

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



Level 2 Certificate in Further Mathematics


Further Mathematics Level 2

8360/2

Practice Paper Set 3

Paper 2

Calculator

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a calculator • mathematical instruments. 	
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Time allowed
2 hours

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 space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

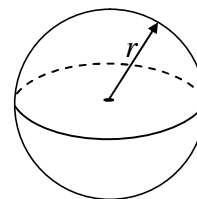
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 105.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.
- The use of a calculator is expected but calculators with a facility for symbolic algebra must **not** be used.

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 - 5	
6 - 7	
8 - 9	
10 - 11	
12 - 13	
14 - 15	
16 - 17	
18 - 19	
20 - 21	
22 - 23	
24	
TOTAL	

Formulae Sheet

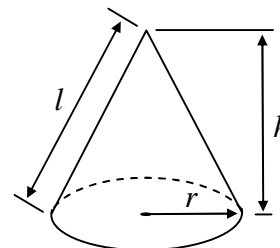
$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

$$\text{Surface area of sphere} = 4\pi r^2$$



$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$

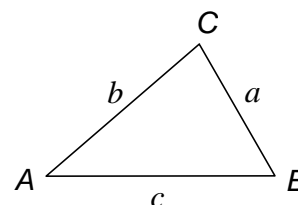
$$\text{Curved surface area of cone} = \pi r l$$



In any triangle ABC

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

$$\text{Sine rule} \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$



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

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Trigonometric Identities

$$\tan \theta \equiv \frac{\sin \theta}{\cos \theta} \quad \sin^2 \theta + \cos^2 \theta \equiv 1$$

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

1 Match each graph with the correct equation.

You will **not** use all of the equations.

One has been done for you.

Circle, centre (0, 0), radius 2

$$x^2 + y^2 = 4$$

$$x^2 + y^2 = 2$$

Straight line, passing through (0, 0)

$$y = 1 - 2x$$

$$y = 3x - 2$$

Straight line, gradient - 2

$$y = 2x$$

Straight line, passing through (2, 6)

$$y = x^2 + 1$$

$$y = 12 - 3x$$

Curve that has positive y values for all x values

$$y = x^2 - 1$$

(4 marks)

4

Turn over ►

2 h is 60% of m .

2 (a) Write an equation connecting h and m .

Answer (1 mark)

2 (b) Also, r is 75% of m .

Work out h as a percentage of r .

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Answer % (2 marks)

3 A curve has gradient function $\frac{dy}{dx} = 2x^2 - 7$

3 (a) Work out the gradient of the curve when $x = -3$

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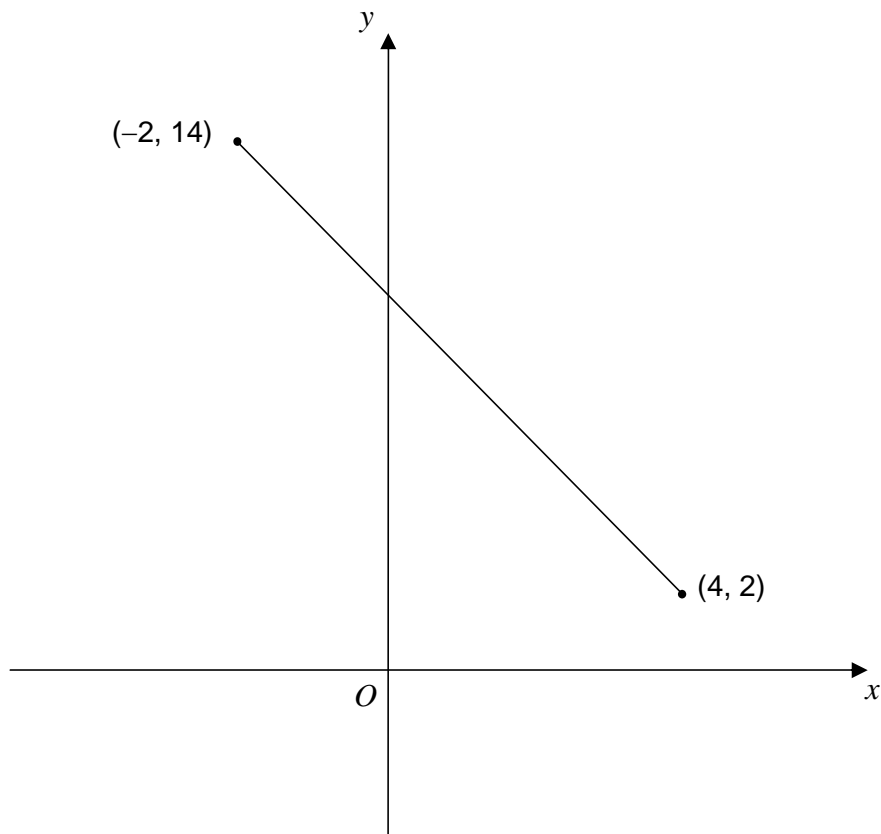
Answer (2 marks)

3 (b) Work out the values of x for which the rate of change of y with respect to x is 1.

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Answer (3 marks)

- 4 The straight line shows a sketch of $y = f(x)$ for the full domain of the function.



- 4 (a) State the domain of the function.

Answer $\leq x \leq$ (1 mark)

- 4 (b) Work out the equation of the line.

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Answer (3 marks)

5
$$\begin{pmatrix} -7 & 4 \\ 5 & -3 \end{pmatrix} \begin{pmatrix} -3 & -4 \\ -5 & t \end{pmatrix} = \mathbf{I}$$

Work out the value of t .

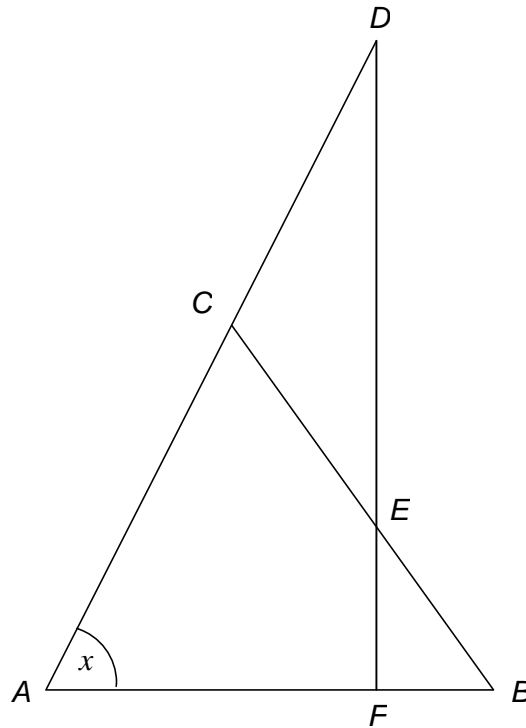
$t = \dots\dots\dots$ (3 marks)

6 Rearrange $c = 5a^2 - b$ to make a the subject.

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Answer $\dots\dots\dots$ (3 marks)

- 7 Triangle ABC is isosceles with $AC = BC$
 Triangle CDE is isosceles with $CD = CE$
 ACD and DEF are straight lines.



Not drawn
accurately

- 7 (a) Prove that angle $DCE = 2x$

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(2 marks)

- 7 (b) Prove that DF is perpendicular to AB .

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(3 marks)

8 (a) $0 < w < 1$

Are the following statements true or false?

Tick a box for each statement.

	True	False
$1 - w > 0$	<input type="checkbox"/>	<input type="checkbox"/>
$w^3 > w^2$	<input type="checkbox"/>	<input type="checkbox"/>
$\frac{1}{w} > w$	<input type="checkbox"/>	<input type="checkbox"/>

(3 marks)

8 (b) $x < -1$

Write the following expressions in order of size.

Start with the smallest.

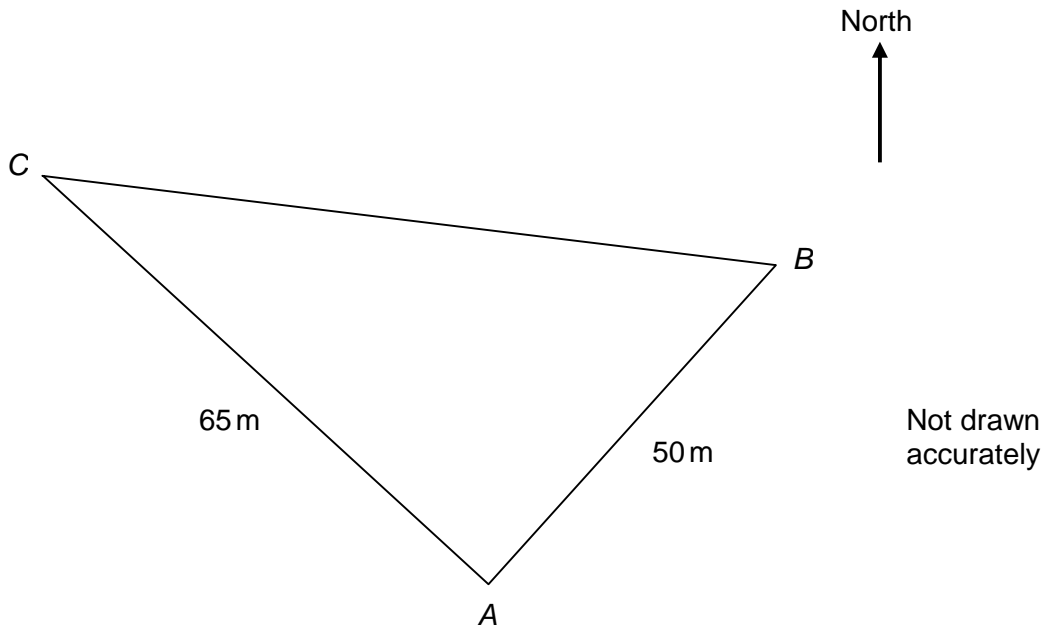
x x^2 x^3 x^4

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Answer (2 marks)

- 9 B is 50 metres from A on a bearing of 040° .
 C is 65 metres from A on a bearing of 325° .



- 9 (a) Explain why angle CAB is 75° .

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(2 marks)

- 9 (b) Work out the distance BC .

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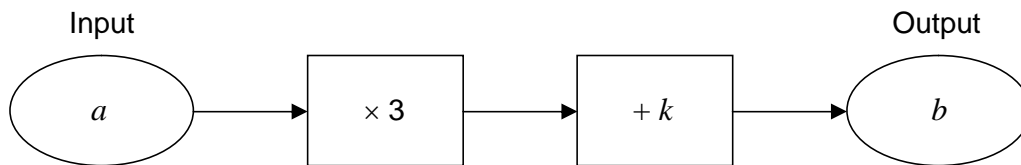
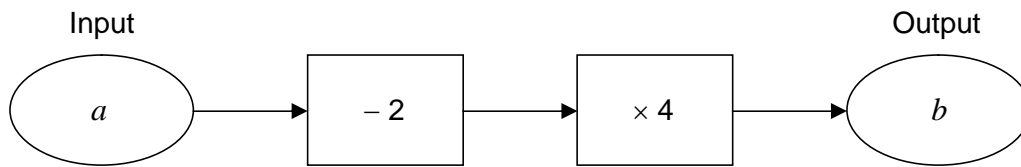
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$BC = \dots\dots\dots$ m (3 marks)

10 Here are two number machines.



Work out a in terms of k .

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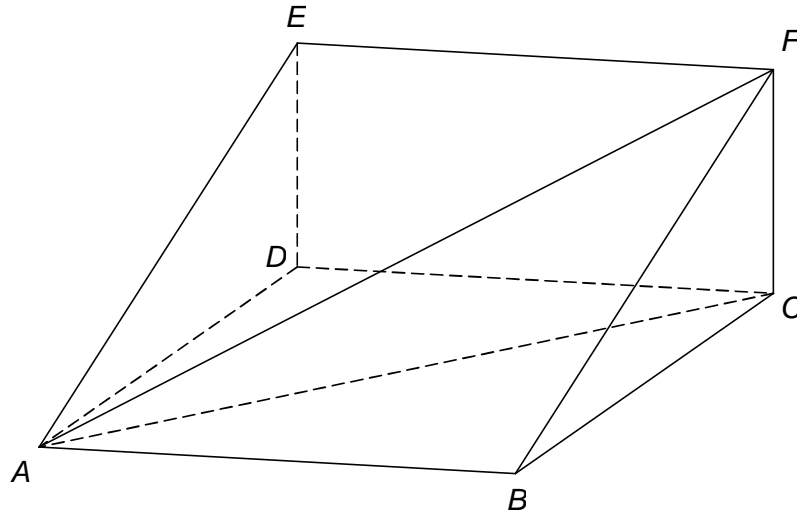
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$a = \dots\dots\dots$ (4 marks)

11 The diagram shows part of a skate ramp, modelled as a triangular prism.

$ABCD$ represents horizontal ground.
The vertical rise of the ramp, CF , is 7 feet.
The distance $BC = 24$ feet.

Not drawn
accurately



You are given that $\text{gradient} = \frac{\text{vertical rise}}{\text{horizontal distance}}$

11 (a) The gradient of BF is **twice** the gradient of AF .

Write down the distance AC .

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$AC = \dots\dots\dots$ feet (1 mark)

11 (b) Greg skates down the ramp along FB .

How much further would he travel if he had skated along FA ?

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Answer feet (4 marks)

12 $f(x) = x^2 + px + q$ for all values of x .

p and q are integers.

$f(0)$ is an odd number.

$f(1)$ is an odd number.

Show that p is an odd number.

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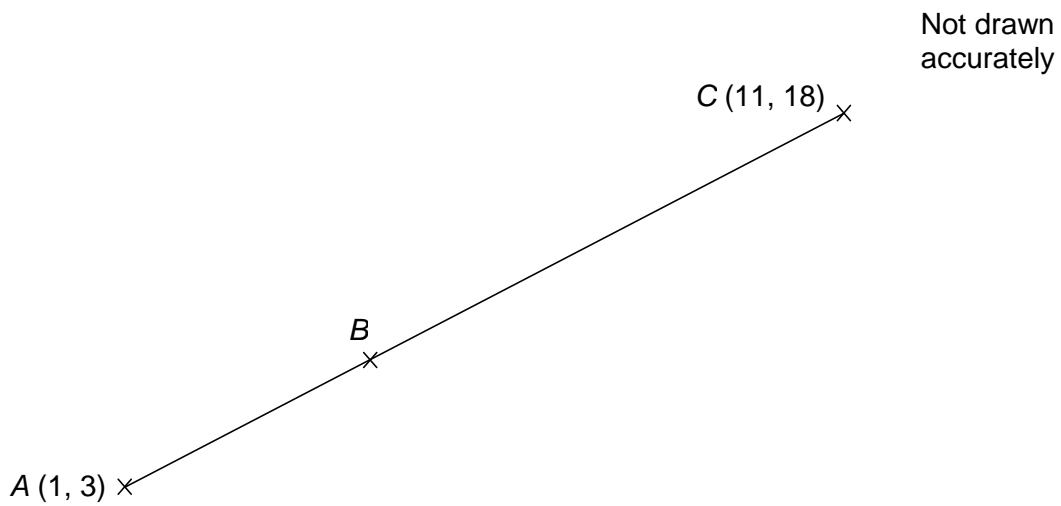
(3 marks)

13 $y = x^{\frac{1}{2}} (x^{\frac{7}{2}} - x^{\frac{1}{2}})$

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

$\frac{dy}{dx} = \dots\dots\dots$ (4 marks)

- 14** Points A , B and C lie on a straight line.
 BC is 50% longer than AB .



Work out the coordinates of B .

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Answer (.....,) (4 marks)

Turn over for the next question

15 (a) Factorise $2x^2 - 3x - 14$

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Answer (2 marks)

15 (b) Hence, or otherwise, solve $2(y - 5)^2 - 3(y - 5) - 14 = 0$

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Answer (3 marks)

16 (a) Write $(x^2)^2$ as a single power of x .

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Answer (1 mark)

16 (b) Factorise fully $x^4 - 1$

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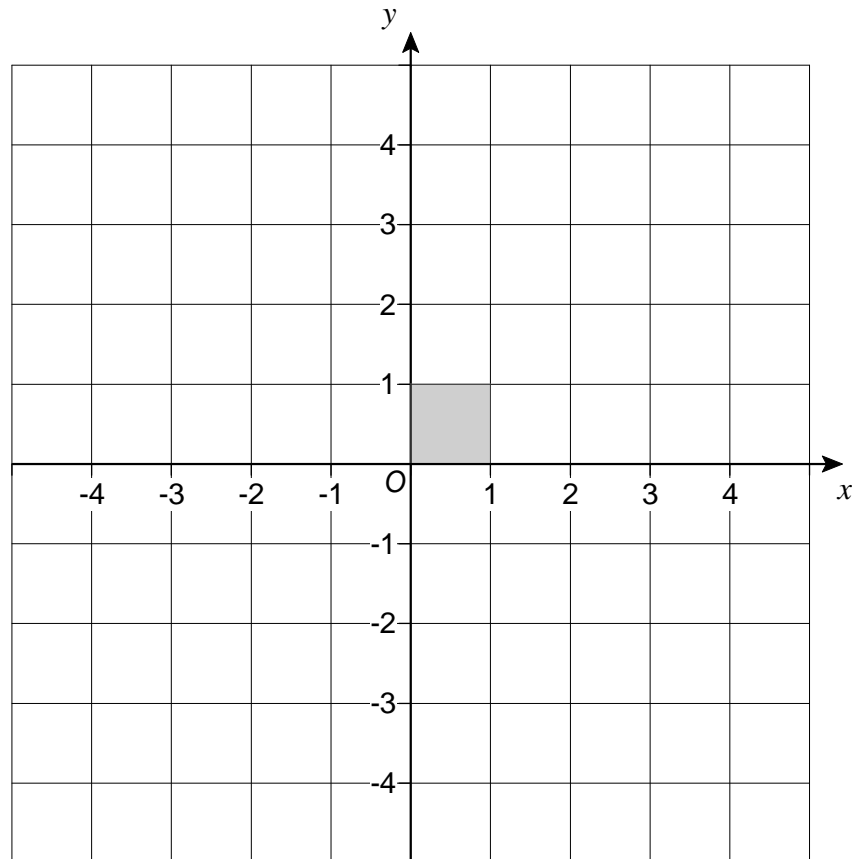
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Answer (2 marks)

Turn over for the next question

- 17 The unit square is shaded on the grid.



- 17 (a) On the grid, draw the image of the unit square after it is transformed using the matrix

$$\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}.$$

(2 marks)

17 (b) Work out the matrix that transforms the unit square by a 270° rotation about O .

Answer $\left(\begin{array}{cc} \dots\dots\dots & \dots\dots\dots \\ \dots\dots\dots & \dots\dots\dots \end{array} \right)$

(2 marks)

Turn over for the next question

18 $C = \frac{3x + 7}{x + 1}$ and $D = \frac{4x - 11}{2x + 3}$

Work out the value of x when $C + D = 5$

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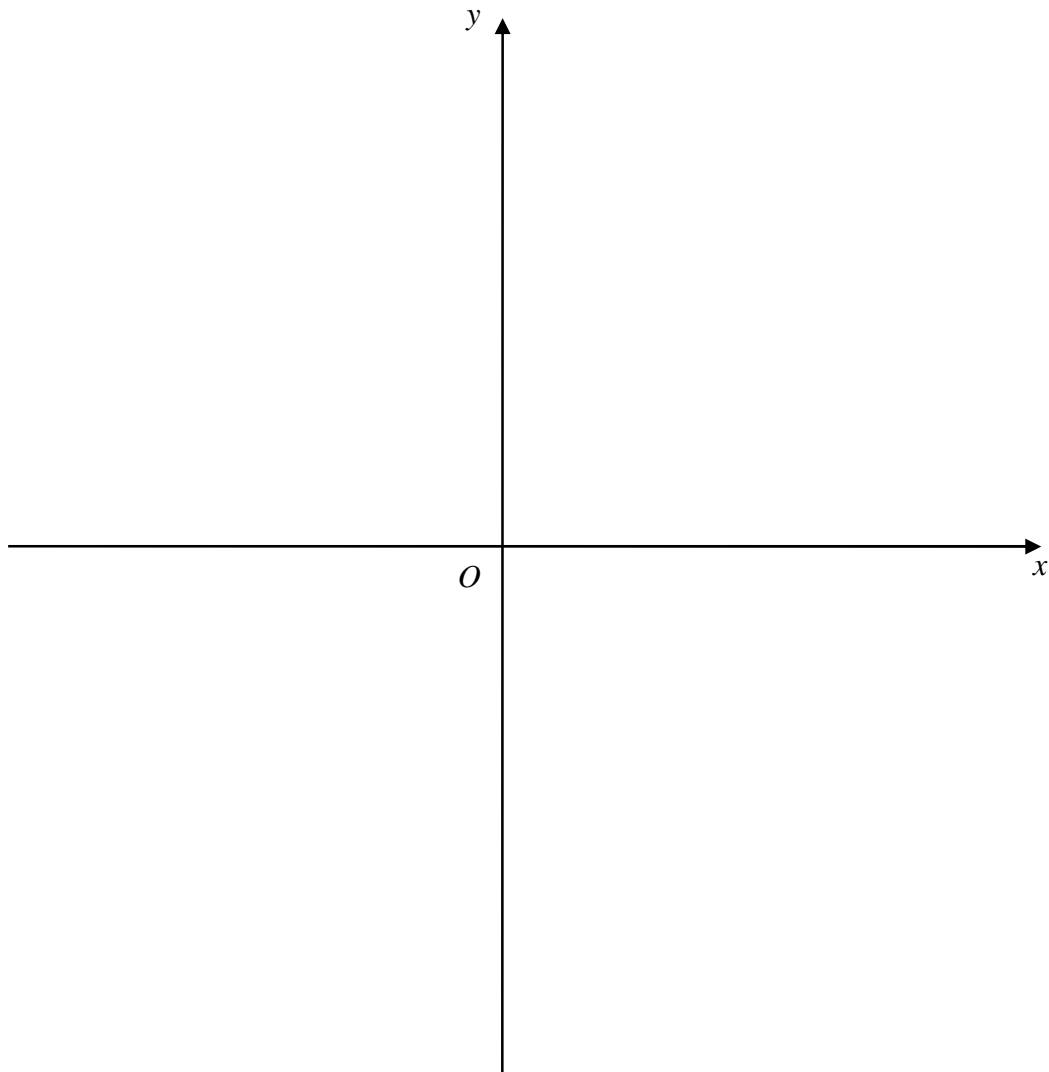
$x = \dots\dots\dots$ (5 marks)

- 19** A cubic function $f(x)$ has domain all values of x .
The curve $y = f(x)$ has two stationary points.

There is a minimum point at $(-2, 1)$.

There is a maximum point at $(2, 5)$.

Sketch the graph of $y = f(x)$ on these axes.



(3 marks)

Turn over for the next question

20 The first five terms of a sequence are shown.

-1 2 9 20 35

Work out an expression for the n th term of the sequence.

n th term = (4 marks)

22 Expand and simplify $xy(2x + 3y)(5x - 2y)$

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Answer (4 marks)

23 $g(x) = x^3 + 3x^2$ for all values of x .

Show that $g(3x) = kx^2(x + 1)$ where k is an integer.

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(3 marks)

24 (a) Factorise $5s^2 - 2s$

Answer (1 mark)

24 (b) Solve $5\sin^2 x - 2\sin x = 0$ for $0^\circ \leq x \leq 360^\circ$

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Answer (4 marks)

Turn over for the next question

- 25 $x^3 + ax^2 + bx + 150$ factorises to $(x + c)^2(x + d)$
 a, b, c and d are positive integers and $c \neq 1$

Work out the values of a, b, c and d .

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Answer $a =$

$b =$

$c =$

$d =$ (6 marks)

6

END OF QUESTIONS

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