Questions

Q1.

(a) Expand and simplify $(m - 8)(m + 5)$

.....

(2)

(b) Factorise fully $5y + 20y^2$

.....

(2)

(c) Simplify $(p^2 + 3)^0$

.....

(1)

(d) Solve $3(2x - 5) = \frac{9 - x}{2}$

Show clear algebraic working.

x = ...

(4)

(Total for question = 9 marks)

(**Q07 4MA1/1H, Jan 2020**)

Q2.

(a) Solve $5(4 - x) = 7 - 3x$

Show clear algebraic working.

x = ...

(3)

(b) Factorise fully $16m^3g^3 + 24m^2g^5$

.....

(2)

(c) (i) Factorise $y^2 - 2y - 48$

.....

(2)

(ii) Hence, solve $y^2 - 2y - 48 = 0$

.....

(1)

(Total for question = 8 marks)

(**Q07 4MA1/1H, Nov 2020**)

Q3.

(a) Simplify $g^6 \times g^4$

.....

(1)

(b) Simplify $k^{10} \div k^3$

.....

(1)

(c) Simplify $(3cd^4)^2$

.....

(2)

(d) Solve the inequality $4x + 7 > 2$

.....

(2)

(Total for question = 6 marks)

(**Q01 4MA1/2H, Nov 2020**)

Q4.

(a) Simplify fully $(8e^{15})^{\frac{2}{3}}$

.....

(2)

(b) Express $\left(\frac{y}{2}\right)^{-4}$ in the form ay^n where a and n are integers.

.....

(2)

(c) Solve $\frac{4x-2}{3} - \frac{5-3x}{4} = 6$

Show clear algebraic working.

x = ...

(4)

(Total for question = 8 marks)

(**Q11 4MA1/2H, Nov 2020**)

Q5.

(a) Expand and simplify $3x(2x + 3) – x(3x + 5)$

.....

(2)

(b) Make t the subject of the formula $p = at - d$

.....

(2)

Given that $\frac{w^5 \times w^n}{w^3} = w^{10}$

(c) work out the value of n.

n = ...

(2)

(Total for question = 6 marks)

(**Q05 4MA1/1H, June 2021**)

Q6.

(a) Factorise $6y^2 - y - 5$

.....

(2)

(b) Make f the subject of $w = \dfrac{2f + 3}{8 - f}$

.....

(3)

(c) Express $4x^2 - 8x + 7$ in the form $a(x + b)^2 + c$ where a, b and c are integers.

.....

(3)

(Total for question = 8 marks)

(**Q17 4MA1/1H, Nov 2021**)

Q7.

(a) Expand and simplify $(n - 6)(n + 4)$

.....

(2)

(b) Solve $2x - 3 = \frac{3x - 5}{4}$

Show clear algebraic working.

x = ...

(3)

(Total for question = 5 marks)

(**QU05 4MA1/1H, June 2022**)

Q8.

A polygon has *n* sides, where $n > 5$

When arranged in order of size, starting with the largest number, the sizes of the interior angles of the polygon, in degrees, are the terms of an arithmetic sequence.

Here are the first five terms of this sequence.

177 175 173 171 169

Find the value of *n*
Show clear algebraic working.

n = ...

(Total for question = 6 marks)

(**QU23 4MA1/1H, June 2022**)

Q9.

Solve the simultaneous equations

$$7x + 3y = 3$$

$$3x - y = 7$$

Show clear algebraic working.

x = ...

y = ...

(Total for question = 3 marks)

(**QU10 4MA1/2H, June 2022**)

Q10.

(i) Factorise $x^2 + 5x - 24$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 24 = 0$

.....

(1)

(Total for question = 3 marks)

(**QU11 4MA1/2H, June 2022**)

Q11.

(a) Expand $3c^3(c + 4)$

.....

(2)

(b) (i) Factorise $x^2 + 8x - 9$

.....

(2)

(ii) Hence, solve $x^2 + 8x - 9 = 0$

.....

(1)

(Total for question = 5 marks)

(**QU05 4MA1/1HR, June 2022**)

Q12.

(a) Solve $p = \dfrac{3p - 5}{10}$

Show clear algebraic working.

p = ...

(3)

(b) Simplify a^0 where $a > 0$

.....

(1)

(c) Simplify fully $\dfrac{3xy^3}{6x^2y}$

.....

(2)

(d) Factorise fully $10c^3d^2 + 15cd^4$

.....

(2)

(Total for question = 8 marks)

(**QU06 4MA1/2HR, June 2022**)

Q13.

(a) Simplify $\frac{2}{y^0}$

.....

(1)

(b) Simplify fully $(16a^4)^{\frac{3}{4}}$

.....

(2)

(c) Expand and simplify $5x(3x + 4)(2x – 1)$

.....

(3)

(Total for question = 6 marks)

(**Q12 4MA1/2HR, Jan 2023**)

Q14.

(a) Expand and simplify $4x(2x + 5) – 3x(2x – 3)$

.....

(2)

Given that $\frac{y^5 \times y^n}{y^6} = y^{13}$

(b) work out the value of n.

n = ...

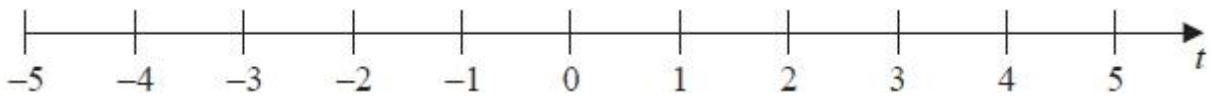
(2)

(c) (i) Solve the inequality $7t - 8 < 2t + 7$

.....

(2)

(ii) On the number line below, represent the solution set of the inequality solved in part (c)(i)



(1)

(Total for question = 7 marks)

(**Q05 4MA1/2H, Jan 2021**)

Q15.

(a) Solve $\frac{9a-7}{5}-\frac{3a-7}{4}=4.55$

Show clear algebraic working.

a = ...

(3)

(b) Make *c* the subject of the formula $p=\sqrt{\frac{ac+8}{3+c}}$

.....

(4)

(Total for question = 7 marks)

(**Q14 4MA1/2H, Jan 2021**)

Q16.

Express

$$\frac{1}{3x-2} \times \frac{9x^2-4}{3x^2-13x-10} - \frac{7}{x-1}$$

as a single fraction in its simplest form.

.....

(Total for question = 5 marks)

(**Q21 4MA1/1H, Nov 2020**)

Q17.

Prove that the difference between two consecutive square numbers is always an odd number.
Show clear algebraic working.

(Total for question = 3 marks)

(**Q17 4MA1/2H, Jan 2020**)

Q18.

Prove algebraically that, for any three consecutive even numbers,

the sum of the squares of the smallest even number and the largest even number is 8 more than twice the square of the middle even number.

(Total for question = 3 marks)

(**Q19 4MA1/2HR, Jan 2023**)

Q19.

Here are the first five terms of an arithmetic sequence.

8 15 22 29 36

Work out the sum of all the terms from the 50th term to the 100th term inclusive.

.....

(Total for question = 4 marks)

(**Q24 4MA1/1H, Nov 2020**)

Q20.

The sum of the first N terms of an arithmetic series, S, is 292
The 2nd term of S is 8.5
The 5th term of S is 13

Find the value of N.
Show clear algebraic working.

N = ...

(Total for question = 5 marks)

(**Q23 4MA1/1H, June 2021**)

Q21.

Without using a calculator, show that $\frac{12}{\sqrt{2}-1} - \left(\sqrt{2}\right)^5 = 2\sqrt{32} + 12$

Show your working clearly.

(Total for question = 3 marks)

(**QU16 4MA1/1H, June 2022**)

Q22.

Make x the subject of $y = \dfrac{5 - 2x}{x + 3}$

.....

(Total for question = 4 marks)

(**Q15 4MA1/2H, Nov 2020**)

Q23.

(a) Express $2x^2 - 12x + 3$ in the form $a(x + b)^2 + c$ where a, b and c are integers.

.....

(3)

The curve **C** has equation $y = 2(x + 4)^2 - 12(x + 4) + 3$

The point M is the minimum point on **C**

(b) Find the coordinates of M

(..... , ...)

(2)

(Total for question = 5 marks)

(**QU23 4MA1/1HR, June 2022**)

Q24.

The curve **S** has equation $y = f(x)$ where $f(x) = x^2$
The curve **T** has equation $y = g(x)$ where $g(x) = 2x^2 - 12x + 13$

By writing $g(x)$ in the form $a(x - b)^2 - c$, where a, b and c are constants, describe fully a series of transformations that map the curve **S** onto the curve **T**.

.....

.....

.....

(Total for question = 4 marks)

(**Q22 4MA1/2H, June 2021**)

Q25.

The function f is such that f(x) = 5 + 6x – x^2 for $x \leq 3$

(a) Express 5 + 6x – x^2 in the form p – (x – q)^2 where p and q are constants.

.....

(2)

(b) Using your answer to part (a), find the range of values of x for which f^{-1}(x) is positive.

.....

(5)

(Total for question = 7 marks)

(**Q21 4MA1/2H, Nov 2020**)

Q26.

(a) Express $7 + 12x – 3x^2$ in the form $a + b(x + c)^2$ where a, b and c are integers.

.....

(3)

C is the curve with equation $y = 7 + 12x – 3x^2$
The point A is the maximum point on **C**

(b) Use your answer to part (a) to write down the coordinates of A

(..... , ...)

(1)

(Total for question = 4 marks)

(**Q20 4MA1/1H, Jan 2022**)

Q27.

Write

$$\frac{4x^2 - 17x - 15}{2x - 1} \times \frac{2x^2 - 7x + 3}{x^2 - 25} + (29 - 4x)$$

as a single fraction in its simplest form.

.....

(Total for question = 4 marks)

(**Q26 4MA1/2HR, Jan 2023**)

Q28.

Express $\left(\frac{20}{x^2-36}-\frac{2}{x-6}\right)\times\frac{1}{4-x}$ as a single fraction in its simplest form.

.....

(Total for question = 3 marks)

(**QU23 4MA1/2HR, June 2022**)

Q29.

The functions f and g are defined as

f(x) = $5x^2 - 10x + 7$ where $x \geq 1$
g(x) = $7x - 6$

(a) Find fg(2)

.....

(2)

(b) Express the inverse function f^{-1} in the form $f^{-1}(x)$ = ...

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

(4)

(Total for question = 6 marks)

(**Q24 4MA1/1H, June 2021**)

Q30.

$f(x) = x^2 - 4$

$g(x) = 2x + 1$

Solve $fg(x) > 0$
Show clear algebraic working.

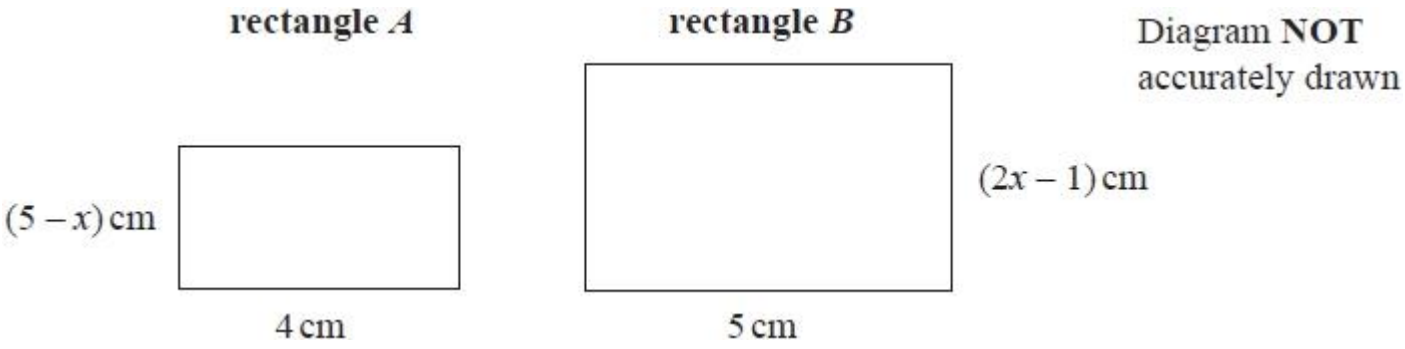
.....

(Total for question = 4 marks)

(**QU19 4MA1/2HR, June 2022**)

Q31.

Here are two rectangles, rectangle *A* and rectangle *B*.



The area of rectangle *B* is twice the area of rectangle *A*.

Work out the value of *x*.
Show your working clearly.

x = ...

(Total for question = 4 marks)

(**Q02 4MA1/2H, Nov 2021**)

Q32.

(a) Simplify $8 \times (4t)^0$

.....

(1)

$x^6 \div x^{-5} = x^p$

(b) Find the value of p

p = ...

(1)

(c) Simplify fully $(2k^2m^4)^3$

.....

(2)

(Total for question = 4 marks)

(**QU09 4MA1/1H, June 2022**)

Q33.

Express each of a, b and c in terms of q so that

$$q + 12x - qx^2$$

can be written as $a - b\,(x - c)^2$

a = ...

b = ...

c = ...

(Total for question = 4 marks)

(**QU24 4MA1/1H, June 2022**)

Q34.

(a) Expand and simplify $(5 - x)(2x + 3)(x + 4)$

Show your working clearly.

.....

(3)

(b) Make c the subject of $g = \dfrac{c+3}{4+c} - 7$

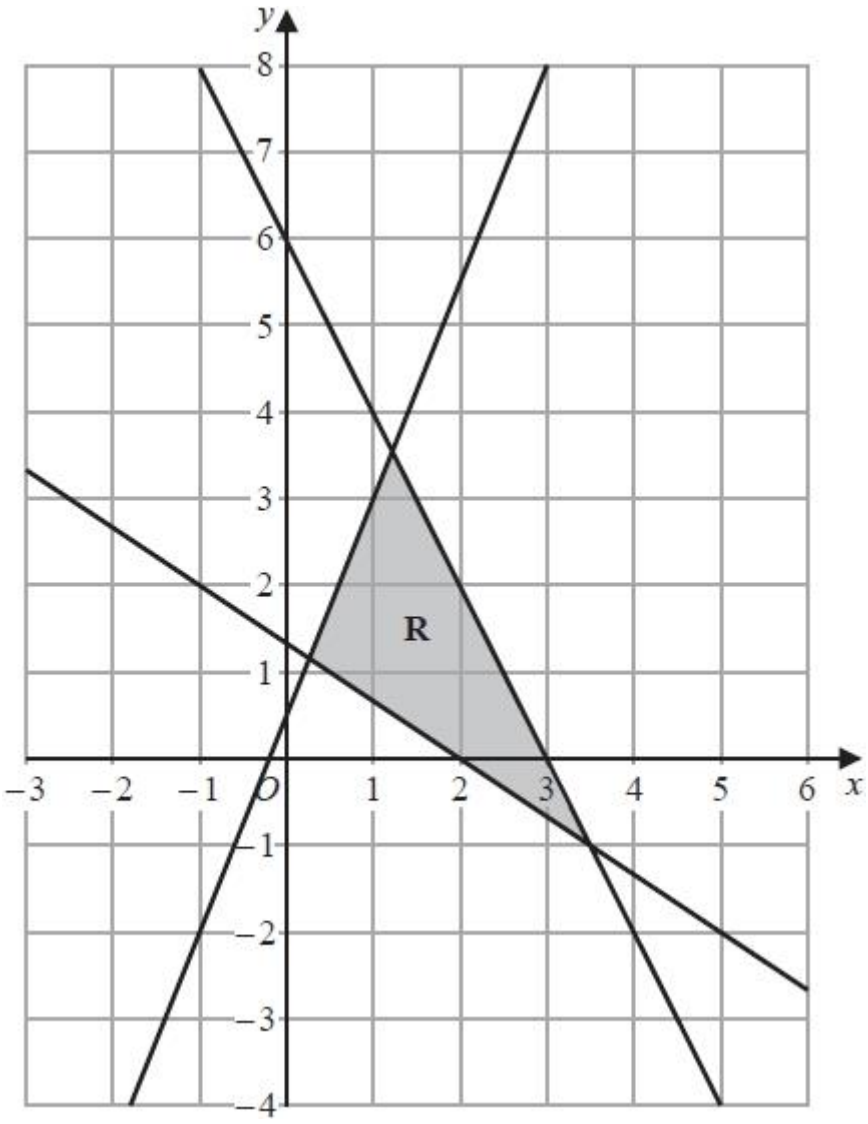
.....

(4)

(Total for question = 7 marks)

(**QU14 4MA1/2H, June 2022**)

Q35.



The region **R**, shown shaded in the diagram, is bounded by the straight lines with equations

$2x + y = 6$
$2y = 5x + 1$
$3y + 2x = 4$

Write down the three inequalities that define **R**

.....

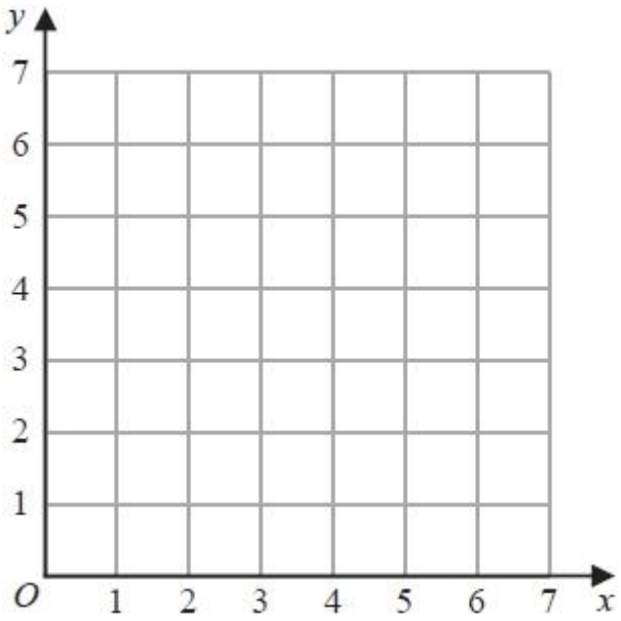
.....

.....

(Total for question = 3 marks)

(**Q11 4MA1/1H, Jan 2023**)

Q36.



(a) On the grid, draw and **label** the straight line with equation

(i) $x = 1.5$
(ii) $y = x$
(iii) $x + y = 6$

(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

$x \geq 1.5$ $y \geq x$ $x + y \leq 6$

Label the region **R**.

(1)

(Total for question = 4 marks)

(**Q04 4MA1/2H, Jan 2021**)

Q37.

(a) Factorise $9x^2 - 4y^2$

.....

(2)

(b) Express $\frac{7}{8} - \frac{x+3}{4x}$ as a single fraction in its simplest form.

.....

(3)

(Total for question = 5 marks)

(**QU11 4MA1/1H, June 2022**)

Q38.

(a) Expand and simplify $5x(x + 2)(3x – 4)$

.....

(3)

(b) Simplify completely $\left(\frac{16w^8}{y^{20}}\right)^{-\frac{3}{4}}$

.....

(3)

(Total for question = 6 marks)

(**Q13 4MA1/1H, Jan 2022**)

Q39.

Expand and simplify $3x(2x - 5)^2$
Show clear algebraic working.

.....

(Total for question = 3 marks)

(**Q13 4MA1/1H, Jan 2023**)

Q40.

(a) Expand and simplify $(y + 4)(2 - y)$

.....

(2)

(b) Factorise fully $15b^5c - 35b^3c^9$

.....

(2)

(Total for question = 4 marks)

(**Q01 4MA1/2H, Jan 2022**)

Q41.

(a) Expand and simplify $(3x - 1)(x + 2)(3x + 1)$

.....

(3)

(b) Simplify fully $\left(\frac{2x^5}{8xy^2}\right)^{-2}$

.....

(3)

(Total for question = 6 marks)

(**QU16 4MA1/1HR, June 2022**)

Q42.

Expand and simplify $4x(3x + 1)(2x – 3)$
Show your working clearly.

.....

(Total for question = 3 marks)

(**Q13 4MA1/1H, June 2021**)

Q43.

Here are the first five terms of an arithmetic sequence.

1 5 9 13 17

(a) Find an expression, in terms of n, for the nth term of this sequence.

.....

(2)

The nth term of another arithmetic sequence is $3n + 5$

(b) Find an expression, in terms of m, for the $(2m)$th term of this sequence.

.....

(1)

(Total for question = 3 marks)

(**QU01 4MA1/1H, June 2022**)

Q44.

$$\frac{18 \times \left(\sqrt{27}\right)^{4n+6}}{6 \times 9^{2n+8}} = 3^x$$

Express x in terms of n

Show your working clearly and simplify your expression.

x = ...

(Total for question = 3 marks)

(**QU24 4MA1/2H, June 2022**)

Q45.

(a) Factorise fully $15y^4 + 20uy^3$

.....

(2)

(b) Solve $4 - 3x = \frac{5 - 8x}{4}$

Show clear algebraic working.

x = ...

(3)

(Total for question = 5 marks)

(**Q05 4MA1/1H, Jan 2021**)

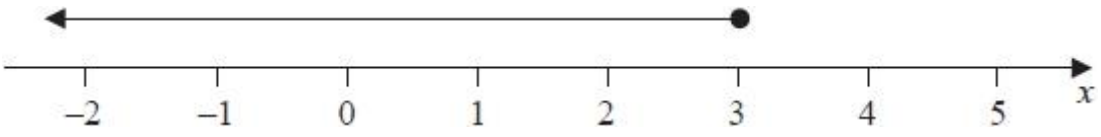
Q46.

(a) Factorise $y^2 - 2y - 48$

.....

(2)

(b) Write down the inequality shown on the number line



.....

(1)

(c) Solve the inequality $7w + 6 > 12w + 14$

.....

(3)

(Total for question = 6 marks)

(**Q10 4MA1/1H, Jan 2023**)

Q47.

(a) Factorise fully $18c^3d^2 - 21c^2$

.....

(2)

(b) (i) Factorise $y^2 - 3y - 18$

.....

(2)

(ii) Hence, solve $y^2 - 3y - 18 = 0$

.....

(1)

(Total for question = 5 marks)

(**Q08 4MA1/1HR, Jan 2023**)

Q48.

y is inversely proportional to $\sqrt{x}$

$y = c^4$ when $x = c^2$ where c is a positive constant.

Find a formula for y in terms of x and c
Give your answer in its simplest form.

.....

(Total for question = 3 marks)

(**Q17 4MA1/1H, Jan 2023**)

Q49.

Find the values of n such that

$$\frac{10^{4n} \times 2^{3(n^2-5n)} \times 5^{2(1-2n)}}{20^2} = 1$$

Show clear algebraic working.

.....

(Total for question = 5 marks)

(**Q26 4MA1/2H, Jan 2023**)

Q50.

The first term of an arithmetic series is $(2t + 1)$ where $t > 0$
The nth term of this arithmetic series is $(14t – 5)$

The common difference of the series is 3

The sum of the first n terms of the series can be written as $p(qt – 1)^r$ where p, q and r are integers.

Find the value of p, the value of q and the value of r
Show clear algebraic working.

p = ... q = ...r = ...

(Total for question = 4 marks)

(**Q22 4MA1/1H, Jan 2023**)

Q51.

(a) Simplify $(64p^9q^{12})^{\frac{2}{3}}$

.....

(2)

(b) Write as a single fraction $\frac{2}{3x} + \frac{4}{5x} - \frac{9}{10x}$

Give your answer in its simplest form.

.....

(2)

(c) Expand and simplify $4x(x - 5)(2x + 3)$

Show your working clearly.

.....

(3)

(Total for question = 7 marks)

(**Q12 4MA1/2H, Nov 2021**)

Q52.

(a) Simplify $\frac{x^9}{x^2}$

.....

(1)

(b) Write $\frac{7^8 \times 7^4}{7^3}$ as a single power of 7

.....

(2)

(Total for question = 3 marks)

(**Q01 4MA1/2H, Jan 2020**)

Q53.

The function f is such that

$$f(x) = \frac{2}{3x - 5} \qquad \text{where } x \neq \frac{5}{3}$$

(a) Find $f\left(\frac{1}{3}\right)$

.....

(1)

(b) Find $f^{-1}(x)$

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

(2)

The function g is such that

$$g(x) = 5x^2 - 20x + 23$$

(c) Express $g(x)$ in the form $a(x - b)^2 + c$

.....

(3)

(Total for question = 6 marks)

(**Q16 4MA1/1HR, Jan 2023**)

Q54.

(a) Find the highest common factor (HCF) of 200 and 420

.....

(2)

$A = 2^3 \times 3 \times 5 \times 7^2$
$B = 2 \times 3^2 \times 7$
$C = 3 \times 5^2 \times 11$

(b) Find the lowest common multiple (LCM) of A, B and C

Write your answer as a product of powers of prime factors.

.....

(2)

(Total for question = 4 marks)

(**Q07 4MA1/2HR, Jan 2023**)

Q55.

Find the lowest common multiple (LCM) of 28 and 105

.....

(Total for question = 2 marks)

(**Q02 4MA1/1H, Jan 2020**)

Q56.

$P = 3^3 \times 5^2 \times 7$
$Q = 3^2 \times 5 \times 7^2$

(a) Write down the highest common factor (HCF) of P and Q

.....

(1)

$P = 3^3 \times 5^2 \times 7$
$Q = 3^2 \times 5 \times 7^2$

(b) Work out the value of $P^3 \times Q$

Give your answer in the form $3^x \times 5^y \times 7^z$ where x, y and z are positive integers.

.....

(2)

(Total for question = 3 marks)

(**QU12 4MA1/1HR, June 2022**)

Q57.

(a) Find the highest common factor (HCF) of 56 and 84

Show your working clearly.

.....

(2)

(b) Find the lowest common multiple (LCM) of 60 and 72

Show your working clearly.

.....

(2)

(Total for question = 4 marks)

(**QU03 4MA1/1H, June 2022**)

Q58.

(a) Write down the value of m, given that $3^4 \times 3^5 = 3^m$

m = ...

(1)

(b) Write down the value of n, given that $(5^3)^7 = 5n$

n = ...

(1)

(c) Find the value of p, given that $\dfrac{7^8 \times 7^2}{7^p}$

p = ...

(2)

(Total for question = 4 marks)

(**Q01 4MA1/2H, Nov 2021**)

Q59.

$\sqrt{2} \times 16 = 2^x$

(a) Find the value of x.

Show your working clearly.

x = ...

(2)

$\dfrac{(11^{-6})^5}{11^4} = 11^n$

(b) Find the value of n.

Show your working clearly.

n = ...

(2)

(Total for question = 4 marks)

(**Q11 4MA1/1H, June 2021**)

Q60.

Solve $2^{-4x} = 32$

x = ...

(Total for question = 2 marks)

(**Q12 4MA1/1HR, Jan 2023**)

Q61.

(a) Simplify $a^7 \times a^4$

.....

(1)

(b) Simplify $w^{15} \div w^3$

.....

(1)

(c) Simplify $(8x^5y^3)^2$

.....

(2)

(d) Make t the subject of $c = t^3 - 8v$

.....

(2)

(Total for question = 6 marks)

(**Q01 4MA1/1H, Jan 2022**)

Q62.

(a) Simplify $e^8 \div e^2$

.....

(1)

(b) Expand and simplify (x – 3)(x + 1)

.....

(2)

(Total for question = 3 marks)

(**Q01 4MA1/1H, Nov 2021**)

Q63.

$-4 \leq 2y < 6$

y is an integer.

(a) Write down all the possible values of y.

.....

(2)

(b) Solve the inequality $7t - 3 \leq 2t + 31$

Show your working clearly.

.....

(2)

(Total for question = 4 marks)

(**Q07 4MA1/1H, June 2021**)

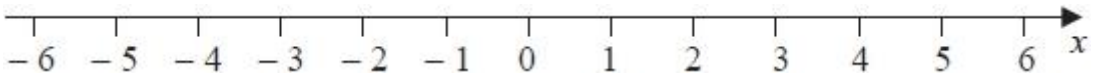
Q64.

(i) Solve the inequalities $-7 \leq 2x - 3 < 5$

.....

(3)

(ii) On the number line, represent the solution set to part (i)

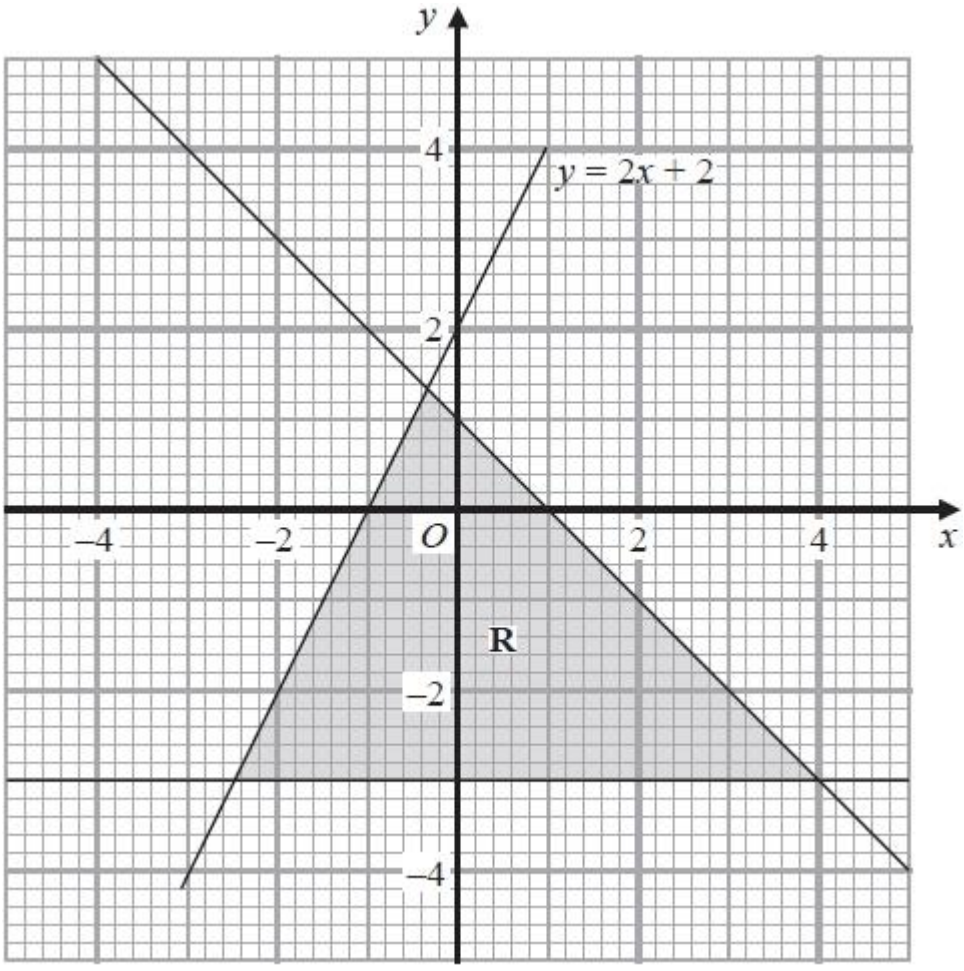


(2)

(Total for question = 5 marks)

(**Q09 4MA1/1H, Nov 2021**)

Q65.



The region **R**, shown shaded in the diagram, is bounded by three straight lines.

Write down the three inequalities that define **R**.

.....

.....

.....

(Total for question = 3 marks)

(**Q13 4MA1/2H, Nov 2021**)

Q66.

$-8 < 2y \leq 2$

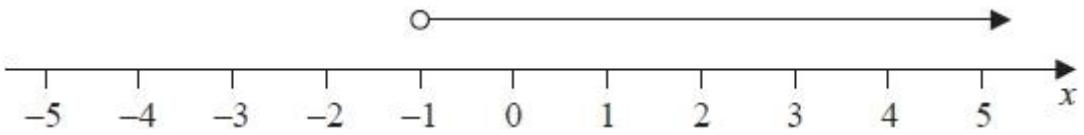
y is an integer.

(a) Find all the possible values of y

.....

(2)

(b) Write down the inequality shown on the number line.



.....

(1)

(Total for question = 3 marks)

(**Q03 4MA1/2HR, Jan 2023**)

Q67.

Solve the inequality $3 - 4x \leq 11$

.....

(Total for question = 2 marks)

(**QU09 4MA1/1HR, June 2022**)

Q68.

(a) Solve the inequality $5x - 7 \leq 2$

.....

(2)

(b) (i) Factorise $y^2 - 2y - 35$

.....

(2)

(ii) Hence, solve $y^2 - 2y - 35 = 0$

.....

(1)

(Total for question = 5 marks)

(**Q06 4MA1/1H, Jan 2022**)

Q69.

The function f is such that $f(x) = x^2 - 8x + 5$ where $x \leq 4$

Express the inverse function f^{-1} in the form $f^{-1}(x) = ...$

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

(Total for question = 3 marks)

(**Q22 4MA1/1H, Jan 2021**)

Q70.

The functions f and g are such that

$$f(x) = x^2 - 2x \qquad g(x) = x + 3$$

The function h is such that $h(x) = fg(x)$ for $x \geq -2$

Express the inverse function $h^{-1}(x)$ in the form $h^{-1}(x) = ...$

$h^{-1}(x)$ = ...

(Total for question = 5 marks)

(**Q21 4MA1/1H, Jan 2020**)

Q71.

The function f is such that $f(x) = 3x^2 - 12x + 7$ where $x \leq 2$

Express the inverse function f^{-1} in the form $f^{-1}(x)$ = ...

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

(Total for question = 4 marks)

(**Q25 4MA1/2H, Jan 2023**)

Q72.

The function g is defined as

$$g: x \mapsto 5 + 6x - x^2 \quad \text{with domain} \quad \{x : x \geqslant 3\}$$

(a) Express the inverse function g^{-1} in the form $g^{-1}: x \mapsto \ldots$

$g^{-1}: x \mapsto$ .....

(4)

(b) State the domain of g^{-1}

.....

(1)

(Total for question = 5 marks)

(**Q25 4MA1/2H, Jan 2022**)

Q73.

F is inversely proportional to the square of *v*.

Given that $F = 6.5$ when $v = 4$

find a formula for F in terms of v

.....

(Total for question = 3 marks)

.(**Q14 4MA1/1H, Nov 2020**)

Q74.

A is inversely proportional to the square of r

$A = 5$ when $r = 0.3$

(a) Find a formula for A in terms of r

.....

(3)

(b) Find the value of A when $r = 7.5A$

A = ...

(3)

(Total for question = 6 marks)

(**Q16 4MA1/2H, June 2021**)

Q75.

A is inversely proportional to C^2

A = 40 when *C* = 1.5

Calculate the value of *C* when *A* = 1000

C = ...

(Total for question = 3 marks)

(**Q15 4MA1/1H, Jan 2022**)

Q76.

Find the lowest common multiple (LCM) of 28, 42 and 63

Show your working clearly.

.....

(Total for question = 3 marks)

(**Q07 4MA1/2H, Jan 2022**)

Q77.

$$A = 2^3 \times 3^2 \times 5^2 \times 11$$
$$B = 2^4 \times 3 \times 5^4 \times 13$$

Find the lowest common multiple (LCM) of A and B.
Give your answer as a product of powers of prime numbers.

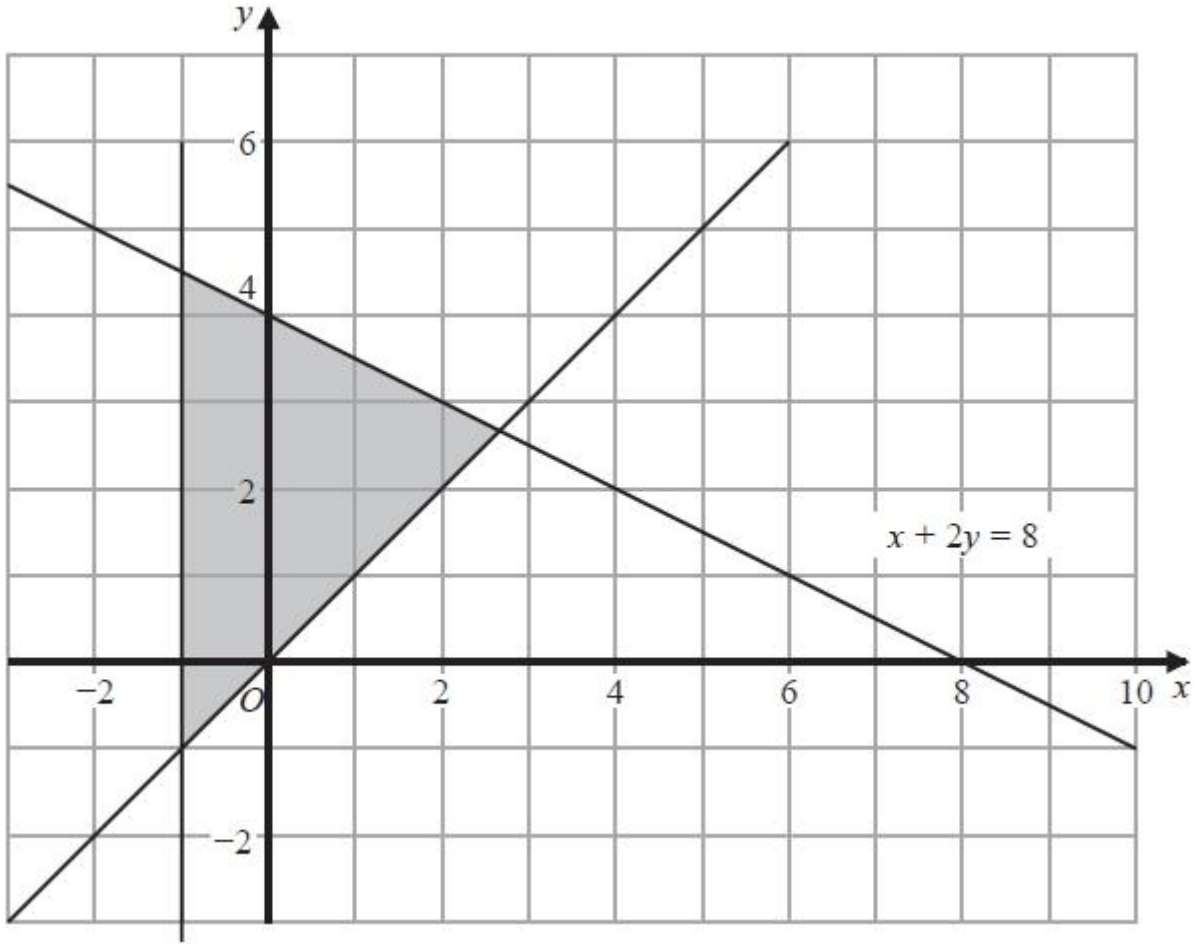
.....

(Total for question = 2 marks)

(**Q09 4MA1/2H, Jan 2021**)

Q78.

The shaded region in the diagram is bounded by three lines.
The equation of one of the lines is given.



Write down three inequalities that define the shaded region.

.....

.....

.....

(Total for question = 3 marks)

(**Q13 4MA1/2H, Jan 2022**)

Q79.

(a) Solve the inequality $2x + 7 > 4$

.....

(2)

(b) Solve $x^2 - 3x - 40 = 0$
Show clear algebraic working.

.....

(3)

(Total for question = 5 marks)

(**Q07 4MA1/2H, Jan 2020**)

Q80.

$$\frac{2^k}{4^n} = 2^x$$

Find an expression for x in terms of k and n

x = ...

(Total for question = 2 marks)

(**QU07 4MA1/2HR, June 2022**)

Q81.

Here are the first 4 terms of an arithmetic sequence.

85 79 73 67

Find an expression, in terms of n, for the nth term of the sequence.

.....

(Total for question = 2 marks)

(**Q02 4MA1/1H, June 2021**)

Q82.

Write 3.6×10^3 as a product of powers of its prime factors.
Show your working clearly.

.....

(Total for question = 3 marks)

(**Q07 4MA1/1H, Nov 2021**)

Q83.

Given that $\frac{3^x}{9^{3x}} = 81$

find the value of x.
Show clear algebraic working.

x = ...

(Total for question = 3 marks)

(**Q12 4MA1/2H, Nov 2020**)

Q84.

Write 600 as a product of powers of its prime factors.
Show your working clearly.

.....

(Total for question = 3 marks)

(**Q01 4MA1/2H, June 2021**)

Q85.

Using algebra, prove that, given any 3 consecutive even numbers, the difference between the square of the largest number and the square of the smallest number is always 8 times the middle number.

(Total for question = 3 marks)

(**Q17 4MA1/1H, June 2021**)

Q86.

Prove that when the sum of the squares of any two consecutive odd numbers is divided by 8, the remainder is always 2
Show clear algebraic working.

(Total for question = 3 marks)

(**Q18 4MA1/2H, Jan 2022**)

Q87.

P is inversely proportional to y^2
When $y = 4$, $P =$ a

(a) Find a formula for P in terms of y and a

.....

(3)

Given also that y is directly proportional to $\sqrt{x}$ and when $x = a$, $P = 4a$

(b) find a formula for P in terms of x and a

.....

(3)

(Total for question = 6 marks)

(**Q19 4MA1/1HR, Jan 2023**)

Q88.

Here is a rectangle.

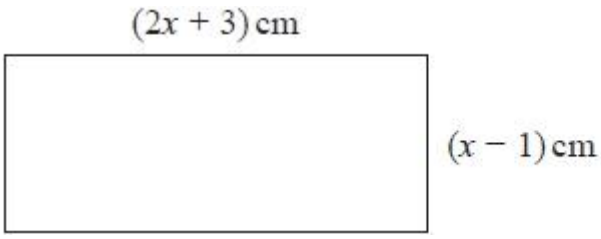


Diagram **NOT** accurately drawn

Given that the area of the rectangle is less than 75 cm^2

find the range of possible values of x

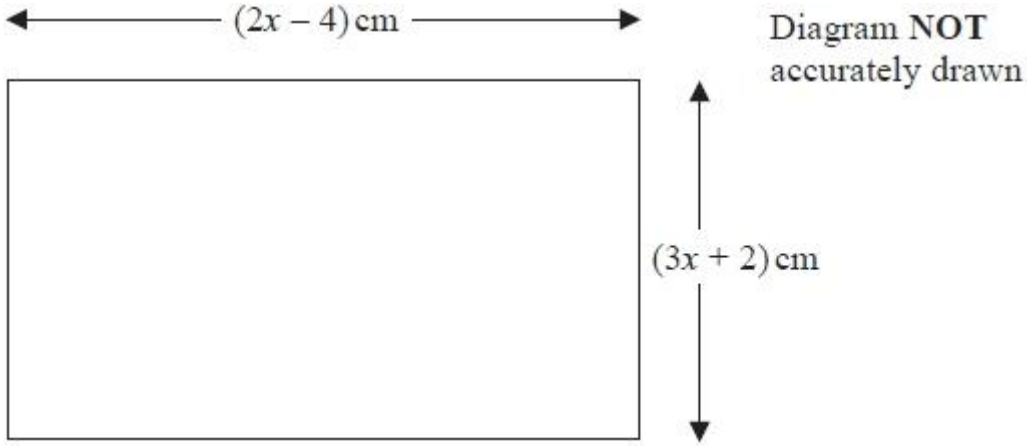
.....

(Total for question = 5 marks)

(**Q22 4MA1/2H, Jan 2022**)

Q89.

The diagram shows a rectangle.



The area of the rectangle is A cm^2

Given that $A < 3x + 27$
find the range of possible values for x.

.....

(Total for question = 5 marks)

(**Q17 4MA1/2H, Nov 2020**)

Q90.

Express

$$\left(\frac{4}{2x-5}-\frac{3}{2x-3}\right)\div\frac{9x-4x^3}{6x^2-17x+5}$$

as a single fraction in its simplest form.

.....

(Total for question = 4 marks)

(**Q24 4MA1/2H, Jan 2020**)

Q91.

Without using a calculator, rationalise the denominator of $\frac{6}{3-\sqrt{7}}$

Simplify your answer.
You must show each stage of your working.

.....

(Total for question = 3 marks)

(**Q19 4MA1/1H, Nov 2020**)

Q92.

Make *x* the subject of $y = \sqrt{\frac{x+1}{x-4}}$

.....

(Total for question = 4 marks)

(**Q16 4MA1/2H, Jan 2020**)

Q93.

The area of a rectangle is 18 cm^2

The length of the rectangle is $\left(\sqrt{7}+1\right)$ cm.

Without using a calculator and showing each stage of your working,

find the width of the rectangle.

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

..... cm

(Total for question = 3 marks)

(**Q20 4MA1/2H, Jan 2020**)

Q94.

An arithmetic sequence has first term 8 and common difference 11
The sequence has k terms, where $k > 21$

The sum of the last 20 terms of the sequence is 10 170

Find the value of k
Show clear algebraic working.

k = ...

(Total for question = 5 marks)

(**Q24 4MA1/1HR, Jan 2023**)

Q95.

An arithmetic series has first term a and common difference d.

The sum of the first $2n$ terms of the series is four times the sum of the first n terms of the series.

Find an expression for a in terms of d.
Show your working clearly.

a = ...

(Total for question = 4 marks)

(**Q24 4MA1/1H, Jan 2021**)

Q96.

In a warehouse there are two types of shelves, type **R** and type **S**.

These two types of shelves are arranged into shelving units that form a sequence of patterns.

Here are the first three terms in the sequence.

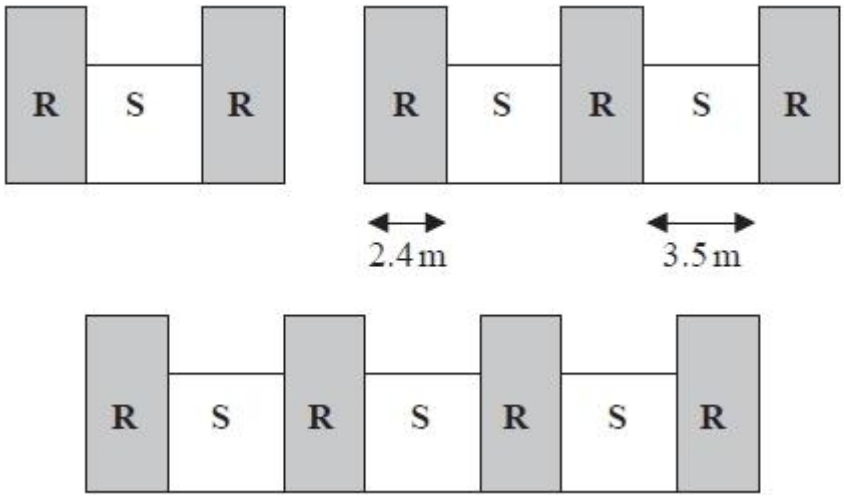


Diagram **NOT** accurately drawn

The width of each type **R** shelf is 2.4 m and the width of each type **S** shelf is 3.5 m

(a) Work out the total width of a shelving unit that has 6 type **R** shelves.

..... m

(2)

A shelving unit has n type **R** shelves.
The total width of this shelving unit is W metres.

(b) Find an expression for W in terms of n

Give your answer in its simplest form.

W = ...

(2)

(Total for question = 4 marks)

(**QU02 4MA1/1HR, June 2022**)

Q97.

Here are the first four terms of an arithmetic series.

$$k \quad \frac{3k}{4} \quad \frac{k}{2} \quad \frac{k}{4}$$

Given that the 15th term of the series is $(90 + 2k)$,

calculate the sum of the first 30 terms of the series.

.....

(Total for question = 5 marks)

(**Q20 4MA1/2H, Nov 2021**)

Q98.

An arithmetic series has first term *a* and common difference *d*, where *d* is a prime number.

The sum of the first *n* terms of the series is S_n and

$S_m = 39$
$S_{2m} = 320$

Find the value of d and the value of *m*
Show clear algebraic working.

d = ...

m = ...

(Total for question = 5 marks)

(**Q26 4MA1/2H, Jan 2022**)

Q99.

The sum of the first 10 terms of an arithmetic series is 4 times the sum of the first 5 terms of the same series.

The 8th term of this series is 45

Find the first term of this series.
Show clear algebraic working.

.....

(Total for question = 5 marks)

(**QU25 4MA1/1HR, June 2022**)

Q100.

Simplify fully $\left(\frac{9x^4}{16y^{10}}\right)^{-\frac{1}{2}}$

.....

(Total for question = 3 marks)

(**Q14 4MA1/2H, June 2021**)

Q101.

Simplify fully $\left(\frac{9t^4w^9}{18t^6w^{10}}\right)^{-2}$

.....

(Total for question = 3 marks)

(**Q11 4MA1/2H, Jan 2021**)

Q102.

(a) Simplify $(2x^3y^5)^4$

.....

(2)

(b) (i) Factorise $x^2 + 5x - 36$

.....

(2)

(ii) Hence, solve $x^2 + 5x - 36 = 0$

.....

(1)

(Total for question = 5 marks)

(**Q09 4MA1/1H, Jan 2021**)

Q103.

(a) Express $\frac{4}{x-2} - \frac{3}{x+1}$ as a single fraction.

Give your answer in its simplest form.

.....

(3)

Expand and simplify $2x(x - 5)(x - 3)$

.....

(3)

(Total for question = 6 marks)

(**Q12 4MA1/1H, Jan 2021**)

Q104.

Solve the simultaneous equations

$$x^2 - 9y - x = 2y^2 - 12$$

$$x + 2y - 1 = 0$$

Show clear algebraic working.

.....

(Total for question = 5 marks)

(**Q19 4MA1/1H, Jan 2021**)

Q105.

The straight line **L** has equation $x - y = 3$
The curve **C** has equation $3x^2 - y^2 + xy = 9$

L and **C** intersect at the points P and Q.

Find the coordinates of the midpoint of PQ.
Show clear algebraic working.

(..... , ...)

(Total for question = 6 marks)

(**Q19 4MA1/2H, Nov 2021**)

Q106.

Solve the simultaneous equations

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

Show clear algebraic working.

.....

(Total for question = 5 marks)

(**Q19 4MA1/1H, Jan 2022**)

Q107.

Solve the simultaneous equations

$$x + 2y = 15$$
$$4x - 6y = 4$$

Show clear algebraic working.

x = ...

y = ...

(Total for question = 3 marks)

(**Q06 4MA1/1HR, Jan 2023**)

Q108.

Solve the simultaneous equations

$$7x - 2y = 34$$
$$3x + 5y = -3$$

Show clear algebraic working.

x = ...

y = ...

(Total for question = 4 marks)

(**Q12 4MA1/1H, Nov 2020**)

Q109.

Solve the simultaneous equations

$$3xy - y^2 = 8$$
$$x - 2y = 1$$

Show clear algebraic working.

.....

(Total for question = 5 marks)

(**Q16 4MA1/2H, Nov 2020**)

Q110.

Solve the simultaneous equations

$$3x + 5y = 3.1$$

$$6x + 3y = 3.75$$

Show clear algebraic working.

x = ...

y = ...

(Total for question = 3 marks)

(**Q10 4MA1/2H, Jan 2022**)

Q111.

Solve the simultaneous equations

$$5x + 4y = -2$$
$$2x - y = 4.4$$

Show clear algebraic working.

x = ...

y = ...

(Total for question = 3 marks)

(**Q07 4MA1/2H, Jan 2023**)

Q112.

Solve the simultaneous equations

Show clear algebraic working.

$$y = 7 - 2x$$

$x^2 + y^2 = 34$

Show clear algebraic working.

.....

(Total for question = 5 marks)

(**Q20 4MA1/2H, Jan 2023**)

Q113.

Solve the simultaneous equations

$$2y^2 + x^2 = -6x + 42$$
$$2x + y = -3$$

Show clear algebraic working.

.....

(Total for question = 5 marks)

(**Q22 4MA1/2HR, Jan 2023**)

Q114.

Solve the simultaneous equations

$$3x - 5y = 25$$

$$4x + 3y = 14$$

Show clear algebraic working.

x = ...

y = ...

(Total for question = 4 marks)

(**QU14 4MA1/1HR, June 2022**)

Q115.

Solve the simultaneous equations

$$x - 2y = 3$$
$$x^2 - y^2 + 2x = 10$$

Show clear algebraic working.

.....

(Total for question = 5 marks)

(**QU21 4MA1/2HR, June 2022**)

Q116.

The line with equation $y = x + 2$ intersects the curve with equation $x^2 + y^2 - 2y = 24$ at the points A and B.

Find the coordinates of A and B.
Show clear algebraic working.

(..... , ...)

(..... , ...)

(Total for question = 5 marks)

(**Q22 4MA1/2H, Jan 2020**)

Q117.

Solve the simultaneous equations

$$5a + 2c = 10$$
$$2a - 4c = 7$$

Show clear algebraic working.

a = ...

c = ...

(Total for question = 3 marks)

(**Q08 4MA1/2H, June 2021**)

Q118.

Solve the simultaneous equations

$$y = 3 - 2x$$
$$x^2 + y^2 = 18$$

Show clear algebraic working.

.....

(Total for question = 5 marks)

(**Q19 4MA1/2H, June 2021**)

Q119.

Solve $3(2 - 4x) = 5 - 8x$
Show clear algebraic working.

x = ...

(Total for question = 3 marks)

(**Q02 4MA1/1H, Jan 2023**)

Q120.

Solve $\frac{x+3}{4} - \frac{7-x}{5} = 4.3$

Show clear algebraic working.

x = ...

(Total for question = 3 marks)

(**Q13 4MA1/2H, Jan 2023**)

Q121.

(i) Factorise $x^2 + 2x - 24$

.....

(2)

(ii) Hence solve $x^2 + 2x - 24 = 0$

.....

(1)

(Total for question = 3 marks)

(**Q09 4MA1/2H, June 2021**)

Q122.

Solve the inequality $6x^2 + 37x \leq 35$
Show clear algebraic working.

.....

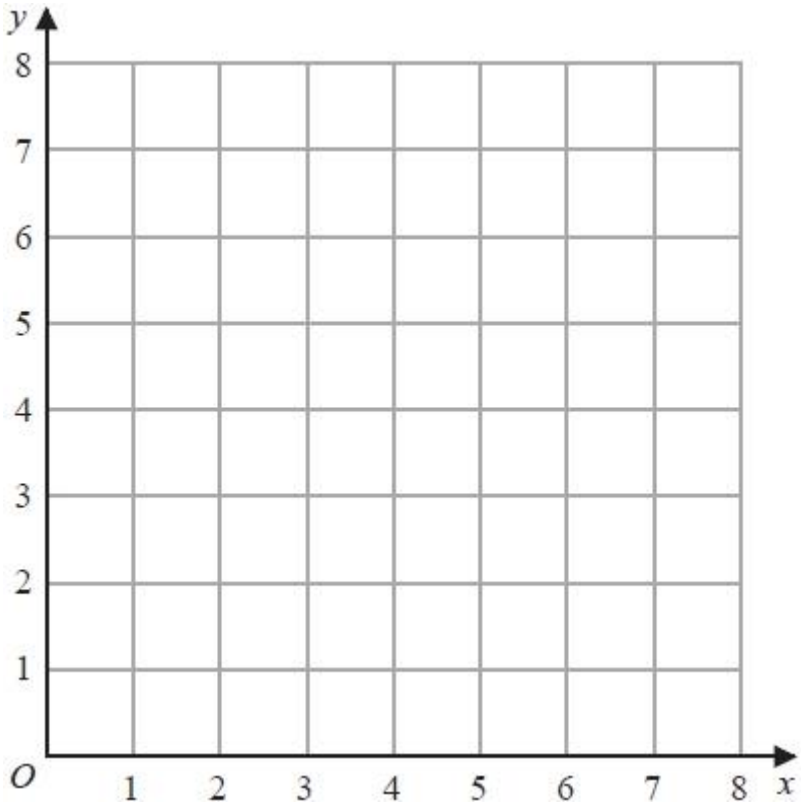
(Total for question = 3 marks)

(**Q22 4MA1/2H, Jan 2023**)

Q123.

(a) On the grid, draw and label with its equation the straight line with equation

(i) $y = 1$ (ii) $x = 2$ (iii) $x + y = 7$



(3)

(b) Show, by shading on the grid, the region that satisfies **all three** of the inequalities

$$y \geqslant 1 \qquad x \geqslant 2 \qquad x + y \leqslant 7$$

Label the region **R**.

(1)

(Total for question = 4 marks)

(**QU02 4MA1/2H, June 2022**)

Q124.

Given that $(8 - \sqrt{x})(5 + \sqrt{x}) = y\sqrt{x} + 21$ where x is a prime number and y is an integer,

find the value of x and the value of y.
Show each stage of your working clearly.

x = ...

y = ...

(Total for question = 3 marks)

(**Q18 4MA1/1H, Jan 2021**)

Q125.

Express $\frac{8}{\sqrt{5}-1}$ in the form $\sqrt{a}+b$ where a and b are integers.

Show each stage of your working clearly.

.....

(Total for question = 3 marks)

(**Q17 4MA1/2H, Nov 2021**)

Q126.

Solve $\sqrt{3}(x-2\sqrt{3})=x+2\sqrt{3}$

Give your answer in the form $a+b\sqrt{3}$ where *a* and *b* are integers.
Show your working clearly.

x = ...

(Total for question = 4 marks)

(**Q18 4MA1/1HR, Jan 2023**)

Q127.

Express $\dfrac{3+\sqrt{8}}{\left(\sqrt{2}-1\right)^2}$ in the form $p+\sqrt{q}$ where *p* and *q* are integers.

Show each stage of your working clearly.

.....

(Total for question = 4 marks)

(**QU21 4MA1/1HR, June 2022**)

Q128.

Show that $\frac{\sqrt{12}}{\sqrt{3}+2}$

can be written in the form $a + \sqrt{b}$ where a and b are integers.

(Total for question = 3 marks)

(**Q17 4MA1/2H, Jan 2022**)

Q129.

(a) Show that $\left(6+2\sqrt{12}\right)^2 = 12\left(7+4\sqrt{3}\right)$

Show each stage of your working.

(3)

(b) Simplify fully $\left(\frac{27a^{12}}{t^{15}}\right)^{-\frac{2}{3}}$

.....

(3)

(Total for question = 6 marks)

(**Q17 4MA1/1H, Jan 2020**)

Q130.

(a) Write down the value of $(m + 2)^0$ where m is a positive integer.

.....

(1)

(b) Simplify $(3a^2b^4)^3$

.....

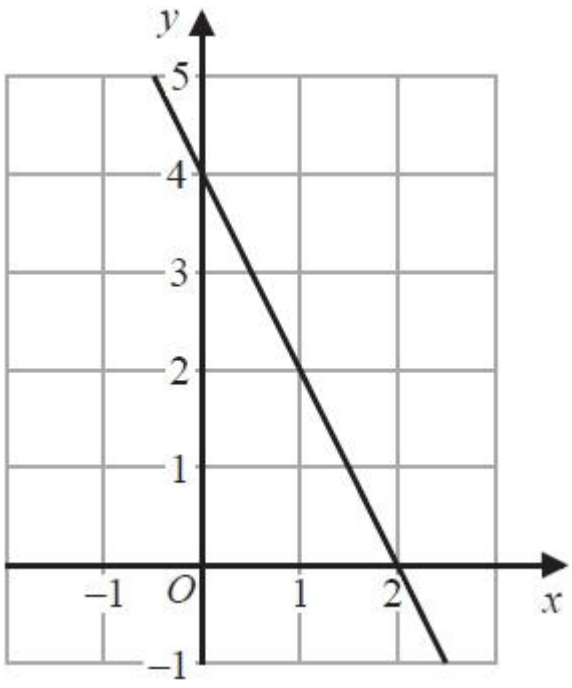
(2)

(c) Factorise fully $14x^2y^4 + 21x^3y^2$

.....

(2)

The diagram shows a straight line drawn on a grid.



(d) Write down an equation of the line.

.....

(2)

(Total for question = 7 marks)

(**Q09 4MA1/2H, Jan 2023**)

Q131.

$$3^{\frac{1}{2}} \times 3^{\frac{2}{5}} = 3^m$$

(a) Work out the value of m

m = ...

(1)

$5^{-10} \div 5^{-4} = 5^n$

(b) Work out the value of n

n = ...

(1)

(Total for question = 2 marks)

(**Q12 4MA1/1H, Jan 2023**)

Q132.

Write $\dfrac{25x^2 - 64}{5x^2 - 13x - 6} \times \dfrac{x^2 - 8x + 15}{5x + 8} - (x - 7)$

as a single fraction in its simplest form.
Show clear algebraic working.

.....

(Total for question = 4 marks)

(**Q21 4MA1/2H, Jan 2021**)

Q133.

Given that $x = \frac{5}{9y + 5}$ and that $y = \frac{5}{5a - 2}$

find an expression for x in terms of a.
Give your expression as a single fraction in its simplest form.

.....

(Total for question = 4 marks)

(**Q21 4MA1/1H, June 2021**)

Q134.

(a) Simplify $(3x^2y)^0$

.....

(1)

(b) (i) Factorise $x^2 - 5x - 36$

.....

(2)

(ii) Hence solve $x^2 - 5x - 36 = 0$

.....

(1)

(Total for question = 4 marks)

(**Q08 4MA1/2H, Nov 2021**)