

Teach Me Maths

Please write clearly in block capitals.

Name _____

Date _____

Level 2 Certificate

FURTHER MATHEMATICS

Paper 2 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:

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

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.
- The use of a calculator is expected, but calculators with a facility for symbolic algebra must not be used.

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 Solve

$$\frac{w+4}{2w-1} = \frac{w-3}{2w+5}$$

[3 marks]

$w =$ _____

2 Line L has equation $5x + 3y = 8$

P is the point $(-4, 6)$

(a) Work out the equation of the line that is perpendicular to L and passes through P .

Give your answer in the form $y = mx + c$

[3 marks]

Answer _____

(b) The line in part (a) crosses the x -axis at Q .

Work out the length PQ .

Give your answer to 3 significant figures.

[2 marks]

Answer _____

3 Simplify fully

$$\frac{6x^2 - 11x - 10}{2x^2 + 7x - 30}$$

[3 marks]

Answer _____

4 Here are the first four terms of a linear sequence.

$$3p - q \quad 3p + 3q \quad 3p + 7q \quad 3p + 11q$$

- (a) Work out an expression for the n th term of the sequence.

[2 marks]

Answer _____

- (b) The 5th term of the sequence is 34.5
The 12th term of the sequence is 104.5
Work out the values of p and q .

[2 marks]

$p =$ _____ $q =$ _____

5 The equation of a curve is

$$y = x^5 + kx^3 \quad \text{where } k \text{ is a constant.}$$

The gradient of the curve at the point where $x = -2$ is 50

Work out the value of k .

[3 marks]

$k =$ _____

6 Each locker at a climbing centre is opened with a 4-digit code.

The code uses the digits 0 to 9 and no digit is used more than once.

When the code is read as a 4-digit number, it is

- even
- greater than 4000

How many different codes are possible?

[3 marks]

Answer _____

- 7 (a) Circle the matrix that represents a reflection in the line $y = -x$

[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) A shape is reflected in the line $y = -x$

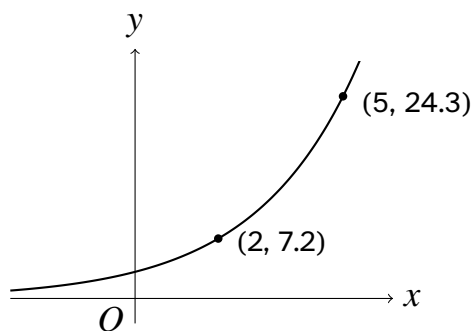
The image is then reflected in the x -axis.

Use matrix multiplication to work out the single transformation that is equivalent to these two reflections.

Describe fully this single transformation.

[3 marks]

- 8 Here is a sketch of the curve $y = a \times b^x$ where a and b are positive constants.
The points $(2, 7.2)$ and $(5, 24.3)$ lie on the curve.



Not drawn accurately

- (a) Work out the values of a and b .

[3 marks]

$a =$ _____ $b =$ _____

- (b) The function f is given by

$$f(x) = a \times b^x \quad \text{with domain} \quad -2 \leq x \leq 4$$

where a and b are your values from part (a).

Work out the range of f .

[2 marks]

Answer _____

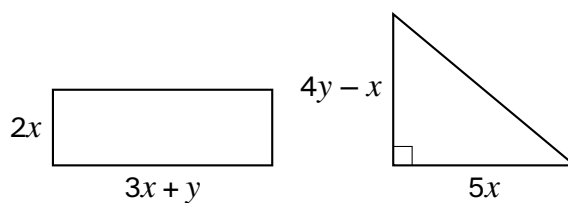
9 n is a positive integer.

$2n + 1$ and $2n + 3$ are consecutive odd numbers.

Prove that the difference between their squares is always 4 times the even number between them.

[3 marks]

- 10** The diagram shows a rectangle and a right-angled triangle.
All lengths are in centimetres.



Not drawn accurately

x and y are positive.

area of rectangle : area of triangle = 4:5

Work out the ratio $x:y$

Give your answer in its simplest form.

[3 marks]

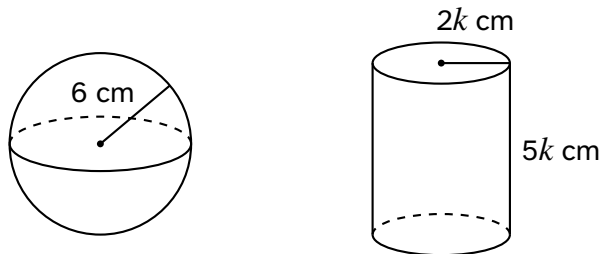
Answer _____

- 11 A solid metal ball is a sphere of radius 6 cm.

A closed cylindrical tin has radius $2k$ cm and height $5k$ cm.

Surface area of a sphere = $4\pi r^2$ where r is the radius

The total surface area of the tin is equal to the surface area of the ball.



Not drawn accurately

Work out the value of k .

Give your answer to 3 significant figures.

[3 marks]

$k =$ _____

12 Lorcan cycles 21 km from his home to a village at an average speed of v km/h.

He then cycles home along the same route at an average speed that is 2.5 km/h less.

The journey home takes 15 minutes longer than the journey to the village.

(a) Show that $2v^2 - 5v - 420 = 0$

[2 marks]

(b) Work out the value of v .

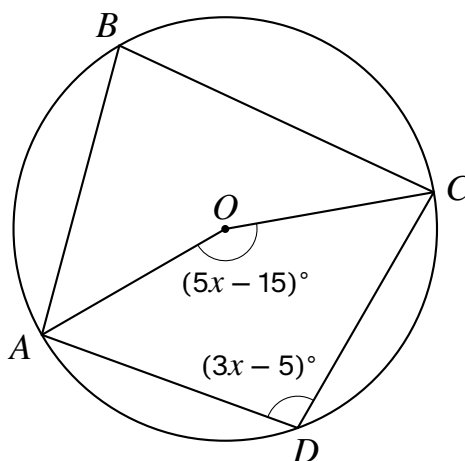
Give your answer to 3 significant figures.

[3 marks]

$v =$ _____

13 A, B, C and D are points on a circle, centre O .

Angle $AOC = (5x - 15)^\circ$ and angle $ADC = (3x - 5)^\circ$



Not drawn accurately

Work out the size of angle ABC .

[4 marks]

Answer _____ degrees

14 a is a constant.

In the expansion of $(4 + ax)^5$ the term in x^2 is $1000x^2$

Work out the possible values of a .

[4 marks]

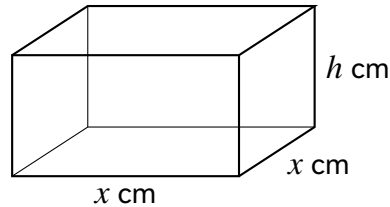
$a = \underline{\hspace{2cm}}$ or $a = \underline{\hspace{2cm}}$

- 15** An open-topped gift box is made from card.

The box is a cuboid with a square base of side x cm and height h cm.

The total area of the card is 1500 cm^2

Assume there is no overlap and no card is wasted.



Not drawn accurately

- (a) The volume of the box is $V \text{ cm}^3$

Show that $V = 375x - 0.25x^3$

[2 marks]

- (b) Use calculus to work out the maximum volume of the box.

You must show that your answer is a maximum.

Give your answer to 3 significant figures.

[4 marks]

Answer _____ cm^3

16 Solve the simultaneous equations

$$2a + b + 4c = 6$$

$$6a + 5b - c = -1$$

$$4a - 3b + 3c = 22$$

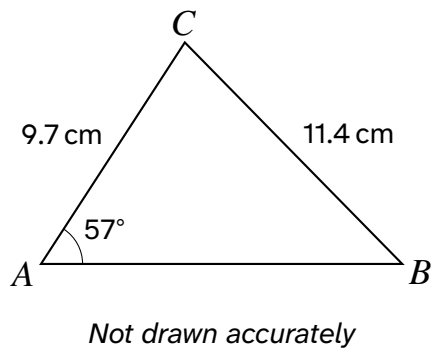
Do not use trial and improvement.

You must show your working.

[5 marks]

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

17 Here is triangle ABC .



Work out the area of triangle ABC .

Give your answer to 3 significant figures.

[4 marks]

Answer _____ cm^2

18 Solve

$$(25^x)^{x+2} = 5 \times 125^x$$

Do not use trial and improvement.

You must show your working.

[4 marks]

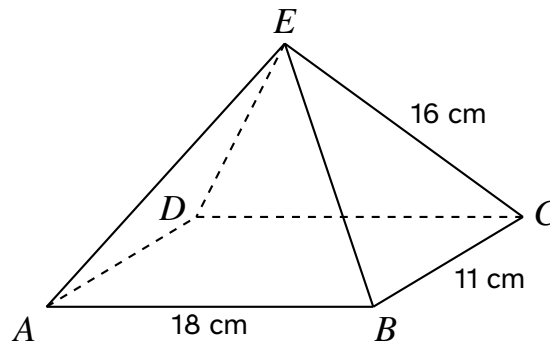
$x =$ _____

19 $ABCDE$ is a pyramid.

The base, $ABCD$, is a horizontal rectangle.

E is vertically above the centre of the base.

$AB = 18\text{ cm}$ $BC = 11\text{ cm}$ Each sloping edge is 16 cm



Not drawn accurately

Work out the size of the angle between the face EBC and the base $ABCD$.

[5 marks]

Answer _____ degrees

20 Solve

$$3 \sin^2 x + 4 = 9 \cos^2 x \quad \text{for} \quad 0^\circ \leq x \leq 360^\circ$$

Give your answers to 1 decimal place.

You must show your working.

[4 marks]

Answer _____

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:

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

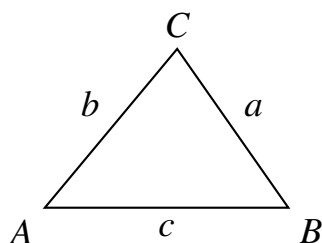
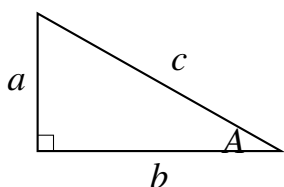
$$\text{Area of a circle} = \pi r^2$$

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 :

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