your working.

[6 marks]

Answer (_____ , _____) and (_____ , _____)

23 Show that

$$\frac{6 \sin^4 x + 6 \sin^2 x \cos^2 x}{2 \cos^2 x + 5 \sin^2 x - 5}$$

can be written as $k \tan^2 x$ where k is an integer.

[3 marks]

END OF QUESTIONS

Formulae Sheet

For AQA Level 2 Certificate in Further Mathematics (8365)

Perimeter, area and volume

Where a and b are the lengths of the parallel sides and h is their perpendicular separation:

$$\text{Area of a trapezium} = \frac{1}{2}(a + b)h$$

Volume of a prism = area of cross section $\times$ length

Where r is the radius and d is the diameter:

$$\text{Circumference of a circle} = 2\pi r = \pi d$$

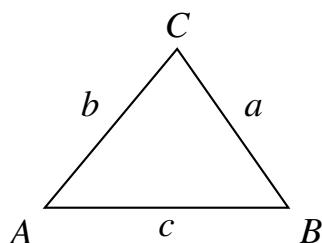
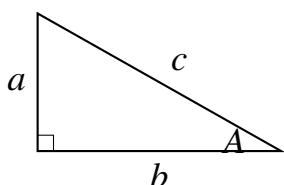
$$\text{Area of a circle} = \pi r^2$$

Quadratic formula

The solution of
 $ax^2 + bx + c = 0$
where $a \neq 0$:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Pythagoras' Theorem and Trigonometry



In any right-angled triangle where a , b and c are the lengths of the sides and c is the hypotenuse:

$$a^2 + b^2 = c^2$$

In any right-angled triangle ABC where a , b and c are the lengths of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$

In any triangle ABC where a , b and c are the lengths of the sides:

$$\text{sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{cosine rule: } a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{Area of triangle} = \frac{1}{2}ab \sin C$$

For any angle θ :

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \quad \text{and} \quad \sin^2 \theta + \cos^2 \theta = 1$$

Coordinate Geometry

Equation of a straight line passing through (x_1, y_1) with gradient m :

$$y - y_1 = m(x - x_1)$$

The general equation of a circle, centre (a, b) , radius r :

$$(x - a)^2 + (y - b)^2 = r^2$$