

Teach Me Maths

Please write clearly in block capitals.

Name _____

Date _____

Level 2 Certificate

FURTHER MATHEMATICS

Paper 1 Non-Calculator

Mock Set A

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** The functions f and g are given by

$$f(x) = 11 - 4x \quad \text{and} \quad g(x) = x^2 - 6$$

- (a) Work out $fg(-2)$

[2 marks]

Answer _____

- (b) Work out $f^{-1}(x)$

[2 marks]

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

- 2** Factorise fully $50x^3y - 8xy^3$

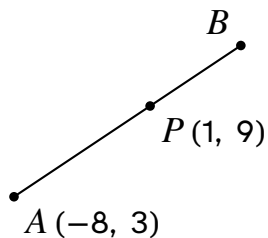
[2 marks]

Answer _____

- 3 A is the point $(-8, 3)$ and P is the point $(1, 9)$

P lies on the line segment AB so that

$$AP:PB = 3:2$$



Not drawn accurately

Work out the coordinates of B .

[3 marks]

Answer (_____ , _____)

4 $\mathbf{A} = \begin{pmatrix} 4 & a \\ b & 8 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 4 & -1 \\ 3 & 2 \end{pmatrix}$

$\mathbf{AB} = 22\mathbf{I}$ where $\mathbf{I}$ is the identity matrix.

Work out the values of a and b .

[3 marks]

$a =$ _____ $b =$ _____

5 The n th term of a sequence is $\frac{5n-2}{4n+3}$

(a) Write down the limiting value of the sequence as $n \rightarrow \infty$

[1 mark]

Answer _____

(b) Show that every term of the sequence is less than the limiting value.

[2 marks]

6 $y = 3x^2 \left(x^4 - 5 + \frac{2}{x} \right)$

Work out $\frac{dy}{dx}$

[3 marks]

$$\frac{dy}{dx} = \underline{\hspace{10cm}}$$

7 (a) Simplify fully $\sqrt{5}(\sqrt{180} - \sqrt{45})$

[2 marks]

Answer _____

(b) Rationalise the denominator and simplify fully

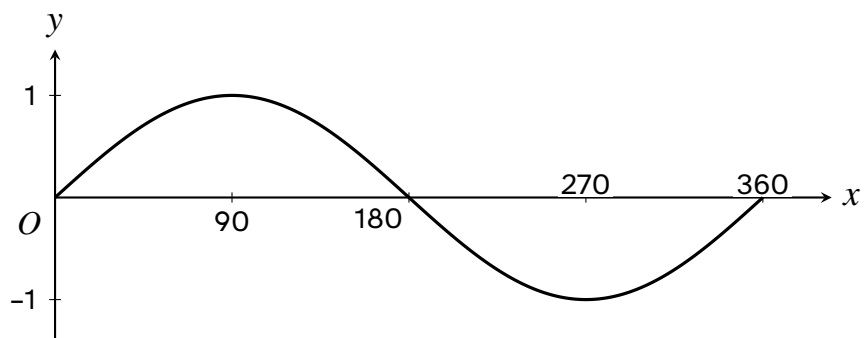
$$\frac{5 + \sqrt{7}}{3 - \sqrt{7}}$$

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

[3 marks]

Answer _____

- 8 The graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$ is shown.



$$\sin 38^\circ = k$$

Use the graph to find the two solutions of $\sin x = -k$ in the range $0^\circ \leq x \leq 360^\circ$

[2 marks]

Answer _____ $^\circ$ and _____ $^\circ$

9 $a(x+2)^2 - b(x-5) \equiv 3x^2 + 7x + c$

Work out the values of a , b and c .

[3 marks]

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

10 Simplify fully

$$\frac{10x^3y^{-1} + 4x^{-2}y^5}{2x^{-3}y^{-2}}$$

Give your answer with positive powers only.

[3 marks]

Answer _____

11 A circle has centre $(-3, 2)$

The circle passes through the point $(2, -2)$

(a) Work out the equation of the circle.

[2 marks]

Answer _____

(b) The circle crosses the y -axis at two points.

Work out the exact y -coordinates of these two points.

Give your answers in their simplest surd form.

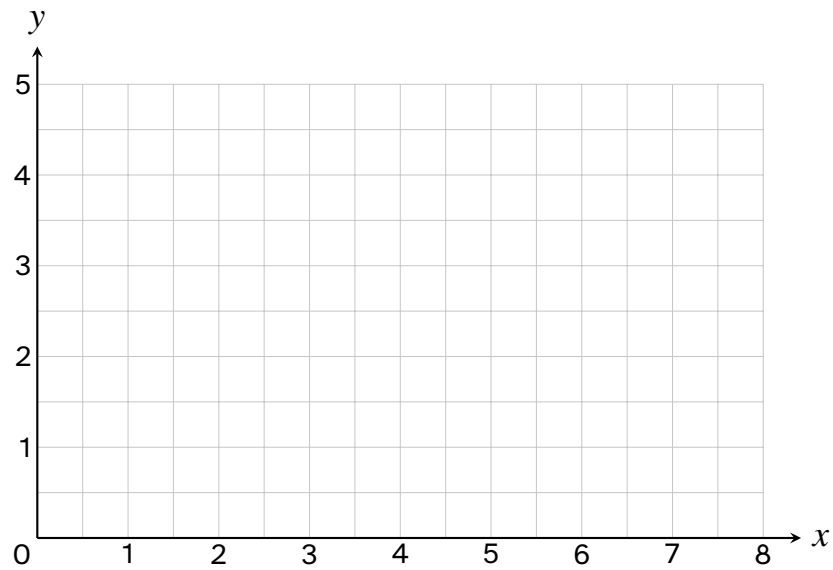
[2 marks]

Answer _____ and _____

12 The function f is given by

$$\begin{aligned} f(x) &= 2x & 0 \leq x < 2 \\ &= x^2 - 8x + 16 & 2 \leq x < 5 \\ &= 1 & 5 \leq x \leq 8 \end{aligned}$$

On the grid, draw the graph of $y = f(x)$ for $0 \leq x \leq 8$



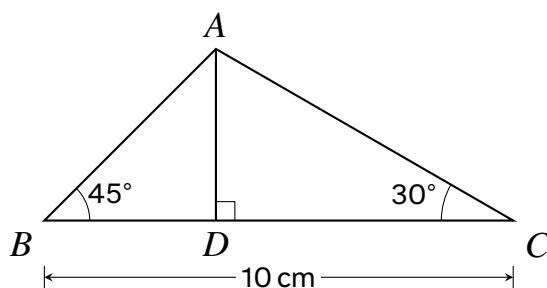
[4 marks]

13 Solve $(2x + 3)^2 \leq x(x - 1) + 19$

[3 marks]

Answer _____

- 14** BDC is a straight line.
 AD is perpendicular to BC .
 $BC = 10$ cm



Not drawn accurately

Work out the length AD .

Give your answer in the form $p\sqrt{3} + q$ where p and q are integers.

[3 marks]

$AD =$ _____ cm

- 15** Make x the subject of

$$y(3 + x^2) = 4(x^2 - w)$$

[4 marks]

$x =$ _____

16 $f(x) = 2x^3 - 3x^2 - 23x + 12$

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

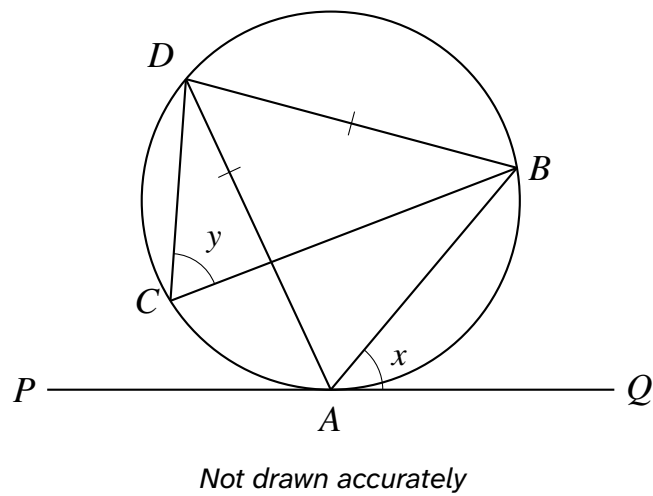
[2 marks]

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

[3 marks]

Answer _____

- 17** A, B, C and D are points on a circle.
 PAQ is the tangent to the circle at A .
 $DA = DB$



Prove that $x + 2y = 180$

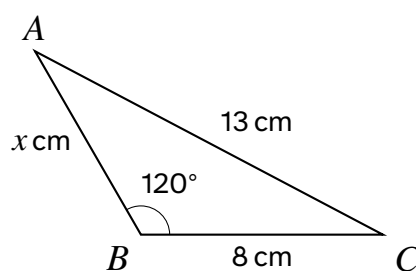
Give a reason for each step of your working.

[4 marks]

- 18** Write $3x^2 - 9x + 2$ in the form $a(x+p)^2 + q$ where a , p and q are constants. **[3 marks]**

Answer _____

- 19** Here is a triangle ABC .



Not drawn accurately

Work out the value of x .

You must show your working.

[4 marks]

$x =$ _____

20 The equation of a curve is $y = x^4 - 4x^3 - 8x^2$

The curve has three stationary points.

Use calculus to find the coordinates of each stationary point and to decide whether it is a maximum or a minimum.

You must show your working.

[6 marks]

Stationary point (_____ , _____) Nature _____

Stationary point (_____ , _____) Nature _____

Stationary point (_____ , _____) Nature _____

21 Solve the simultaneous equations

$$\frac{x}{2} - \frac{y}{3} = 1$$

$$x^2 + xy = 16$$

Do not use trial and improvement.

You must show your working.

[6 marks]

$x =$ _____ $y =$ _____

$x =$ _____ $y =$ _____

22 Prove that

$$(\sin x - 2 \cos x)^2 + \tan x (4 \cos^2 x - \cos x) \equiv (4 + 3 \sin x)(1 - \sin x)$$

[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:

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

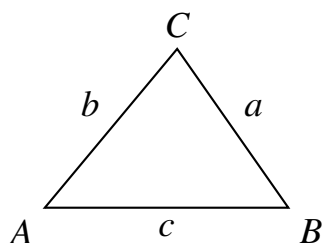
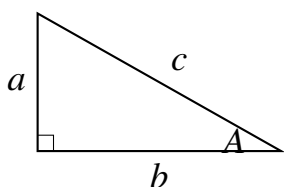
$$\text{Area of a circle} = \pi r^2$$

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 :

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