1st Class Maths

The first QR code is a revision video
The second is solutions to the questions

Product Rule for Counting		
Factorising and Simplifying		
Equations with Indices		
Domain and Range		
Piecewise Functions		
Equation of a Circle		
Limiting Values of Sequences		
Three Simultaneous Equations		
Binomial Expansion		
Long Division of Polynomials		
The Factor Theorem		
Differentiation (Power Rule)		

Differentiation (Gradients, Tangents, Normals)		
Differentiation (Increasing and Decreasing Functions)		
Differentiation (Maxima and Minima)		
Differentiation (Perimeter, Area, Volume Problems)		
Matrix Multiplication		
The Identity Matrix		
Matrix Transformations		
Combining Transformations		
Solving Trig Equations		
Trig Identities		
Harder Trig Equations		

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

1 A school awards a prize to one student for each of the subjects maths, English and science.

Teachers nominate students and the headteachers picks one winner per subject.

This year there were

5 nominations for maths
4 nominations for English
2 nominations for science

1 (a) How many different ways can the headteacher select the award winners? **[2 marks]**

Answer _____

One student was nominated for both the maths and science prize.

All other students are only nominated for one award.

The headteacher doesn't want any students to receive more than one award.

1 (b) How many different ways can the headteacher select the award winners with no student winning more than one award. **[2 marks]**

Answer _____

Do not write outside the box

2 Abbie is selecting a new mobile phone.

When choosing the phone configuration there are

4 possible memory sizes
2 possible processor speeds
12 possible colours

2 (a) How many different possible phone configurations are there?

[2 marks]

Answer _____

Abbie's mum Jenny also wants a phone.

Jenny wants her phone to

have either a 32 GB, 64 GB or 128 GB of memory
have the fastest processor possible
be a colour that she likes

2 (b) Jenny calculates that this is 25% of the total possible configurations.
How many of the colours does Jenny like?

[2 marks]

Answer _____

8

Do not write outside the box

3 Isaac, Jamie, Kezia, Lucy and Miriam are contestants on a gameshow.

The gameshow has four rounds that are music, science, sport and history.

The team must select one player for each round.

A player can be selected for multiple different rounds.

3 (a) How many ways are there of selecting players for the four rounds? **[2 marks]**

Answer _____

3 (b) If instead each player can only play one round, how many ways are there of selecting players for the four rounds now? **[2 marks]**

Answer _____

Do not write outside the box

4 Here are the birthdates of 5 members of a chess club.

Rees	Jamie	Jack	Luke	Joel
10th	21st	24th	14th	15th

They need to select a 6 digit code number for the lock on their chess equipment.

They do this by selecting three of their birthdates and writing them as a number.

For example if was Rees chosen first, Jamie second and Jack third the code would be 102124

4 (a) How many possible 6 digit code numbers can be made in this way? **[2 marks]**

Answer _____

4 (b) How many of 6 digit code numbers that can be made are a multiple of 5? **[2 marks]**

Answer _____

4 (c) How many of 6 digit code numbers that can be made are greater than 150 000? **[2 marks]**

Answer _____

10

Do not write outside the box

5 Here are six numbered cards.

1	2	4	5	6	8

5 (a) Using all of cards how many different 6 digit numbers can be made? **[2 marks]**

Answer _____

5 (b) Using the cards how many different 5 digit numbers can be made? **[2 marks]**

Answer _____

5 (c) Using the cards how many different 4 digit numbers can be made that are a multiple of 5? **[2 marks]**

Answer _____

5 (d) Using the cards how many different numbers can be made that are between 40 000 and 500 000 **[3 marks]**

Answer _____

Do not write outside the box

6 How many integers between 40 000 and 90 000 can be formed from these digits

3 4 6 8 9

with no repetition of any digit?

[2 marks]

Answer _____

7 How many even integers greater than 500 000 can be formed from these digits

1 2 3 5 7 9

with no repetition of any digit?

[3 marks]

Answer _____

8 How many four-digit multiples of 5 are there if the first digit is greater than 3?

1 2 3 5 7 9

with no repetition of any digit?

[3 marks]

Answer _____

17

Do not write outside the box

9 How many 5 digit even numbers can be made from these digits

1 3 6 7 8

with no repetition of any digit?

[2 marks]

Answer _____

10 Here are six numbered cards.

3	4	5	6	7	8

Using five or six of the cards, how many numbers can be made greater than 60 000

[3 marks]

Answer _____

Do not write outside the box

11 Integers are made using some of the digits 1, 2, 3, 4, 5 and 6.

Each integer made

is greater than 3000
has no digit repeated
is a multiple of 5

How many integers can be made?

[4 marks]

Answer _____

12 Integers are made using some of the digits 2, 4, 6, 7, 8, and 9

Each integer made

is greater than 80000
has no digit repeated
is odd

How many integers can be made?

[4 marks]

Answer _____

13

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

Do not write outside the box

1 (a) Factorise fully $6p^2 + 15p^5$ **[2 marks]**

Answer _____

1 (b) Factorise fully $9m^4 + 36m^2$ **[2 marks]**

Answer _____

1 (c) Factorise fully $2a^4b - a^3b^3$ **[2 marks]**

Answer _____

1 (d) Factorise fully $9t^2 - 4$ **[2 marks]**

Answer _____

Do not write outside the box

2 (a) Factorise fully $4x^5 - 100x^3$ **[3 marks]**

Answer _____

2 (b) Factorise fully $3x^2 + 2xy - y^2$ **[3 marks]**

Answer _____

2 (c) Factorise fully $3(x + 4)^5 - (x + 4)^4$ **[3 marks]**

Answer _____

17

Do not write outside the box

3 Factorise fully $x^4 - 8x^2 + 12$ **[3 marks]**

Answer _____

4 Simplify fully $\frac{6x - 18}{x^2 - 9}$ **[3 marks]**

Answer _____

5 Simplify fully $\frac{6x^4 + 3x^3}{4x^2 - 1}$ **[3 marks]**

Answer _____

Do not write outside the box

6 Simplify fully $\dfrac{6x^2 - 2xy}{4xy - 12x^2}$ **[3 marks]**

Answer _____

7 Simplify fully $\dfrac{x^4 - 4x^2}{x^5 - 2x^4}$ **[3 marks]**

Answer _____

8 Simplify fully $\dfrac{2x^4 - 2x^3y}{x^3 - xy^2}$ **[4 marks]**

Answer _____

19

Do not write outside the box

9 Simplify fully $\dfrac{4(x-1)^3 + x(x-1)^2}{10x^2 - 18x + 8}$ **[5 marks]**

Answer _____

10 Simplify fully $\dfrac{3x^2 - 6x}{x^4 - 16} \div \dfrac{1}{x^2 + 4}$ **[6 marks]**

Answer _____

11

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

Do not write outside the box

1 Solve $(4x^3)^{\frac{1}{2}} = 250$ **[3 marks]**

Answer _____

2 Solve $4x^{\frac{1}{3}} - x^{-\frac{1}{3}} = 0$ **[3 marks]**

Answer _____

3 Solve $9x^{\frac{3}{2}} = \frac{4}{\sqrt{x}}$ **[3 marks]**

Answer _____

Do not write outside the box

4 Solve $\dfrac{(8x^{1.5})^2}{\sqrt[4]{x^9}} = 1$ **[4 marks]**

Answer _____

5 Solve $9^x \times \dfrac{1}{27} = \left(\dfrac{1}{3^x}\right)^x$ **[4 marks]**

Answer _____

17

Turn over ►

Do not write outside the box

6 Solve $\dfrac{\sqrt{5^x}}{25^{3x}} = 0.2$ **[4 marks]**

Answer _____

7 Solve $16^x = \dfrac{(8^3)^3 + (2^6)^4}{36}$ **[4 marks]**

Answer _____

Do not write outside the box

8 Solve $9^x = \dfrac{2^3}{3^{50} - 3^{48}}$ **[4 marks]**

Answer _____

9 Solve $\dfrac{(5^x)^x}{25^x} = 125$ **[4 marks]**

Answer _____

16

Do not write outside the box

10 Solve $125^3 \times 25^{(x+1)} = 5^{20}$ **[3 marks]**

Answer _____

11 Solve $27^4 \times 81^{2x} = 0.\dot{3}$ **[3 marks]**

Answer _____

Do not write outside the box

12 By multiplying both sides of the equation by $x^{\frac{1}{2}}$

Solve $x^{\frac{3}{2}} + 20x^{-\frac{1}{2}} = 9x^{\frac{1}{2}}$

You **must** show your working. **[3 marks]**

Answer _____

13 By multiplying both sides of the equation by $x^{\frac{1}{2}}$

Solve $x^{\frac{3}{2}} + 24x^{-\frac{1}{2}} = 14x^{\frac{1}{2}}$

You **must** show your working. **[3 marks]**

Answer _____

12

Do not write outside the box

14 By multiplying both sides of the equation by $x^{\frac{1}{2}}$

Solve $x^{\frac{3}{2}} + x^{\frac{1}{2}} = 12x^{-\frac{1}{2}}$ for $x > 0$

You **must** show your working. **[3 marks]**

Answer _____

15 By multiplying both sides of the equation by $x^{\frac{1}{2}}$

Solve $2x^{\frac{3}{2}} = 3x^{\frac{1}{2}} + 4x^{-\frac{1}{2}}$ for $x > 0$

Give your answer to 3 significant figures.
You **must** show your working. **[4 marks]**

Answer _____

Do not write outside the box

16 By multiplying both sides of the equation by $x^{\frac{1}{3}}$

Solve $x^{\frac{5}{3}} + 2x^{\frac{2}{3}} = 15x^{-\frac{1}{3}}$

You **must** show your working. **[3 marks]**

Answer _____

17 By multiplying both sides of the equation by $x^{\frac{1}{3}}$

Solve $x^{\frac{5}{3}} + 30x^{-\frac{1}{3}} = 11x^{\frac{2}{3}}$

You **must** show your working. **[3 marks]**

Answer _____

13

Turn over ►

Do not write outside the box

18 By multiplying both sides of the equation by $x^{\frac{1}{5}}$

Solve $x^{\frac{9}{5}} = 7x^{\frac{4}{5}} - 6x^{-\frac{1}{5}}$

You **must** show your working. **[3 marks]**

Answer _____

19 By multiplying both sides of the equation by $x^{\frac{2}{5}}$

Solve $x^{\frac{8}{5}} + 12x^{-\frac{2}{5}} = 8x^{\frac{3}{5}}$

You **must** show your working. **[3 marks]**

Answer _____

Do not write outside the box

20 By expanding and simplifying, solve

$$\left(2x^{-\frac{1}{2}} + x^{\frac{3}{2}}\right)^2 = 9 + x^3$$

Give your answers to 3 significant figures. **[6 marks]**

Answer _____

12

Do not write outside the box

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

1 (a) The function f is given by $f(x) = x^2 + 2$ with domain $5 < x < 11$

Work out the range of the function. **[2 marks]**

Answer _____

1 (b) The function g is given by $g(x) = \sqrt{x - 4}$

Give a reason why $x > 0$ is not a suitable domain for $g(x)$ **[1 mark]**

1 (c) The function h is given by $h(x) = 4x + 2$

The range is $-18 < h(x) < 10$

Work out the domain of the function. **[2 marks]**

Answer _____

Do not write outside the box

2 (a) The function f is given by $f(x) = 2 - 5x$ with domain $-3 < x < 5$

Work out the range of the function. **[2 marks]**

Answer _____

2 (b) The function g is given by $g(x) = \frac{x + 1}{x - 3}$

Give a reason why $x > 0$ is not a suitable domain for $g(x)$ **[1 mark]**

2 (c) The function h is given by $h(x) = 2x^3$

The range is $-250 < h(x) < 16$

Work out the domain of the function. **[2 marks]**

Answer _____

10

Do not write outside the box

3 (a) The function f is given by $f(x) = \frac{36}{x}$

The range is $1.5 < f(x) < 12$

Work out the domain of the function. **[2 marks]**

Answer _____

3 (b) The function g is given by $g(x) = \frac{100}{2x - 3}$

Write down the value of x for which the function not defined. **[1 mark]**

Answer _____

3 (c) The function h is given by $h(x) = \sin(x) + 1$ for all x

Write down the range of the function. **[2 marks]**

Answer _____

Do not write outside the box

4 (a) The function f is given by $f(x) = 2^x - 1$ for all x

Work out the range of the function. **[2 marks]**

Answer _____

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

Work out the range of the function. **[2 marks]**

Answer _____

4 (c) The function h is given by $h(x) = 3x^2$

The range is $0 \leq h(x) \leq 300$

Work out the domain of the function. **[2 marks]**

Answer _____

11

Do not write outside the box

5 The function f is given by $f(x) = \cos(x)$ with domain $30° < x < 60°$

Work out the range of the function. **[2 marks]**

Answer _____

6 The function g is given by $g(x) = x^2 + 4x - 3$ for all x

Work out the range of the function. **[3 marks]**

Answer _____

Do not write outside the box

7 (a) $f(x) = x^3 - 9x^2 + 24x - 15$

$y = f(x)$ has two stationary points.

Work out the coordinates of the two stationary points and determine their nature.

[6 marks]

Stationary Point (_____ , _____) Nature _____

Stationary Point (_____ , _____) Nature _____

7 (b) $f(x)$ has domain $0 < x < 3$

Work out the range of the function.

[2 marks]

Answer _____

13

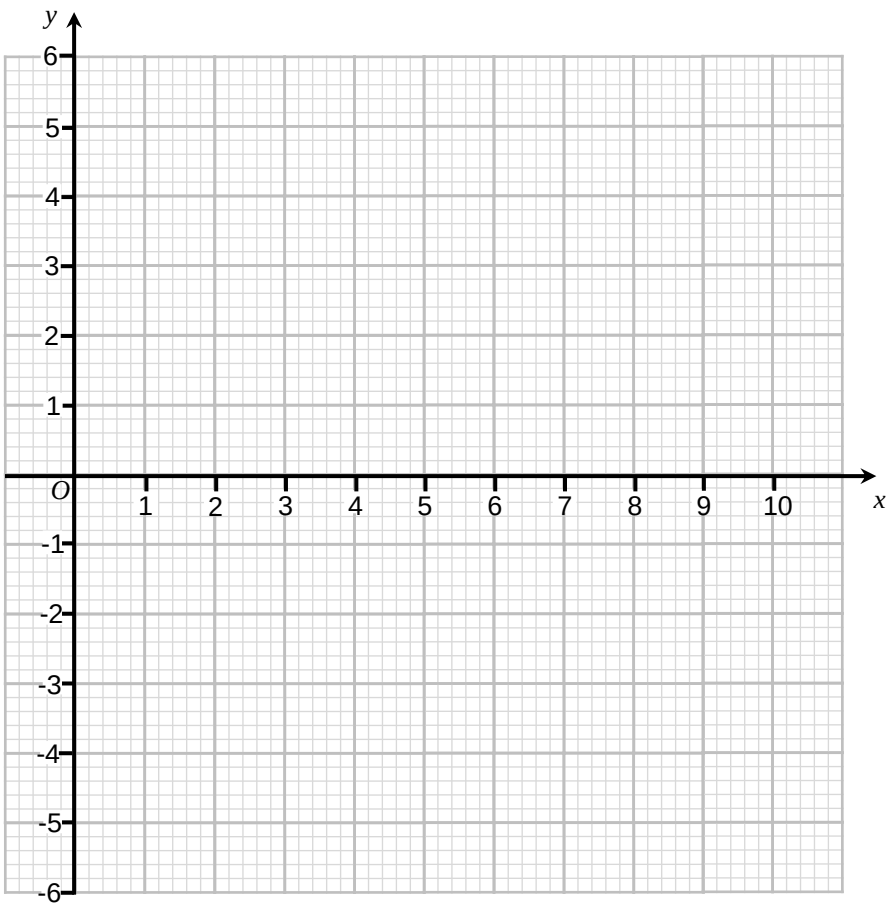
Answer **all** questions in the spaces provided.

Do not write outside the box

1 A function f is given by

$$f(x) = 2x - 3 \qquad 0 \leq x < 3$$
$$= 6 - x \qquad 3 \leq x < 7$$
$$= -1 \qquad 7 \leq x \leq 10$$

Draw a sketch of $y = f(x)$ for values of x from 0 to 10. **[4 marks]**

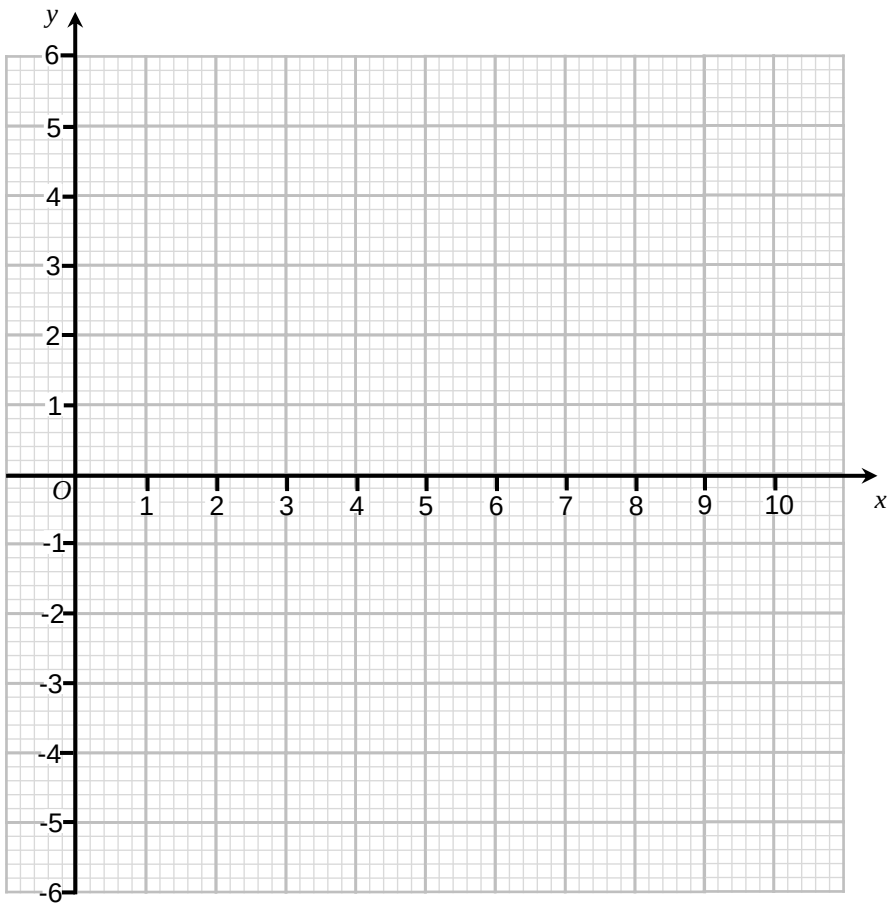


Do not write outside the box

2 A function f is given by

$$f(x) = 5 - 0.5x \qquad 0 \leq x < 4$$
$$= -4x + 19 \qquad 4 \leq x < 6$$
$$= x - 11 \qquad 6 \leq x \leq 10$$

Draw a sketch of $y = f(x)$ for values of x from 0 to 10. **[4 marks]**



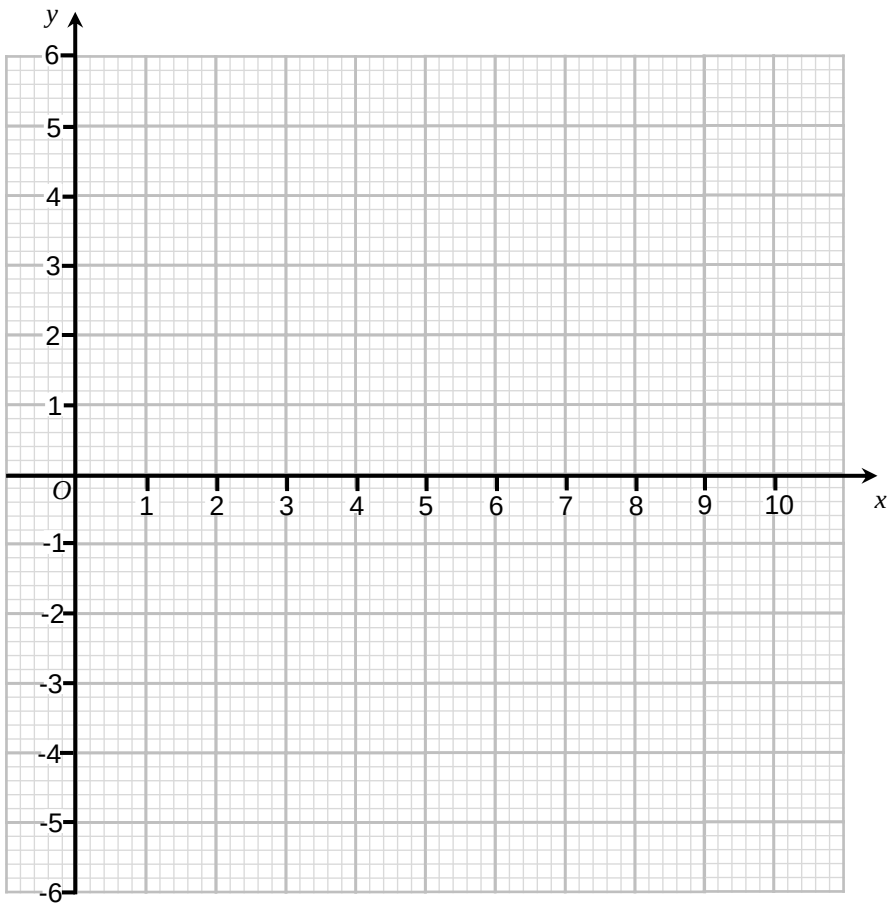
8

Do not write outside the box

3 A function f is given by

$$f(x) = x^2 \qquad 0 \leq x < 2$$
$$= 6 - x \qquad 2 \leq x < 4$$
$$= 4 - 0.5x \qquad 4 \leq x \leq 10$$

Draw a sketch of $y = f(x)$ for values of x from 0 to 10. **[4 marks]**

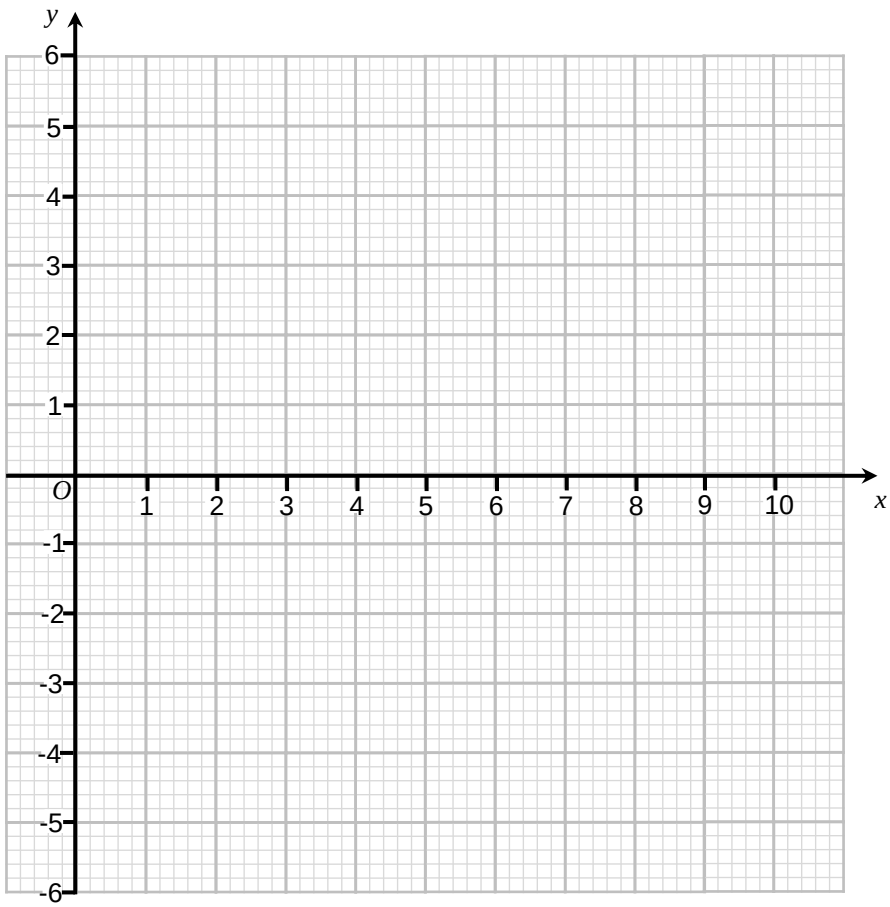


Do not write outside the box

4 A function f is given by

$$f(x) = 5 - x^2 \qquad 0 \leq x < 3$$
$$= 3x - 13 \qquad 3 \leq x < 6$$
$$= 5 \qquad 6 \leq x \leq 10$$

Draw a sketch of $y = f(x)$ for values of x from 0 to 10. **[4 marks]**



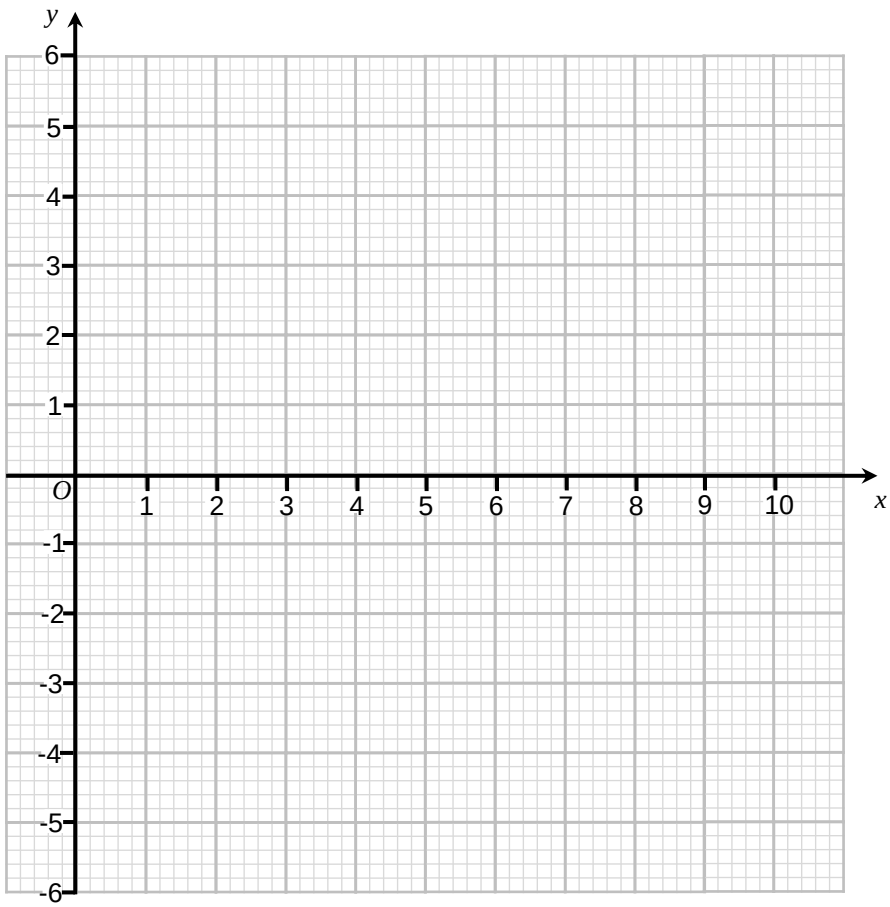
8

Do not write outside the box

5 A function f is given by

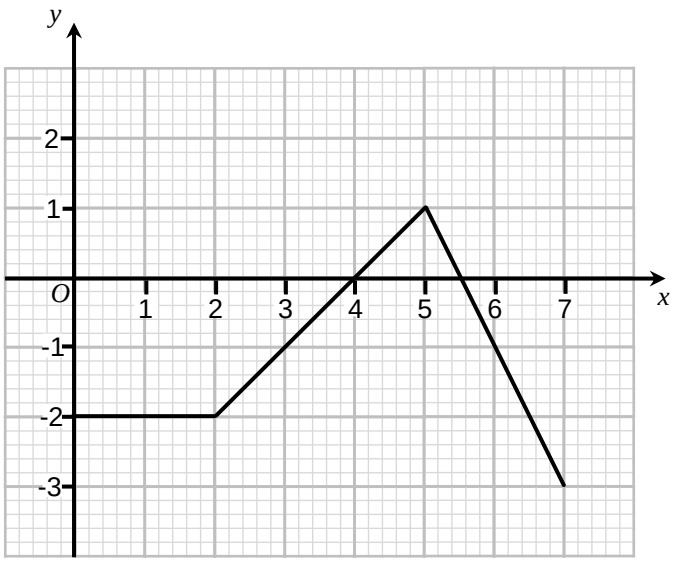
$$f(x) = x + 2 \qquad 0 \leq x < 3$$
$$= x^2 - 12x + 32 \qquad 3 \leq x < 8$$
$$= 12 - \frac{3}{2}x \qquad 8 \leq x \leq 10$$

Draw a sketch of $y = f(x)$ for values of x from 0 to 10. **[4 marks]**



Do not write outside the box

6 Here is a graph of $y = f(x)$



Define f(x), stating clearly the domain for each part. **[3 marks]**

f(x) = _____ ____ ≤ x < ____

_____ ____ ≤ x < ____

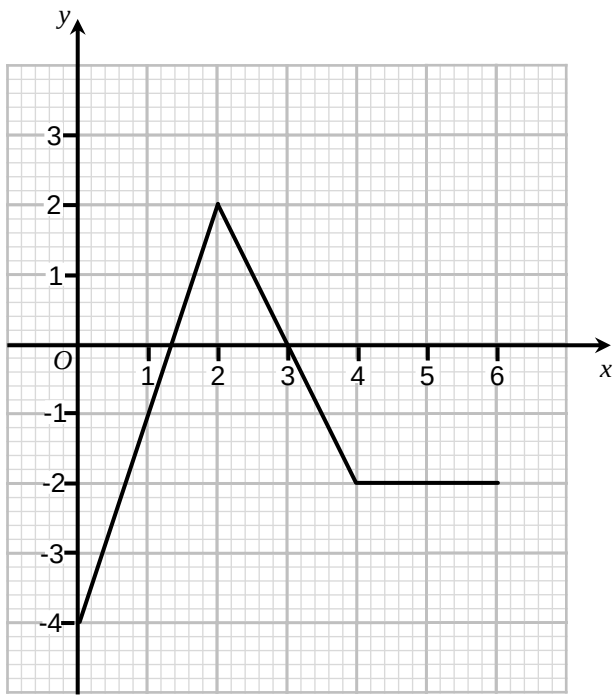
_____ ____ ≤ x ≤ ____

7

Turn over ►

Do not write outside the box

7 Here is a graph of $y = f(x)$



Define f(x), stating clearly the domain for each part. **[3 marks]**

f(x) = _____ _____ ≤ x < _____

_____ _____ ≤ x < _____

_____ _____ ≤ x ≤ _____

Do not write outside the box

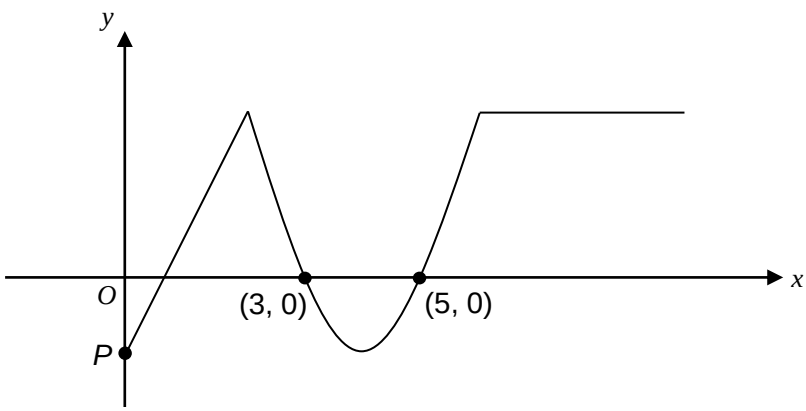
8 $f(x) = ax + b \quad 0 \leq x < 2$

$= (x - c)(x - d) \quad 2 \leq x < 6$

$= e \quad 6 \leq x \leq 10$

a, b, c, d and e are constants with $c < d$

A sketch of $y = f(x)$ is shown.



The point P is where the function intersects the y-axis.

The line $y = P$ is tangential to the curved part of the graph.

Find the values of a, b, c, d and e.

[5 marks]

$a =$ _____ $b =$ _____ $c =$ _____ $d =$ _____ $e =$ _____

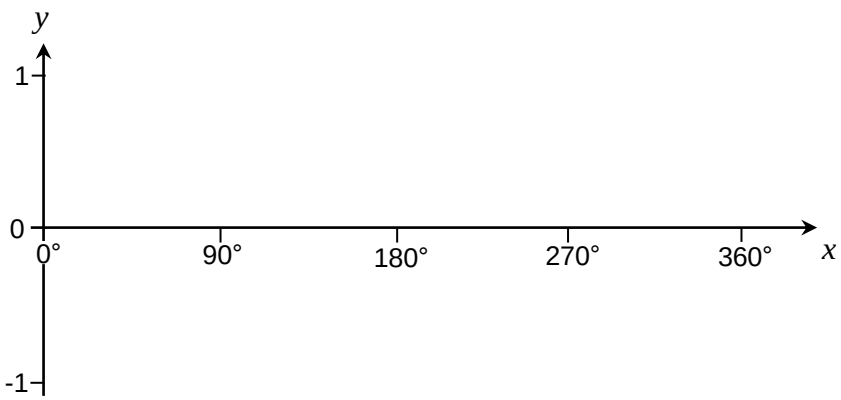
8

Do not write outside the box

9 A function f is given by

$$f(x) = \sin(x°) \qquad 0° \leq x < 180°$$
$$= 0 \qquad 180° \leq x < 270°$$
$$= \cos(x°) \qquad 270° \leq x \leq 360°$$

9 (a) Draw a sketch of $y = f(x)$ for values of x from 0° to 360° **[3 marks]**



9 (b) $0 < k < 1$

How many solutions are there to the equation $f(x) = k$ **[1 mark]**

Answer _____

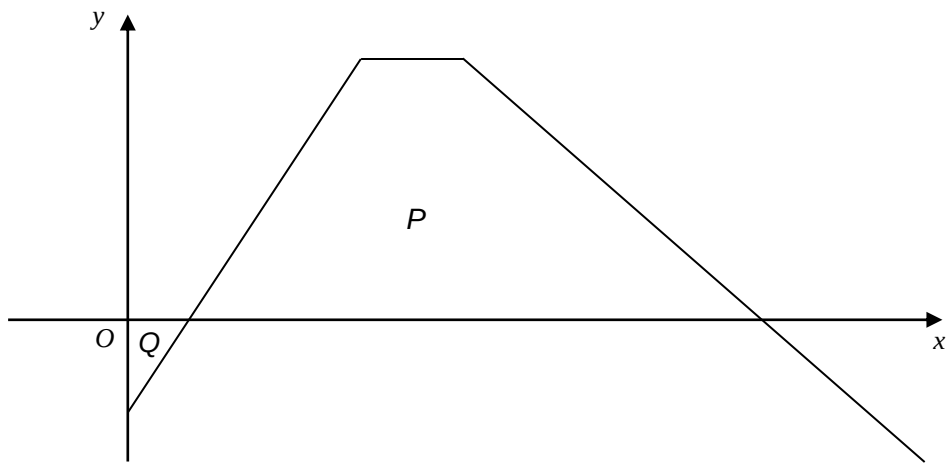
Do not write outside the box

10 $f(x) = 2x - 5 \quad 0 \leq x < 10$

$= a \quad 10 \leq x < 15$

$= 30 - x \quad x \geq 15$

A sketch of $y = f(x)$ is shown.



10 (a) Work out the value of a **[2 marks]**

$a =$ _____

10 (b) How many times bigger is the area of trapezium P than triangle Q? **[4 marks]**

Answer _____

10

Do not write outside the box

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

1 The equation of a circle is $x^2 + y^2 = 16$

1 (a) Write down the coordinates of the centre of the circle. **[1 mark]**

(_____ , _____)

1 (b) Write down the radius of the circle. **[1 mark]**

Answer _____

2 The equation of a circle is $(x - 3)^2 + (y + 2)^2 = 5$

2 (a) Write down the coordinates of the centre of the circle. **[1 mark]**

(_____ , _____)

2 (b) Write down the radius of the circle. **[1 mark]**

Answer _____

Do not write outside the box

3 Write down the equation of a circle, centre (-3, 1) and radius $\sqrt{10}$. **[2 marks]**

Answer _____

4 Write down the equation of a circle, centre (0, 6) and radius $\frac{1}{2}$ **[2 marks]**

Answer _____

5 A circle has centre (1, -4) and radius 5.

Show that the circle passes through point *P* (4, -8). **[3 marks]**

11

Do not write outside the box

6 A circle, centre (1, 3) passes through the point P (9, 9)

Work out the equation of the circle. **[3 marks]**

Answer _____

7 AB is the diameter of a circle.
A is (-5,-1) and B is (5, 23)

Work out the equation of the circle. **[3 marks]**

Answer _____

Do not write outside the box

8 Circles C_1 and C_2 both have the same centre (1, -2)

The radius of C_1 is 10.
The difference in the areas of the two circles is 96π

Work out two possible equations for the circle C_2 **[4 marks]**

Answer _____

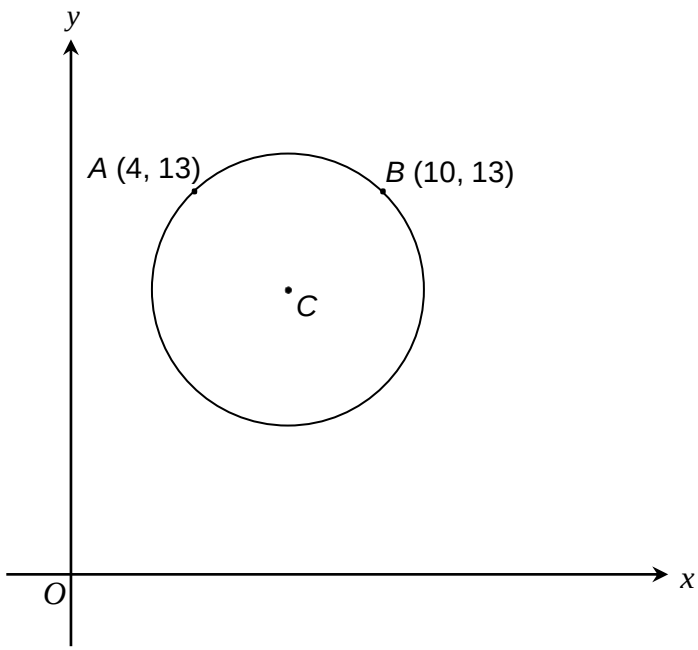
and

Answer _____

11

Do not write outside the box

9 The circle, centre *C*, passes through the points *A* (4, 13) and *B* (10, 13)



The area of triangle *ABC* is 12 units^2

Work out the equation of the circle.

[5 marks]

Answer _____

Do not write outside the box

10 The circle with equation $(x - 3)^2 + (y - 3)^2 = 68$ passes through the point P (5, -5)

Work out the equation of the tangent to the circle at the point P. **[4 marks]**

Answer _____

9

Do not write outside the box

11 The circle with equation $(x - 4)^2 + (y + 1)^2 = 13$ passes through the point Q (6, -4)

Work out the equation of the tangent to the circle at the point Q. **[4 marks]**

Answer _____

4

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

Do not write outside the box

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

1 (a) A term in the sequence has the value $\frac{3}{2}$

Work out the value of n.

[2 marks]

Answer _____

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

[1 mark]

Answer _____

Do not write outside the box

2 The nth term of a sequence is $\dfrac{7n}{10n + 6}$

2 (a) A term in the sequence has the value $\dfrac{2}{3}$

Work out the value of n.

[2 marks]

Answer _____

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

[1 mark]

Answer _____

6

Do not write outside the box

3 The nth term of a sequence is $\dfrac{14n - 21}{4n}$

3 (a) The k^{th} term of the sequence is the first term that has a value greater than 3.

Work out the value of k.

[2 marks]

$k =$ _____

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

[1 mark]

Answer _____

Do not write outside the box

4 The nth term of a sequence is $\dfrac{50 - 6n}{3n}$

4 (a) The k^{th} term of the sequence is the first negative term.

Work out the value of k.

[2 marks]

$k =$ _____

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

[1 mark]

Answer _____

6

Do not write outside the box

5 The nth term of a sequence is $\frac{n^2 + 20}{3n^2}$

5 (a) A term in the sequence has the value $\frac{2}{5}$

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 _____

Do not write outside the box

6 The nth term of a sequence is $\dfrac{4n^2 + 45}{5n^2 - 30}$

6 (a) A term in the sequence has the value 0.9

Work out the value of n.

[2 marks]

Answer _____

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

[1 mark]

Answer _____

6

Do not write outside the box

7 The nth term of a sequence is $\dfrac{2n^2}{3n^2 - 9}$

7 (a) Show that the difference between the first two terms of the sequence is 3.

[3 marks]

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

[1 mark]

Answer _____

Do not write outside the box

8 The nth term of a sequence is $\dfrac{20 - 6n^2}{an^2 + 35}$

8 (a) The limiting value of the sequence as $n \to \infty$ is equal to $-\dfrac{2}{3}$

Write down the value of a. **[1 mark]**

$a =$ _____

8 (b) A term in the sequence has the value -0.5

Work out the value of n. **[3 marks]**

Answer _____

8

Turn over ►

Do not write outside the box

9 The nth term of a sequence is $\dfrac{4n^2 + 6}{3n^2 + 2n}$

9 (a) Two terms in the sequence have the value $\frac{5}{4}$

Work out the both possible values of n.

[4 marks]

Answer _____

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

[1 mark]

Answer _____

Do not write outside the box

10 The nth term of a sequence is $\frac{3n+3}{2n-1} - \frac{2n^2+n}{3n^2-8}$

10 (a) Work out the value of the second term of the sequence **[2 marks]**

Answer _____

10 (b) Work out the limiting value of the sequence as n $\rightarrow \infty$ **[3 marks]**

Answer _____

10

Do not write outside the box

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

1 Solve the simultaneous equations

$$4a + 2b + c = 25$$
$$a + 3b - 2c = 9$$
$$2a - b + 3c = 11$$

Do **not** use trial and improvement.

You **must** show your working. **[5 marks]**

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

Do not write outside the box

2 Solve the simultaneous equations

$$9a - b - 2c = 8$$
$$4a + b + 3c = 4$$
$$2a - 4b - c = -9$$

Do **not** use trial and improvement.

You **must** show your working.

[5 marks]

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

10

Do not write outside the box

3 Solve the simultaneous equations

$$3a + 2b + 2c = 24$$
$$2a - 6b + 3c = 29$$
$$a + 3b + 4c = 0$$

Do **not** use trial and improvement.

You **must** show your working. **[5 marks]**

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

Do not write outside the box

4 Solve the simultaneous equations

$$2a - 2b - 4c = 2$$
$$a - 4b + 2c = -14$$
$$3a - 3b - 5c = 0$$

Do **not** use trial and improvement.

You **must** show your working. **[5 marks]**

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

10

Do not write outside the box

5 Solve the simultaneous equations

$$5a + 2b - c = 19$$
$$10a - 3b - 6c = 79$$
$$3b - 2c = 1$$

Do **not** use trial and improvement.

You **must** show your working. **[5 marks]**

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

Do not write outside the box

6 Solve the simultaneous equations

$$4a - b - c = -7$$
$$8a + 5b + 2c = 27$$
$$6a + 2b - 3c = 17$$

Do **not** use trial and improvement.

You **must** show your working. **[5 marks]**

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

10

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

Do not write outside the box

1 Expand and simplify fully $(3 + x)^4$ **[4 marks]**

Answer _____

2 Expand and simplify fully $(x - 2)^6$ **[4 marks]**

Answer _____

3 Expand and simplify fully $(1 + 2x)^5$ **[4 marks]**

Answer _____

4 Expand and simplify fully $(1 - 3x)^4$ **[4 marks]**

Answer _____

16

Do not write outside the box

5 Work out the coefficient of x^3 in the expansion of $(2 + x)^5$ **[2 marks]**

Answer _____

6 Work out the coefficient of x^5 in the expansion of $(2 - x)^6$ **[2 marks]**

Answer _____

7 Work out the coefficient of x^2 in the expansion of $(3x - 2)^4$ **[2 marks]**

Answer _____

Do not write outside the box

8 The coefficient of x^2 in the expansion of $(1 + ax)^7$ is 189.

Work out the two possible values of a.

[3 marks]

Answer _____ and _____

9 The coefficient of x^5 in the expansion of $(b - x)^6$ is -120.

Work out the value of b.

[3 marks]

Answer _____

12

Do not write outside the box

10 The coefficient of x^3 in the expansion of $(2c + x)^5$ is 360.

Work out the two possible values of c.

[3 marks]

Answer _____ and _____

11 The coefficient of x^3 in the expansion of $(2 + dx)^6$ is 20000.

Work out the value of d.

[3 marks]

Answer _____

Do not write outside the box

12 In the expansion of $(a + bx)^3$

the coefficient of x is -150
the coefficient of x^2 is 60

Work out the values of a and b. **[5 marks]**

$a =$ _____ $b =$ _____

11

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

Do not write outside the box

1 Use long division to find the result of $(x^3 + 9x^2 + 26x + 24) \div (x + 3)$

[2 marks]

Answer _____

2 Use long division to find the result of $(x^3 + 8x^2 + 17x + 10) \div (x + 5)$

[2 marks]

Answer _____

Do not write outside the box

3 Use long division to find the result of $(x^3 + 5x^2 + 2x - 8) \div (x + 2)$

[2 marks]

Answer _____

4 Use long division to find the result of $(x^3 - 4x^2 + x + 6) \div (x - 3)$

[2 marks]

Answer _____

8

Do not write outside the box

5 Use long division to find the result of $(2x^3 + 7x^2 - 17x - 10) \div (2x + 1)$

[2 marks]

Answer _____

6 Use long division to find the result of $(3x^3 - 4x^2 - 13x - 6) \div (3x + 2)$

[2 marks]

Answer _____

Do not write outside the box

7 Use long division to find the result of $(2x^3 + 9x^2 - 11x - 30) \div (x + 5)$

[2 marks]

Answer _____

8 Use long division to find the result of $(4x^3 + 16x^2 - x - 4) \div (2x - 1)$

[2 marks]

Answer _____

8

Turn over ►

Do not write outside the box

9 $(x + 3)$ divides into $(x^3 + 8x^2 + kx + 12)$ without remainder.

[4 marks]

Find the value of k.

$k =$ _____

10 Use long division to find the result of $(2x^4 - 10x^2 + 3x + 2) \div (x - 2)$

[3 marks]

Answer _____

7

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

Do not write outside the box

1 $f(x) = x^3 + 5x^2 + 2x - 8$

1 (a) Use the factor theorem to show that $(x + 4)$ is a factor of $f(x)$.

[2 marks]

1 (b) Hence, fully factorise $f(x)$.

[3 marks]

Answer _____

Do not write outside the box

2 $f(x) = 2x^3 + 13x^2 + 13x - 10$

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

[2 marks]

2 (b) Hence, fully factorise $f(x)$.

[3 marks]

Answer _____

10

Turn over ►

Do not write outside the box

3 $f(x) = x^3 - 5x^2 - 2x + 24$

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

[2 marks]

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

[3 marks]

Answer _____

Do not write outside the box

4 $f(x) = 4x^3 - 11x^2 + 5x + 2$

4 (a) Use the factor theorem to show that $(4x + 1)$ is a factor of $f(x)$.

[2 marks]

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

[3 marks]

Answer _____

10

Turn over ►

Do not write outside the box

5 $f(x) = 3x^3 - 10x^2 + 4x + 8$

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

[2 marks]

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

[3 marks]

Answer _____

Do not write outside the box

6 $f(x) = x^3 + ax^2 - 21x - 18$

6 (a) $(x + 3)$ is a factor of $f(x)$. Find the value of a.

[3 marks]

$a =$ _____

6 (b) Hence, fully factorise $f(x)$.

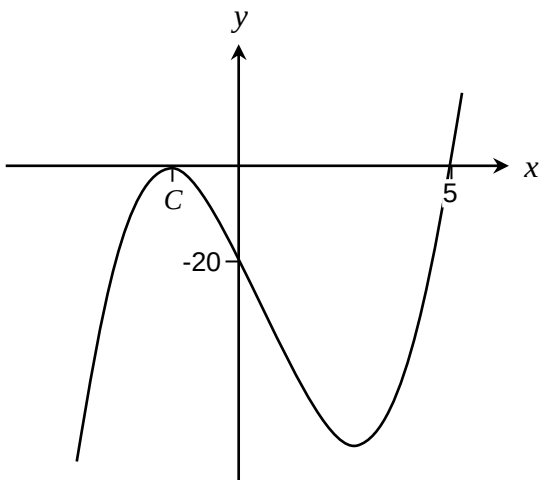
[3 marks]

Answer _____

10

Do not write outside the box

7 A sketch of the graph $y = x^3 - x^2 + px + q$ is shown.



7 (a) Write down the value of q. **[1 mark]**

$q =$ _____

7 (b) Work out the value of p. **[3 marks]**

$p =$ _____

7 (c) The graph touches the x-axis at the point C.
Work out the x coordinate of the point C. **[3 marks]**

Answer _____

Do not write outside the box

8 $f(x) = 2x^3 + 11x^2 + ax + b$

8 (a) $(x - 2)$ and $(x + 6)$ are factors of $f(x)$. Find the values of a and b. **[4 marks]**

$a =$ _____ $b =$ _____

8 (b) Solve $f(x) = 0$ **[3 marks]**

Answer _____

14

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

Do not write outside the box

1 $y = 2x^3 + 3x^2 + 4x + 1$

Work out $\frac{dy}{dx}$ **[2 marks]**

$\frac{dy}{dx} =$

2 $y = 5x^4 - x^2 + x - 4$

Work out $\frac{dy}{dx}$ **[2 marks]**

Do not write outside the box

3 $y = 20 - 4x^{-2} + \frac{x}{4}$

Work out $\frac{dy}{dx}$ **[2 marks]**

$\frac{dy}{dx} =$ _____

4 $y = \frac{2}{x^3} - \frac{3}{x}$

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

Answer _____

9

Do not write outside the box

5 $y = (2x + 1)(x - 3)$

Work out $\frac{dy}{dx}$ **[3 marks]**

$\frac{dy}{dx} =$ _____

6 $y = x^2(2x^2 - 3)$

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

Answer _____

Do not write outside the box

7 $y = \dfrac{3x + 5x^2}{x^2}$

Work out $\dfrac{dy}{dx}$ **[3 marks]**

$\dfrac{dy}{dx} =$

8 $y = \dfrac{6 + 8x^3 - x^2}{x^3}$

Work out $\dfrac{dy}{dx}$ **[4 marks]**

$\dfrac{dy}{dx} =$

13

Do not write outside the box

9 $y = (x + 1)(x + 2)(x + 3)$

Work out $\frac{dy}{dx}$ **[4 marks]**

$\frac{dy}{dx} =$ _____

10 $y = 5 - \frac{x^3 + 8}{4x^2}$

Work out $\frac{dy}{dx}$ **[4 marks]**

$\frac{dy}{dx} =$ _____

8

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

Do not write outside the box

1 Work out the gradient of the curve $y = x^3 - 5x^2 + 7x + 9$

at the point where $x = 3$

[3 marks]

Answer _____

2 Work out the gradient of the curve $y = x^4 + 4x$

at the point where $x = -2$

[3 marks]

Answer _____

Do not write outside the box

3 Work out the gradient of the curve $y = 8 - \frac{3}{x}$

at the point where $x = 2$

[3 marks]

Answer _____

4 Work out the gradient of the curve $y = (x^2 + 1)^2$

at the point where $x = 1$

[4 marks]

Answer _____

13

Do not write outside the box

5 $y = 3x^2 - 5x + 1$

Work out the value of x at which the rate of change of y with respect to x is -2

[4 marks]

Answer _____

6 $y = 3x - \frac{4}{x^2}$

Work out the value of x at which the rate of change of y with respect to x is 2

[4 marks]

Answer _____

Do not write outside the box

7 $y = 2x^3 - 3x^2 - 12x$

Work out the values of x at which the rate of change of y with respect to x is 24

[4 marks]

Answer _____

8 $y = 6x + \frac{4}{x}$

Work out the values of x at which the rate of change of y with respect to x is -3

[5 marks]

Answer _____

17

Do not write outside the box

9 $y = ax^3 - 4x$

At $x = 1$ the rate of change of y with respect to x is 17

Work out the value of a.

[3 marks]

Answer _____

10 $y = x^2 - \frac{a}{x}$

At $x = 5$ the rate of change of y with respect to x is 16

Work out the value of a.

[4 marks]

Answer _____

Do not write outside the box

11 A curve has equation $y = x^3 + 3x$

Work out the equation of the tangent to the curve at the point (2, 14) **[4 marks]**

Answer _____

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

Work out the equation of the **normal** to the curve at the point (1, -1) **[4 marks]**

Answer _____

15

Do not write outside the box

13 P is the point on the curve $y = \frac{x^2 + 7}{4}$ where $x = 1$

13 (a) Work out the equation of the **normal** to the curve at P. **[5 marks]**

Answer _____

13 (b) The normal at P also intersects the curve at Q.

Work out the coordinates of Q. **[5 marks]**

$Q = ($ _____ , _____ $)$

9

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

Do not write outside the box

1 Work out the values of x for which $f(x) = 3x^2 - 4x$ is a decreasing function.

Give your answer as an inequality.

[3 marks]

Answer _____

2 Work out the values of x for which $f(x) = \frac{1}{3}x^3 + 2x^2 - 12x$ is a decreasing function.

Give your answer as an inequality.

[5 marks]

Answer _____

Do not write outside the box

3 Work out the values of x for which $f(x) = 10x - x^2$ is an increasing function.

Give your answer as an inequality.

[3 marks]

Answer _____

4 Work out the values of x for which $f(x) = x^3 + 4x^2 - 3x$ is an increasing function.

Give your answer as an inequality.

[5 marks]

Answer _____

16

Turn over ►

Do not write outside the box

5 $f(x) = \frac{1}{3}x^3 - 3x^2 + 11x$

Use differentiation to show that $f(x)$ is an increasing function for all values of x.

[3 marks]

6 $f(x) = 3x^2 - 10x - \frac{1}{3}x^3$

Use differentiation to show that $f(x)$ is an decreasing function for all values of x.

[3 marks]

Do not write outside the box

7 $f(x) = x^3 + 3x^2 + 7x$

Use differentiation to show that $f(x)$ is an increasing function for all values of x.

[4 marks]

8 $f(x) = -3x^3 + 18x^2 - 38x$

Use differentiation to show that $f(x)$ is an decreasing function for all values of x.

[4 marks]

14

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

Do not write outside the box

1 $y = 2x^3 - 4x^2$

Work out $\frac{d^2y}{dx^2}$ **[3 marks]**

$\frac{d^2y}{dx^2} =$ _____

2 $y = \frac{2}{x} + 9x$

Work out $\frac{d^2y}{dx^2}$ **[3 marks]**

$\frac{d^2y}{dx^2} =$ _____

Do not write outside the box

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

Work out the value of $\frac{d^2y}{dx^2}$ when $x = 2$

[4 marks]

Answer _____

4 The curve $y = x^4 - 32x$ has one stationary point.

Work out the coordinates of the stationary point.

[4 marks]

Answer (_____ , _____)

14

Do not write outside the box

5 Work out the coordinates of the two stationary points for the curve $y = x^3 + 3x^2$

[4 marks]

Stationary Point (_____ , _____)

Stationary Point (_____ , _____)

6 $y = \frac{18}{x} + 2x$

Show that y has a minimum value when $x = 3$

[5 marks]

Do not write outside the box

7 The curve $y = x^3 + 12x^2 + 36x + 1$ has two stationary points.

Work out the coordinates of the two stationary points and determine their nature.

[6 marks]

Stationary Point (_____ , _____) Nature _____

Stationary Point (_____ , _____) Nature _____

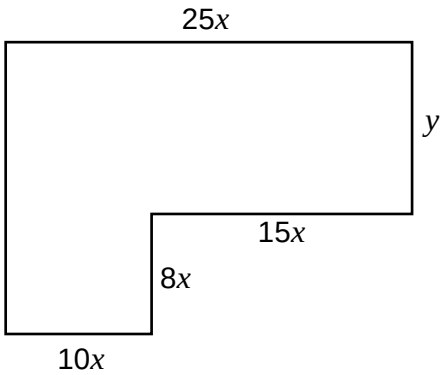
15

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

Do not write outside the box

1 This shape is made from two rectangles.

All dimensions are in centimetres.



Not drawn accurately

The perimeter of the shape is 298 cm

1 (a) Show that $y = 149 - 33x$ **[2 marks]**

The area of the shape is A cm^2

1 (b) Show that $A = 3725x - 745x^2$ **[2 marks]**

Do not write outside the box

1 (c) Use differentiation to work out the maximum value of A as x varies. **[3 marks]**

Answer _____

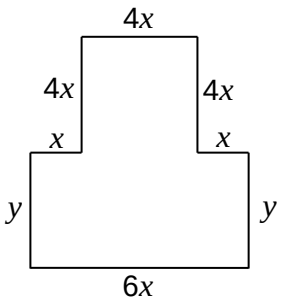
7

Turn over ►

Do not write outside the box

2 This shape is made from a square and a rectangle.

All dimensions are in centimetres.



Not drawn accurately

The perimeter of the shape is 220 cm

2 (a) Show that $y = 110 - 10x$ **[2 marks]**

The area of the shape is A cm^2

2 (b) Show that $A = 660x - 44x^2$ **[2 marks]**

Do not write outside the box

2 (c) Use differentiation to work out the maximum value of A as x varies. **[3 marks]**

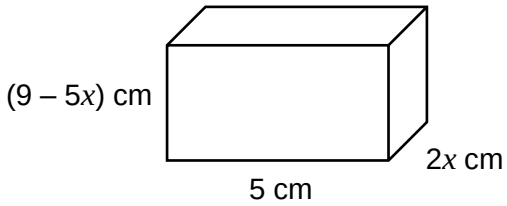
Answer _____

7

Turn over ►

Do not write outside the box

3 This lengths of a cuboid are 5 cm, $2x$ cm and $(9 - 5x)$ cm



Not drawn accurately

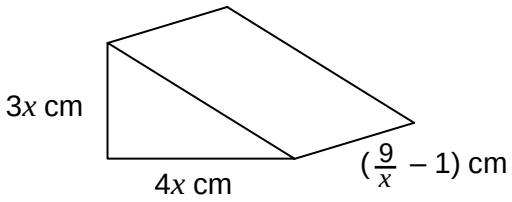
3 (a) Show that the volume of the cuboid, V, is given by $V = 90x - 50x^2$ **[2 marks]**

3 (b) Use differentiation to work out the maximum value of V as x varies. **[3 marks]**

Answer _____

Do not write outside the box

4 Here is a triangular prism.



4 (a) Show that the volume of the prism, V, is given by $V = 54x - 6x^2$ **[2 marks]**

4 (b) Use differentiation to work out the maximum value of V as x varies. **[3 marks]**

Answer _____

10

Video Solutions

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

Do not write outside the box

1 Work out $6\begin{pmatrix} -2 \\ 5 \end{pmatrix}$ **[1 mark]**

Answer _____

2 Work out $-4\begin{pmatrix} 8 \\ -1 \end{pmatrix}$ **[1 mark]**

Answer _____

3 Work out $3\begin{pmatrix} 5 & 1 \\ 2 & 0 \end{pmatrix}$ **[1 mark]**

Answer _____

4 Work out $-4\begin{pmatrix} 6 & -2 \\ -2 & 4 \end{pmatrix}$ **[1 mark]**

Answer _____

Do not write outside the box

5 Work out $\begin{pmatrix} 4 & 0 \\ 2 & 1 \end{pmatrix}\begin{pmatrix} 1 \\ 5 \end{pmatrix}$ **[1 mark]**

Answer _____

6 Work out $\begin{pmatrix} -3 & 1 \\ 6 & -2 \end{pmatrix}\begin{pmatrix} 2 \\ -1 \end{pmatrix}$ **[1 mark]**

Answer _____

7 Work out $\begin{pmatrix} 2 & 3 \\ 0 & 5 \end{pmatrix}\begin{pmatrix} 1 & 0 \\ 4 & 2 \end{pmatrix}$ **[2 marks]**

Answer _____

8

Do not write outside the box

8 Work out $\begin{pmatrix} 2 & -4 \\ 0 & 3 \end{pmatrix}\begin{pmatrix} 1 & -1 \\ 4 & -3 \end{pmatrix}$ **[2 marks]**

Answer _____

9 Work out $\begin{pmatrix} 3 & 5 \\ 4 & 0 \end{pmatrix}\begin{pmatrix} 1 & -1 \\ 2 & 2 \end{pmatrix}\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ **[3 marks]**

Answer _____

Do not write outside the box

10 Work out $5\begin{pmatrix} -2 & 4 \\ -3 & 0 \end{pmatrix}\begin{pmatrix} 1 \\ 5 \end{pmatrix}$ **[2 marks]**

Answer _____

11 Work out $3\begin{pmatrix} 0 & 3 \\ -1 & 0 \end{pmatrix}\begin{pmatrix} 6 & 1 \\ -2 & -1 \end{pmatrix}$ **[3 marks]**

Answer _____

10

Do not write outside the box

12 $\mathbf{A} = \begin{pmatrix} 5 & 2 \\ 3 & -3 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} -1 \\ 0 \end{pmatrix}$ $\mathbf{C} = \begin{pmatrix} 0 & 1 \\ 3 & 2 \end{pmatrix}$

12 (a) Work out **AB**

[1 mark]

Answer _____

12 (b) Work out 2**AC**

[3 marks]

Answer _____

12 (c) Work out $\mathbf{C}^2$

[2 marks]

Answer _____

Do not write outside the box

12 (d) By finding **AC** and **CA,** show that matrix multiplication is not commutative.

[5 marks]

11

Turn over ►

Do not write outside the box

13 Work out $\begin{pmatrix} \sqrt{3} & 1 \\ 1 & \sqrt{2} \end{pmatrix}\begin{pmatrix} 2 & \sqrt{3} \\ 0 & 1 \end{pmatrix}$ **[2 marks]**

Answer _____

14 Work out $\begin{pmatrix} a & 4 \\ a^2 & a \end{pmatrix}\begin{pmatrix} 2 & 4a^2 \\ a & -a^3 \end{pmatrix}$

Fully simplify your answer. **[4 marks]**

Answer _____

Do not write outside the box

15 $a\begin{pmatrix} 4 & 1 \\ 0 & -2 \end{pmatrix}\begin{pmatrix} b \\ -3 \end{pmatrix} = \begin{pmatrix} -9 \\ 9 \end{pmatrix}$

Work out the values of a and b.

[5 marks]

$a =$ _____ $b =$ _____

16 $\begin{pmatrix} 0 & c \\ d & d \end{pmatrix}\begin{pmatrix} d \\ 3 \end{pmatrix} = \begin{pmatrix} -12 \\ 10 \end{pmatrix}$

Work out the values of c and d.

[4 marks]

$c =$ _____ $d =$ _____ and $d =$ _____

15

Do not write outside the box

17 $\mathbf{A} = \begin{pmatrix} 3 & 4 \\ 3 & 1 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 1 & x \\ 3 & 1 \end{pmatrix}$ $\mathbf{C} = \begin{pmatrix} 4 & 2 \\ 2 & 0 \end{pmatrix}$

$\mathbf{AB} = k\mathbf{C}^2$

Work out the values of k and x.

[5 marks]

$k =$ _____ $x =$ _____

Do not write outside the box

18 $\begin{pmatrix} 2 & b \\ a & 3b \end{pmatrix}\begin{pmatrix} a \\ 1 \end{pmatrix} = \begin{pmatrix} 8 \\ 19 \end{pmatrix}$

Work out two pairs of values of a and b.

[5 marks]

$a =$ _____ $b =$ _____

$a =$ _____ $b =$ _____

10

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

Do not write outside the box

1 Show that $\begin{pmatrix} 2 & -1 \\ 4 & 3 \end{pmatrix}\begin{pmatrix} 6 & 2 \\ -8 & 4 \end{pmatrix} = k\,\mathbf{I}$

where k is a constant and **I** is the identity matrix.

[3 marks]

2 $\mathbf{A} = \begin{pmatrix} 0 & -6 \\ 4 & 8 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 1 & b \\ a & 0 \end{pmatrix}$

$\mathbf{AB} = 3\mathbf{I}$ where **I** is the identity matrix.

Work out the values of a and b.

[3 marks]

$a =$ _____ $b =$ _____

Do not write outside the box

3 $\mathbf{A} = \begin{pmatrix} a+1 & b \\ 2b & a-3 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 3 & -2 \\ -4 & 5 \end{pmatrix}$

AB = 14I

where **I** is the identity matrix.

Work out the values of a and b.

[4 marks]

$a =$ _____ $b =$ _____

4 $\mathbf{A} = \begin{pmatrix} -2 & 2 \\ 2 & 0 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} a & a \\ a & b \end{pmatrix}$

$A^2B = I$

where **I** is the identity matrix.

Work out the values of a and b.

[4 marks]

$a =$ _____ $b =$ _____

8

Do not write outside the box

5 $\mathbf{M} = \begin{pmatrix} \sqrt{12} & 4 \\ 0 & \sqrt{8} \end{pmatrix}$ $\mathbf{N} = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

$\mathbf{MN} = \sqrt{6}\,\mathbf{I}$ where **I** is the identity matrix.

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

[6 marks]

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

6

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

Do not write outside the box

1 Write down the matrix for each of the following transformations

1 (a) A rotation 90° clockwise about the origin. **[1 mark]**

Answer _____

1 (b) A reflection in the x-axis. **[1 mark]**

Answer _____

1 (c) An enlargement, scale factor 5, centre the origin. **[1 mark]**

Answer _____

1 (d) A rotation 180° about the origin. **[1 mark]**

Answer _____

1 (e) A reflection in the line $y = -x$ **[1 mark]**

Answer _____

Do not write outside the box

2 $\mathbf{A} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

2 (a) The point P (1, 1) is transformed by the matrix A.

Work out the coordinates of the image P'.

[2 marks]

$P' =$ _____

2 (b) The point Q (x, y) is transformed by the matrix A^2

The image Q' has coordinates $(0, -1)$

Work out the values of x and y.

[3 marks]

$x =$ _____ $y =$ _____

10

Turn over ►

Do not write outside the box

3 (a) A (1, 0), B (1, 1) and C (0, 1) are vertices of the unit square $OABC$.

The square is mapped to $OA'B'C'$ under the transformation matrix $\mathbf{M} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

Work out the coordinates of A', B' and C'.

[3 marks]

$A' =$_____ $B' =$_____ $C' =$_____

3 (b) Describe fully the transformation represented by matrix **M**.

[2 marks]

Do not write outside the box

4 The unit square *OABC* is transformed by the matrix $\begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix}$ to the square *O'A'B'C'*

The diagonal of square *O'A'B'C'* has length $\sqrt{50}$

Work out two possible values of k.

[4 marks]

$k =$ _____ or $k =$ _____

9

Do not write outside the box

5 $\mathbf{B} = \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix}$

The points M (1, 5) and N (3, 3) are transformed by matrix B to points M' and N'

5 (a) Work out the length of line $M'N'$ giving your answer in the form $a\sqrt{b}$ **[4 marks]**

Answer _____

5 (b) Circle the geometric shape formed by $MNN'M'$ **[1 mark]**

Parallelogram Rhombus Trapezium Kite

5

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

Do not write outside the box

1 (a) $\mathbf{A} = \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$

Describe geometrically the single transformation represented by **A** **[1 mark]**

Answer _____

1 (b) $\mathbf{A} = \begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$

Describe geometrically the single transformation represented by $\mathbf{A}^2$ **[2 marks]**

Answer _____

Do not write outside the box

2 (a) $\mathbf{P} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$ $\mathbf{Q} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$

Point *A* has coordinates (0, 1)

A is transformed by the matrix **PQ** to the point *A'*

Find the coordinates of *A'*

[3 marks]

A' = (_____ , _____)

2 (b) Describe geometrically the single transformation represented by **PQ** **[1 mark]**

Answer _____

_____

7

Do not write outside the box

3 Here are three transformations in the $x - y$ plane.

A: Rotation through 90° clockwise about the origin.
B: Reflection in the line $y = x$
C: Transformation A followed by transformation B.

Use matrix multiplication to show that C is equivalent to a single reflection.

[4 marks]

Do not write outside the box

4 Here are two transformations in the $x - y$ plane.

A: Rotation through 180° clockwise about the origin.
B: Reflection in the line $y = 0$

4 (a) Use matrix multiplication to find a single matrix **M** that represents transformation A followed by transformation B

[2 marks]

M = _____

4 (b) Describe geometrically the single transformation represented by **M** **[1 mark]**

Answer _____

_____

7

Turn over ►

Do not write outside the box

5 Here are two transformations in the $x - y$ plane.

A: Rotation through 90° anticlockwise about the origin.
B: Enlargement, scale factor 3, centre the origin.

The point P is transformed to P' by transformation A followed by transformation B.

The coordinates of P' are (0, 3).

Find the coordinates of P **[4 marks]**

P = (_____ , _____)

Do not write outside the box

6 Use matrix multiplication to show that three successive rotations, 90° clockwise about the origin is equivalent to one rotation, 90° anticlockwise about the origin.

[3 marks]

7

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

Do not write outside the box

1 Solve $\cos x = 0.5$ for $0° \leq x \leq 360°$ **[2 marks]**

Answer _____

2 Solve $\sin x = \frac{\sqrt{3}}{2}$ for $0° \leq x \leq 360°$ **[2 marks]**

Answer _____

3 Solve $\tan x = 1$ for $0° \leq x \leq 360°$ **[2 marks]**

Answer _____

Do not write outside the box

From here on give all answers to 1 decimal place

4 Solve $\cos x = 0.25$ for $0° \leq x \leq 360°$ **[2 marks]**

Answer _____

5 Solve $\sin x = 0.9$ for $0° \leq x \leq 360°$ **[2 marks]**

Answer _____

6 Solve $\tan x = 2.2$ for $0° \leq x \leq 360°$ **[2 marks]**

Answer _____

12

Do not write outside the box

7 Solve $\cos x = -0.3$ for $0° \leq x \leq 360°$ **[2 marks]**

Answer _____

8 Solve $\sin x = -0.17$ for $0° \leq x \leq 360°$ **[2 marks]**

Answer _____

9 Solve $\tan x = -0.4$ for $0° \leq x \leq 360°$ **[2 marks]**

Answer _____

Do not write outside the box

10 Solve $3\cos x = 1$ for $0° \leq x \leq 360°$ **[3 marks]**

Answer _____

11 Solve $4\tan x = 5$ for $0° \leq x \leq 360°$ **[3 marks]**

Answer _____

12 Solve $3 - \sin x = 3.2$ for $0° \leq x \leq 360°$ **[3 marks]**

Answer _____

15

Do not write outside the box

13 Solve $\cos^2 x = 0.09$ for $0° \leq x \leq 360°$ **[4 marks]**

Answer _____

14 Solve $3\tan^2 x = 12$ for $0° \leq x \leq 360°$ **[4 marks]**

Answer _____

8

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

Do not write outside the box

1 Show that $2\cos^2\theta - \sin^2\theta \equiv 2 - 3\sin^2\theta$ **[2 marks]**

2 Show that $2\sin^2\theta\tan\theta + 2\cos\theta\sin\theta \equiv 2\tan\theta$ **[3 marks]**

3 Show that $\frac{\sin^3\theta}{\tan\theta} + \cos^3\theta \equiv \cos\theta$ **[3 marks]**

Do not write outside the box

4 Show that $\tan\theta + \cos\theta + \sin\theta\tan\theta \equiv \dfrac{1 + \sin\theta}{\cos\theta}$ **[3 marks]**

5 Show that $\dfrac{2\sin^2\theta + \sin^2\theta\cos\theta}{\sin\theta\cos\theta} \equiv 2\tan\theta + \sin\theta$ **[3 marks]**

6 Show that $8 - 3\sin\theta\cos\theta\tan\theta$ can be written in the form $a\cos^2\theta + b$ where a and b are integers. **[3 marks]**

17

Do not write outside the box

7 Show that $\frac{1 + 3\sin\theta}{\sin\theta} - \frac{\sin\theta}{\tan^2\theta} \equiv \sin\theta + 3$ **[4 marks]**

8 Show that $\frac{(\sin\theta + 1)(\sin\theta - 1)}{\cos\theta} \equiv -\cos\theta$ **[4 marks]**

Do not write outside the box

9 Show that $(1 + \sin\theta)^2 + (1 + \cos\theta)^2 - 2\sin\theta \equiv 3 + 2\cos\theta$ **[4 marks]**

10 Show that $\dfrac{\sin\theta\cos\theta + \cos\theta}{\cos^2\theta} - \sin\theta\tan\theta \equiv \cos\theta + \tan\theta$ **[4 marks]**

16

Do not write outside the box

11 Show that $\frac{2\sin\theta\cos\theta + 1}{\cos^2\theta} \equiv (1 + \tan\theta)^2$ **[4 marks]**

4

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

Do not write outside the box

1 Solve $2\cos^2\theta = \cos\theta$ for $0° \leq \theta \leq 360°$ **[3 marks]**

Answer _____

2 Solve $3\tan^2\theta = 2\tan\theta$ for $0° \leq \theta \leq 360°$ **[3 marks]**

Answer _____

Do not write outside the box

3 Solve $\sin^3\theta = \sin\theta$ for $0° \leq \theta \leq 360°$ **[3 marks]**

Answer _____

4 Solve $\frac{\sin\theta}{2} = \frac{\cos\theta}{5}$ for $0° \leq \theta \leq 360°$ **[3 marks]**

Answer _____

12

Do not write outside the box

5 Solve $\tan^2\theta = \tan\theta + 6$ for $0° \leq \theta \leq 360°$ **[4 marks]**

Answer _____

6 Solve $4\sin^2\theta + 3 = 7\sin\theta$ for $0° \leq \theta \leq 360°$ **[4 marks]**

Answer _____

Do not write outside the box

7 Solve $2\tan^2\theta = 11\tan\theta - 5$ for $0° \leq \theta \leq 360°$ **[4 marks]**

Answer _____

8 Solve $2\cos^2\theta = 7\cos\theta - 3$ for $0° \leq \theta \leq 360°$ **[4 marks]**

Answer _____

16

Do not write outside the box

9 (a) Show that $5\cos^2\theta - 4 \equiv 1 - 5\sin^2\theta$ **[1 mark]**

9 (b) Hence, solve $5\cos^2\theta - 4 = 4\sin\theta$ for $0° \leq \theta \leq 360°$ **[4 marks]**

Answer _____

10(a) Show that $\frac{4\sin\theta - 3\cos\theta}{\cos\theta} \equiv 4\tan\theta - 3$ **[1 mark]**

10 (b) Hence solve $\tan^2\theta\cos\theta = 4\sin\theta - 3\cos\theta$ for $0° \leq \theta \leq 360°$ **[4 marks]**

Answer _____

10