GCSE TO A-LEVEL MATHEMATICS

TRANSITION WORK PACKAGE 2025

This pack contains a series of mathematics questions in the areas of GCSE Algebra, Geometry and Number for students wishing to study A-Level Mathematics.

An important note that the intent behind this pack is to highlight several of the key skills from GCSE which are essential for success in A-Level. The outcomes from this pack are designed to offer an opportunity for initial reflection and consolidation at the start of the course, to establish the correct mindset and culture in post-16 mathematics.

The questions have been deliberately picked to offer a mix of challenge and core competency checks. Your problem solving will be tested here, treat the questions like exam questions and if you are stuck, try to reflect on the hints and tips you were given for your examinations.

Instructions PLEASE READ:

- Students are required to **complete all questions** to the best of their ability.
- Working out for should be completed on rough paper with **final answers written in spaces provided in this pack.**
- Workings should be kept for reference and **NOT** discarded.
- At the start of the academic year, you will be given instructions on how to set up your DR FROST account which is where you will **transfer your final answers** to.

Algebra

Question 1

Skill involved: 193f: Collect like terms with powers and combinations of two variables within each term.

Simplify

$$3xy - 2xy^2 - 3x^2 + 10xy^2 + 5x^2$$

....

Question 2

Skill involved: 197k: Substitute fractions into basic algebraic expressions and formulae with variables on the denominator.

Work out the exact value of

$$\frac{1}{x+s}$$

given that

$$x = \frac{1}{3} \text{ and } s = \frac{3}{4}$$

Input note: If your answer is a fraction, give it in its simplest form.

....

Question 3

Skill involved: 158e: Use laws of indices for multiplying, dividing and power of a power.

Simplify

$$\frac{\left(9^2\right)^7}{9^3}$$

Give your answer as a power of 9.

....

Question 4

Skill involved: 252k: Expand and simplify the difference of two sets of single brackets with integer multipliers.

Expand and simplify

$$4(x + 5) - 3(x - w)$$

....

Question 5

Skill involved: 252m: Expand and simplify two sets of single brackets, where multipliers are variables or terms.

Expand and simplify

$$4x(4x + 7) - x(4x + 1)$$

....

Question 6

Skill involved: 299h: Expand double brackets given in the form $(a \pm bx)(c \pm dx)$

Expand and simplify

$$(11 - 8x)(12 + 7x)$$

....

Question 7

Skill involved: 299k: Expand double brackets given in the form $(ax \pm b)(cx^2 \pm dx \pm e)$

Expand the brackets below:

$$(x - 4)\left(2x^2 + 11x - 10\right)$$

Simplify your answer.

....

Question 8

Skill involved: 299n: Expand and simplify the sum of a double and single bracket expansion.

Expand and simplify

$(2x + 5)^2 + 4x(x - 3)$

....

Question 9

Skill involved: 300c: Expand an expression given in the form $(ax \pm b)(cx \pm d)(ex \pm f)$

Expand and simplify:

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

....

Question 10

Skill involved: 300f: Expand an expression given in the form $(ax + b)^3 + (cx + d)^2$

Expand and simplify:

$(2 - 3x)^3 + (x - 4)^2$

....

Question 11

Skill involved: 362b: Factorise quadratic expressions given in the form $x^2 - bx + c$

Factorise the following quadratic:

$x^2 - 16x + 48$

....

Question 12

Skill involved: 362c: Factorise quadratic expressions given in the form $x^2 + bx - c$

Factorise the following quadratic:

$x^2 + 4x - 12$

....

Question 13

Skill involved: 363a: Factorise the difference of two squares given in the form $x^2 - a^2$ or $a^2 - x^2$

Factorise the following:

$y^2 - 100$

....

Question 14

Skill involved: 364b: Factorise quadratic expressions given in the form $ax^2 - bx + c$ with $a > 1$

Factorise:

$3x^2 - 11x + 6$

....

Question 15

Skill involved: 198h: Write an expression or formula for the area of a composite or rectilinear shape.

Find an expression for the area of the shape below.
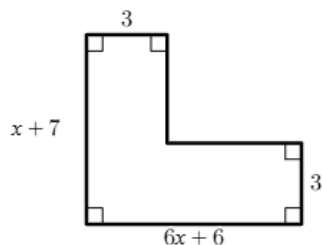
Give your answer in its simplest form.

....

Question 16

Skill involved: 199f: Solve a two-step equation of the form $ax + b = c$ where the solution is a negative integer.

Solve for x:

$$5x + 52 = 2$$

$x = \ldots\ldots\ldots$

Question 17

Skill involved: 199j: Solve a linear equation requiring simplification to the form $ax + b = c$ where the solution is a positive or negative terminating decimal or a fraction.

Solve for x:

$$15 + 3x - 4 - x = 2$$

$x = \ldots\ldots\ldots$

Question 18

Skill involved: 254d: Solve an equation with brackets and requiring simplification, with the variable on one side.

Solve for x:

$$5(3x - 10) - 7x = 19$$

$x = \ldots\ldots\ldots$

Question 19

Skill involved: 257f: Solve a linear equation with two sets of brackets on one side requiring simplification.

Solve for x:

$$3(4 - 5x) + 5(2x + 3) = 5(1 + x)$$

$x = \ldots\ldots\ldots$

Question 20

Skill involved: 258h: Solve equations of the form $\frac{ax}{b} = cx + d$

Solve for x:

$$\frac{8x}{3} = -x + 2$$

$x = \dots\dots\dots$

Question 21

Skill involved: 258k: Solve equations of the form $\frac{ax+b}{c} = \frac{dx+e}{f}$

Solve for x:

$$\frac{3x-5}{2} = \frac{5x+2}{5}$$

$x = \dots\dots\dots$

Question 22

Skill involved: 200g: Solve a two-step equation involving a power of a variable.

Solve:

$$x^2 - 8 = 17$$

$x = \dots\dots\dots$

or $x = \dots\dots\dots$

Question 23

Skill involved: 200h: Solve a two-step equation involving the nth root of a variable.

Solve for x :

$$3\sqrt{x} = 6$$

$x = \dots\dots\dots$

Question 24

Skill involved: 367a: Solve quadratic equations given in the form $(\mathbf{ax} + \mathbf{b})(\mathbf{cx} + \mathbf{d}) = \mathbf{0}$

Solve

$$(5x + 4)(4x + 1) = 0$$

$x = \ldots\ldots\ldots$

or $x = \ldots\ldots\ldots$

Question 25

Skill involved: 417a: Solve a quadratic equation to get exact solutions.

Solve the following quadratic equation, leaving your answers in exact form.

$$4x^2 + 6x + 1 = 0$$

$x = \ldots\ldots\ldots$

or $x = \ldots\ldots\ldots$

Question 26

Skill involved: 462a: Solve an equation requiring multiplication by a single algebraic term, leading to a quadratic equation.

Solve:

$$3x + \frac{20}{x} + 17 = 0$$

$x = \ldots\ldots\ldots$

or $x = \ldots\ldots\ldots$

Geometry

Question 1

Skill involved: 288b: Use Pythagoras' theorem to calculate a shorter side of a right-angled triangle.

Find the value of x.
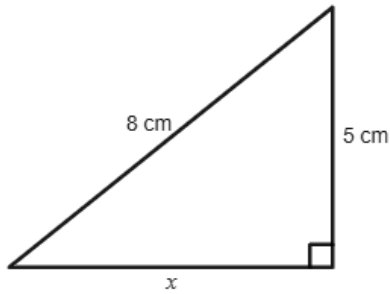
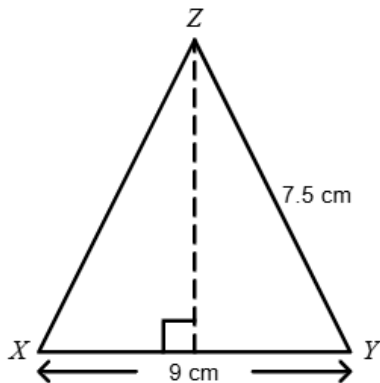Give your answer correct to 1 decimal place.

.... cm

Question 2

Skill involved: 288e: Use Pythagoras' theorem to find the area of a triangle.
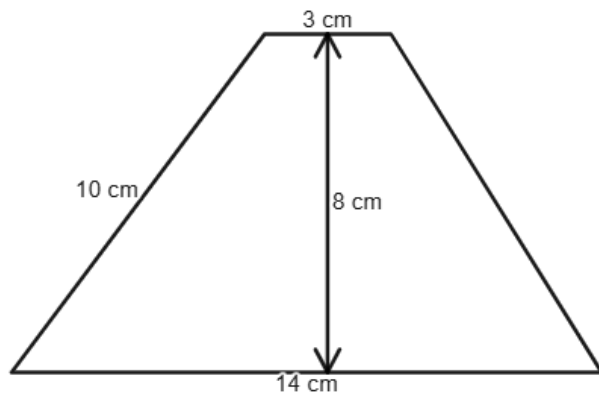
The diagram below shows the isosceles triangle XYZ.

Find the area of triangle XYZ.

.... cm ^{2}

Question 3

Skill involved: 338e: Determine the perimeter of a composite shape in surd form, where a missing side is found by use of Pythagoras' theorem.

Work out the perimeter of the following shape.

Give your answer in surd form.

$$\text{Perimeter} = \text{..............................} \text{ cm}$$

Question 4

Skill involved: 321d: Use sin, cos and tan to determine the hypotenuse or adjacent side in a right-angled triangle.

Determine the value of x in the diagram.
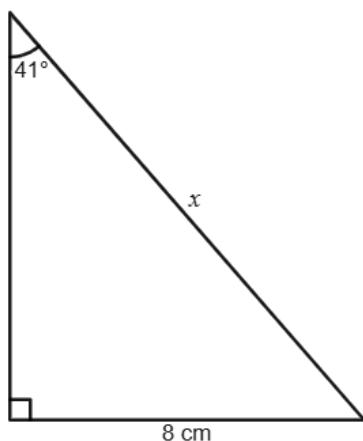
Give your answer correct to 1 decimal place.

$$x = \text{..............................} \text{ cm}$$

Question 5

Skill involved: 321e: Use Pythagoras' theorem then trigonometry to determine an unknown side.

Work out the value of x.
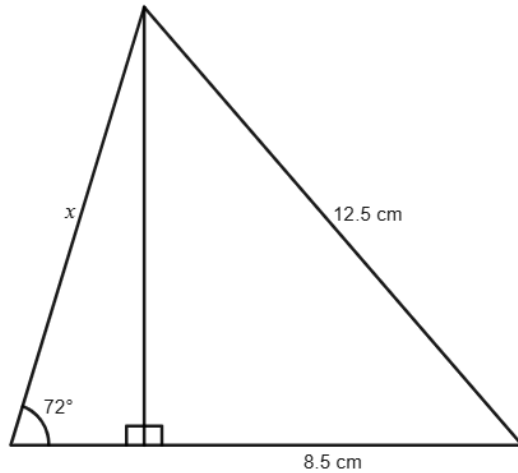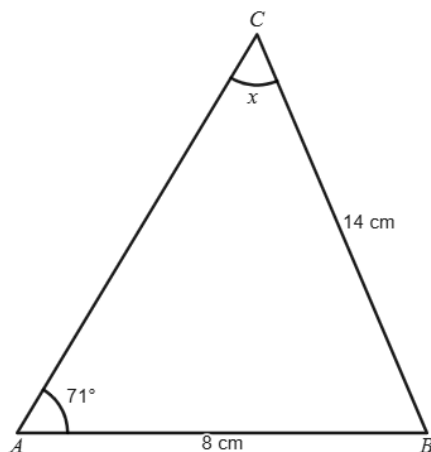

Give your answer correct to 1 decimal place.

$x =$ .... cm

Question 6

Skill involved: 465b: Use the sine rule/Law of Sines to determine acute angles in non right-angled triangles.

Find the value of x.
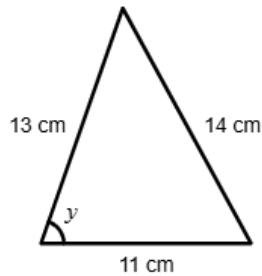

Give your answer correct to 1 decimal place.

$x =$ .... °

Question 7

Skill involved: 466c: Use the cosine rule/Law of Cosines to determine unknown angles in non right-angled triangles.

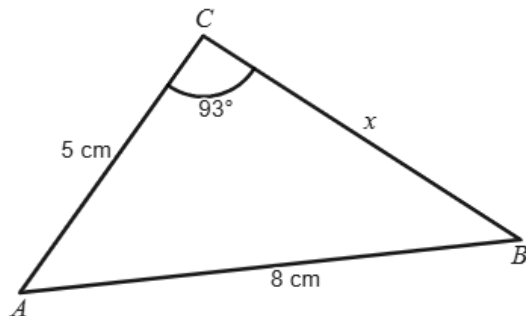Find the value of y.

Give your answer correct to 1 decimal place.

$$y = \text{................................} \quad °$$

Question 8

Skill involved: 466g: Use a combination or repetition of the sine rule/Law of Sines and cosine rule/Law of Cosines within a single triangle.

Find the value of x.
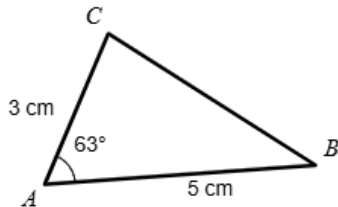

Give your answer correct to 1 decimal place.

$$x = \text{................................} \quad \text{cm}$$

Question 9

Skill involved: 467a: Calculate the area of a triangle using two lengths and the included angle.

Find the area of the triangle ABC.
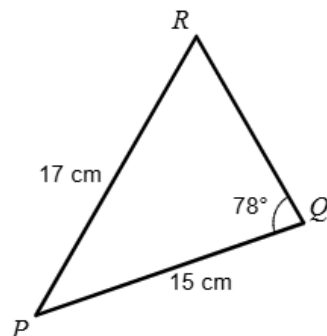

Give your answer correct to 1 decimal place.

.... cm ^{2}

Question 10

Skill involved: 467d: Calculate the area of a triangle using two lengths and an angle not included between the two sides.

Find the area of the triangle PQR.

Give your answer correct to 1 decimal place.

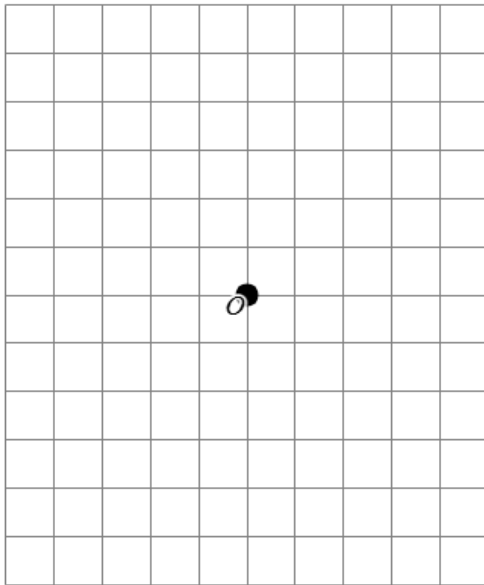.............................. cm ^{2}

Question 11

Skill involved: 373f: Draw the addition or subtraction of column vectors.

Given that:

$$p = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$$
$$q = \begin{pmatrix} 7 \\ 3 \end{pmatrix}$$

Draw the vector $p - q$ from the point O.

Question 12

Skill involved: 373g: Add or subtract scalar multiples of vectors.

Given that:

$$a = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$$
$$b = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$
$$c = \begin{pmatrix} 6 \\ 5 \end{pmatrix}$$

Write $4a - 2b - 3c$ as a column vector.

$$4a - 2b - 3c = \begin{pmatrix} \quad \end{pmatrix}$$

Number

Question 1

Skill involved: 335e: Multiply two surds that require simplifying.

Simplify

$$5\sqrt{6} \times 2\sqrt{2}$$

....

Question 2

Skill involved: 335h: Multiply or divide surds with algebra.

Simplify fully.

$$(\sqrt{10})y^2 \div \sqrt{\frac{160}{y^6}}$$

....

Question 3

Skill involved: 336b: Add or subtract surds that require simplifying.

Simplify

$$9\sqrt{98} + 7\sqrt{50}$$

....

Question 4

Skill involved: 337g: Multiply three brackets involving surds.

Expand and simplify:

$$(\sqrt{7} - 2)(\sqrt{7} - 3)(5 + \sqrt{7})$$

....

Question 5

Skill involved: 393c: Rationalise the denominator of a fraction given in the form $\frac{a}{\sqrt{b} + \sqrt{c}}$ or $\frac{a\sqrt{b}}{\sqrt{c} + \sqrt{d}}$

Rationalise the denominator of

$$\frac{2}{\sqrt{5} + \sqrt{3}}$$

Give your answer in the form $a\sqrt{5} + b\sqrt{3}$

....

Question 6

Skill involved: 393e: Rationalise the denominator of a fraction given in the form $\frac{a + \sqrt{b}}{c + \sqrt{b}}$

Rationalise the denominator of:

$$\frac{\sqrt{2}+3}{\sqrt{2}-1}$$

Give your answer in in the form $a + b\sqrt{2}$

....

Question 7

Skill involved: 393i: Rationalise the denominator of a fraction where either the numerator or the denominator is squared.

Show that

$$\frac{\left(\sqrt{8}-\sqrt{2}\right)^2}{\sqrt{2}+1}$$

can be written in the form $a + b\sqrt{2}$ where a and b are integers.

....

Question 8

Skill involved: 394l: Raise an algebraic term to the power of a positive unit fraction.

Simplify

$$\left(16m^2 n^{12}\right)^{\frac{3}{2}}$$

....

Question 9

Skill involved: 394n: Raise an algebraic term to the power of a negative fraction.

Simplify

$$\left(16x^{14}\right)^{-\frac{1}{2}}$$

....

Question 10

Skill involved: 394r: Write a surd expression in one variable as a power of that variable (or value).

Given that

$$x^k = x\sqrt{x}$$

Find the value of k.

$k = $ ....

Question 11

Skill involved: 162j: Solve problems involving LCM and HCF where one or more of the numbers is unknown.

The lowest common multiple (LCM) of a and b is 10.

The lowest common multiple of a and c is 18.

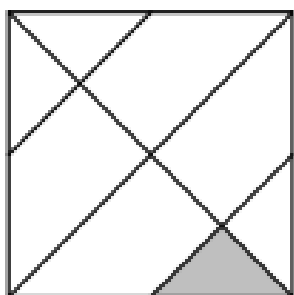Find the least possible value of the lowest common multiple of b and c.

....

Stretch and Challenge

Question 1

The diagram shows a square, its two diagonals and two line segments, each of which connects two midpoints of sides of the square.
What fraction of the area of the square is shaded?
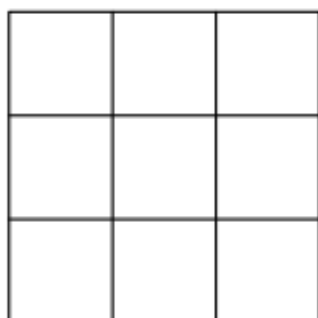
$\frac{1}{8}$ [ ]

$\frac{1}{10}$ [ ]

$\frac{1}{12}$ [ ]

$\frac{1}{16}$ [ ]

$\frac{1}{24}$ [ ]

Question 2

To draw a 3 by 3 square grid you need 8 straight lines, as shown.

How many straight lines do you need to draw a n by n square grid?

$n + 5$ [ ]

$3n - 1$ [ ]

$n^2 - 1$ [ ]

$4(n - 1)$ [ ]

$2(n + 1)$ [ ]

Question 3

Jill was given a large jar of jam. She gave one sixth of the jam to Jan. Jill then gave one thirteenth of the remaining jam to Jas. Jill was left with 1 kg of jam.

What was the weight, in kg, of the jam in Jill's jar at the start?

1.2 [ ]

1.3 [ ]

1.4 [ ]

1.6 [ ]

1.9 [ ]

Question 4

The mean of p and q is 13; the mean of q and r is 16; the mean of r and p is 7.

What is the mean of p, q and r?

12 [ ]

13 [ ]

14 [ ]

15 [ ]

16 [ ]

Question 5

How many of the following polygons could exist?

A triangle with all three sides the same length, but three different interior angles.
A quadrilateral with all four sides the same length, but four different interior angles.
A pentagon with all five sides the same length, but five different interior angles.

only the pentagon [ ]

only the quadrilateral [ ]

the quadrilateral and the pentagon [ ]

all three [ ]

none of them [ ]

Question 6

The sum of the lengths of the three sides of a right-angled triangle is 16 cm. The sum of the squares
of the lengths of the three sides of the triangle is 98 cm ^{2}.

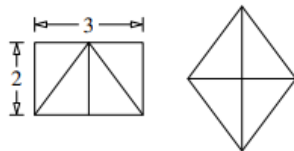What is the area, in cm ^{2}, of the triangle?

8 [ ]

10 [ ]

12 [ ]

14 [ ]

16 [ ]

Question 7

A 3 by 2 rectangle is split into four congruent right-angled triangles, as shown in the left-hand diagram.
Those four triangles are rearranged to form a rhombus, as shown in the right-hand diagram.

What is the ratio of the perimeter of the rectangle to the perimeter of the rhombus?

3 : 2 [ ]

2 : 1 [ ]

1 : 1 [ ]

1 : 2 [ ]

2 : 3 [ ]

Question 8

What is the positive difference between the numerator and the denominator when the expression shown is written as a single fraction in its simplest form?

$$\frac{n}{n+1-\dfrac{n+2}{n+3}}$$

$2n + 2$ [ ]

$1n + 2$ [ ]

$2n$ [ ]

2 [ ]

1 [ ]

Question 9

I roll two standard six-sided fair dice. At least one of the scores obtained on the dice is 3.

What is the probability that both of the scores on the dice are 3?

$\frac{1}{12}$ [ ]

$\frac{1}{11}$ [ ]
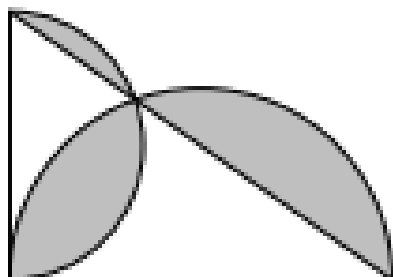
$\frac{1}{6}$ [ ]

$\frac{1}{3}$ [ ]

$\frac{1}{4}$ [ ]

Question 10

A semicircle of radius 3 units is drawn on one edge of a right-angled triangle, and a semicircle of radius 4 units is drawn on another edge. The semicircles intersect on the hypotenuse of the triangle, as shown.

What is the shaded area, in square units?

$\frac{25\pi}{2} - 24$ [ ]

12 [ ]

$\frac{25\pi}{2} - 6$ [ ]

$25\pi - 24$ [ ]

24 [ ]