Name	Date started	Target end date

WJEC GCSE Mathematics and Numeracy (Double Award) — Question Pack

Converting recurring decimals to fractions using place-value algebra, identifying rational and irrational numbers, and reasoning about √2 and &p

REVISE
.wales

2.06 — Recurring decimals & rational/irrational numbers

Spec 1.5.1, 1.6.1, 1.6.2 — Unit 2 (no calculator)

Converting recurring decimals to fractions using place-value algebra, identifying rational and irrational numbers, and reasoning about √2 and π-style irrationals. Sourced from legacy WJEC GCSE Mathematics Higher non-calculator papers, organised for revision under the 2025 spec.

2025 SPECIFICATION

Estimated time for entire question pack: ~1 hours 20 minutes

*Derived from the GCSE Higher pace of **~1.5 min/mark** (53 marks across 18 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. Questions are organised against the 2025 specification. Questions are ordered chronologically by sitting, with custom-written and SAM questions at the end.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working — method marks are awarded for clear setup.

*A calculator is **not** permitted on any question in this pack (Unit 2 is the non-calculator paper).*

Recurring decimals & rational/irrational numbers — what the new spec asks

WJEC GCSE Mathematics (first teaching 2025) · Unit 2: non-calculator.

Recurring decimals 1.6.1

- Notation: dot above a digit means it recurs.
- Convert by multiplying by 10^n where n is the block length.
- Subtract the original x, then solve for the fraction.

Mixed recurring 1.6.1

- Shift past the non-recurring digits before subtracting.
- Use $10^a x$ and $10^{a+n} x$ where a is pre-period length, n is block length.
- Simplify the resulting fraction.

Rationals & irrationals 1.6.2

- $\mathbb{Q}$: ratios of integers; finite or recurring decimals.
- Irrationals: non-terminating, non-recurring decimals.
- Examples: $\sqrt{2}$, π, e are irrational.

Combining numbers 1.5.1

- rational + irrational = irrational.
- rational $\times$ irrational = irrational (unless rational = 0).
- Two irrationals can multiply to a rational, e.g. $\sqrt{2} \cdot \sqrt{2} = 2$.

Recurring decimals & rational/irrational numbers in one page

Quick-reference notes — revisit before each question. Don't use during the questions.

Recurring decimal notation

A dot above a digit means it recurs; dots above two digits mean the whole block recurs.

$0\cdot\dot{3} = 0\cdot 333\ldots$, $\quad 0\cdot\dot{1}\dot{2} = 0\cdot 121212\ldots$.

Convert single-digit recurrence

Let $x = 0\cdot\dot{3}$. Then $10x = 3\cdot\dot{3}$.

Subtract: $9x = 3$, so $x = \frac{1}{3}$.

Always subtract the original x, not $1x$ written out.

Convert two-digit recurrence

Let $x = 0\cdot\dot{2}\dot{7}$. Multiply by 100 to shift one full block.

$100x = 27\cdot\dot{2}\dot{7}$.

$99x = 27 \Rightarrow x = \frac{27}{99} = \frac{3}{11}$.

Three-digit recurrence

Use $1000x$ for a three-digit block.

$0\cdot\dot{2}4\dot{5} = \frac{245}{999}$, then simplify if possible.

Mixed pre-period

$0\cdot 2\dot{3}$: shift past the non-recurring part first.

$x = 0\cdot 2\dot{3} \Rightarrow 10x = 2\cdot\dot{3}, 100x = 23\cdot\dot{3}$.

$90x = 21 \Rightarrow x = \frac{21}{90} = \frac{7}{30}$.

Rationals vs irrationals

$\mathbb{Q}$ = rationals = $\frac{p}{q}$ with p, q integers, $q \neq 0$
.

Irrationals (in $\mathbb{R} \setminus \mathbb{Q}$) include $\sqrt{2}, \sqrt{3}, \pi, e$.

Every terminating or recurring decimal is rational.

Spotting irrationals

$\sqrt{n}$ irrational unless n is a perfect square.

Sum: rational + irrational = irrational.

Product: rational $\times$ irrational = irrational (unless rational is 0).

Make a target rational

Pair irrationals that cancel: $\sqrt{2} \times \sqrt{2} = 2$, $\sqrt{2} + (3 - \sqrt{2}) = 3$.

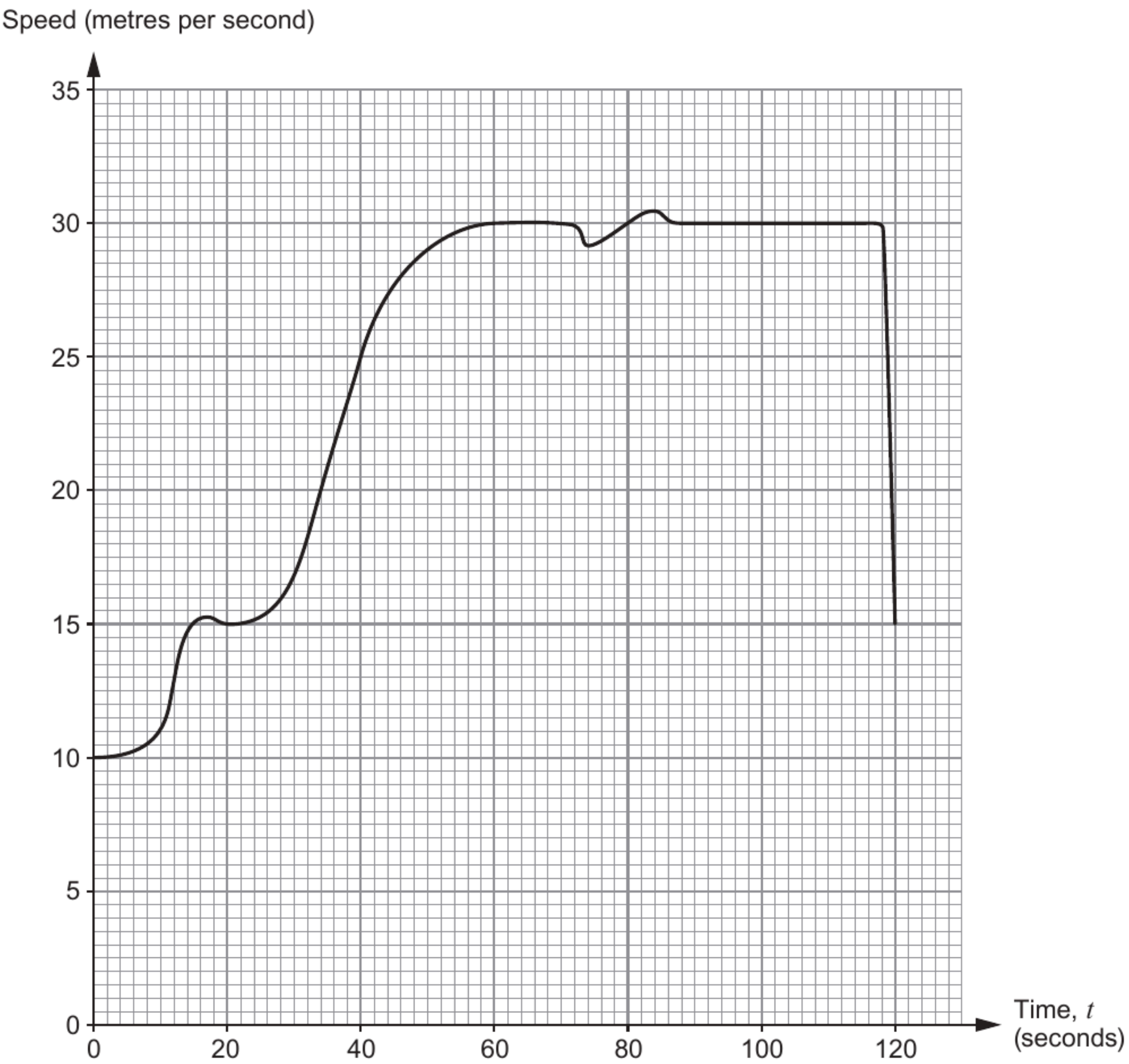
Or use a difference of squares: $(\sqrt{5} + 1)(\sqrt{5} - 1) = 4$.

Common traps

- $1 \div 7 = 0\cdot\dot{1}4285\dot{7}$ — spot the recurring block.
- $0\cdot 99\dot{9} = 1$, so $0\cdot\dot{9} = 1$ exactly.
- π is irrational, but $\frac{22}{7}$ is just an approximation.

Examiner only

10. The graph below shows a 120-second section of Iestyn's car journey to work this morning.



(a) (i) At t = 50 seconds, estimate the acceleration of Iestyn's car in m/s^2. Leave your answer as a fraction. [3]

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Examiner only

(ii) At another time, Iestyn calculated the acceleration of the car to be $0{\cdot}2\dot{4}$ m/s^2.
Write this recurring decimal as a fraction. [2]

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(b) (i) Calculate an estimate of the distance travelled by Iestyn's car in the first 80 seconds of his journey.
You must consider the speed of the car when t = 0, 20, 40, 60 and 80 seconds. [4]

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(ii) Hence, calculate an estimate of the average speed of Iestyn's car for this entire 120-second section of his car journey.
Give your answer in m/s. [4]

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Examiner only

11. *(a)* Evaluate $49^{-\frac{1}{2}}$. [1]

(b) Express $0{\cdot}3\dot{7}\dot{2}$ as a fraction. [2]

(c) Find the value of $\left(\sqrt{63}-\sqrt{7}\right)^2$. [3]

Examiner only

19. *(a)* Give one example to show that the square of an irrational number is **not** always rational. [1]

Number = ...

Square of the number = ...

(b) Find two **different** irrational numbers to make the answer to the calculation below rational.
Complete the calculation by filling in the three boxes. [1]

☐ × ☐ = ☐

Examiner only

15. *(a)* Express $0{\cdot}6\dot{4}\dot{2}$ as a fraction. [2]

(b) Evaluate $\left(\frac{1}{36}\right)^{-\frac{1}{2}}$. [2]

Examiner only

8. Eirlys works for an accountancy firm.
She receives an annual salary, which is paid in equal instalments.

Eirlys has calculated that, so far this financial year, she has been paid $0{\cdot}41\dot{6}$ of her annual salary.

(a) Express $0{\cdot}41\dot{6}$ as a fraction in its lowest terms. [3]

(b) Use your answer from part *(a)* to find the number of months' pay Eirlys has received. [1]

Examiner only

15. *(a)* Express $0{\cdot}\dot{2}4\dot{5}$ as a fraction. [2]

(b) Expand and simplify $(8-3\sqrt{7})(5+\sqrt{7})$. [2]

Examiner only

15. *(a)* Express $0{\cdot}3\dot{7}$ as a fraction. [2]

(b) (i) Calculate $\left(\sqrt{8}-\sqrt{2}\right)^2$. [2]

(ii) Calculate $\dfrac{\sqrt{6}\times\sqrt{20}}{\sqrt{3}}$.

Give your answer in the form $a\sqrt{b}$, where a and b are integers, and b is as small as possible. [2]

Examiner only

13. *(a)* Express $0{\cdot}24\dot{8}$ as a fraction. [2]

(b) Evaluate $\left(\frac{1}{27}\right)^{-\frac{2}{3}}$. [2]

Examiner only

14. *(a)* Express $0{\cdot}\dot{4}7\dot{5}$ as a fraction. [2]

(b) Circle the correct answer for the following statement. [1]

$16^{-\frac{3}{4}}$ is equal to

–12	$\frac{1}{8}$	–8	$\frac{1}{12}$	–16·75

Examiner only

14. *(a)* Express $0{\cdot}8\dot{1}\dot{2}$ as a fraction. [2]

(b) Simplify $\sqrt{72}$.
Circle your answer. [1]

$2\sqrt{6}$ $6\sqrt{2}$ $6\sqrt{12}$ 36 $36\sqrt{2}$

(c) Expand and simplify $\left(7-2\sqrt{5}\right)\left(3+\sqrt{5}\right)$. [2]

Examiner only

14. *(a)* Evaluate $4^{-\frac{3}{2}}$. [2]

(b) Evaluate $\frac{1}{3} + 0{\cdot}0\dot{2}$.

Express your answer as a fraction. [3]

Examiner only

15. Write down an **irrational** number whose value is between 9 and 10.
Write your answer in the box below. [1]

Irrational number is:

16. Fully factorise the expression $k^3p - kp^3$. [3]

Examiner only

16. (a) Circle the correct answer for each of the following statements.

(i) $64^{\frac{2}{3}}$ is equal to [1]

$\frac{128}{3}$ 96 $\frac{194}{3}$ 16 512

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(ii) $10000^{-\frac{1}{2}}$ is equal to [1]

$-\frac{1}{100}$ $\frac{1}{100}$ -5000 -100 $\frac{1}{5000}$

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(b) Express $0{\cdot}07\dot{1}\dot{4}$ as a fraction. [2]

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Examiner only

(c) Simplify $\sqrt{11\frac{1}{4}}$.

Give your answer in the form $\frac{a\sqrt{5}}{b}$, where a and b are integers. [2]

(d) Give an example of an irrational number that lies between 6 and 7. [1]

My example of an irrational number is ……………………

Examiner only

1. (a) Evaluate $\sqrt{0{\cdot}9^3 - 0{\cdot}9^4}$. [2]

(b) What is the greatest integer value of n if $2n < 17$? [1]

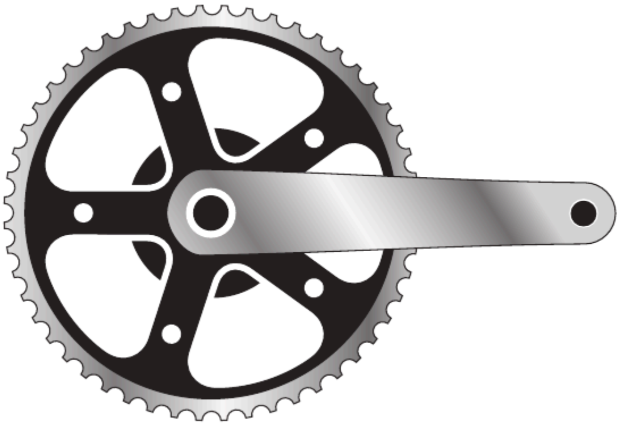
Greatest integer value of n = ...

(c) What is the least integer value of n if $2^n > 125$? [1]

Least integer value of n = ...

Examiner only

9. (a) Geraint has bought a new front cog for his bike.



The cog has a mass of 150 g, **correct to the nearest 10 g**.
The cog has been made from a metal that has a density of 3 g/cm^3, **correct to the nearest g/cm^3**.
Calculate the maximum possible volume of the cog. [3]

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Examiner only

(b) This picture shows part of Geraint's bike.

A simplified diagram of the cogs and the chain is shown below.

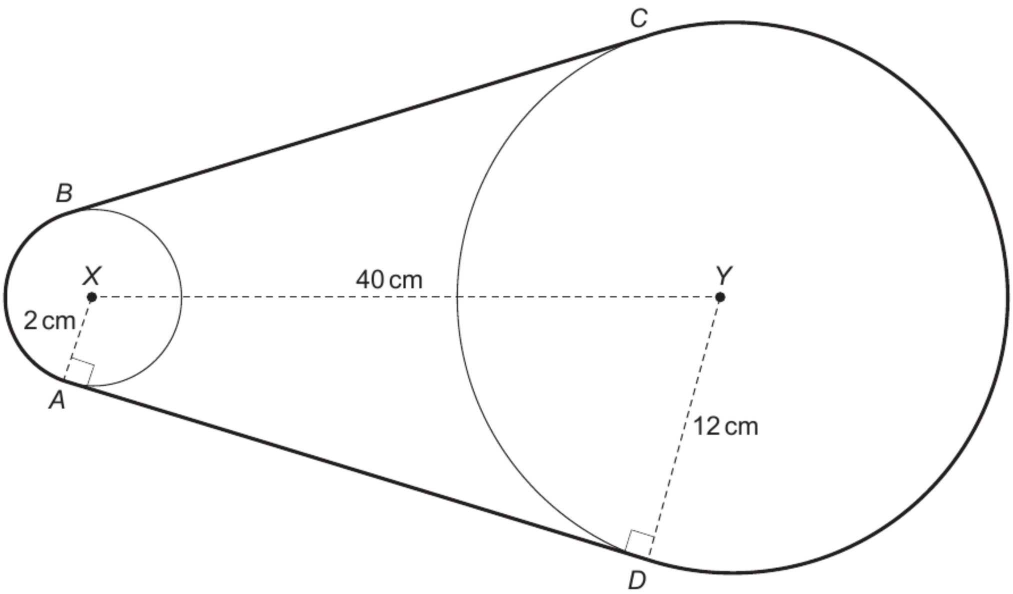

Diagram not drawn to scale

X and *Y* are the centres of the cogs and *XY* is a line of symmetry.
BC and *AD* are straight sections of the chain.

The larger cog has a radius of 12 cm.
The smaller cog has a radius of 2 cm.

(i) Use Pythagoras' theorem to show that the length of *AD* is $10\sqrt{15}$ cm.
You must show all your working. [3]

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Examiner only

(ii)

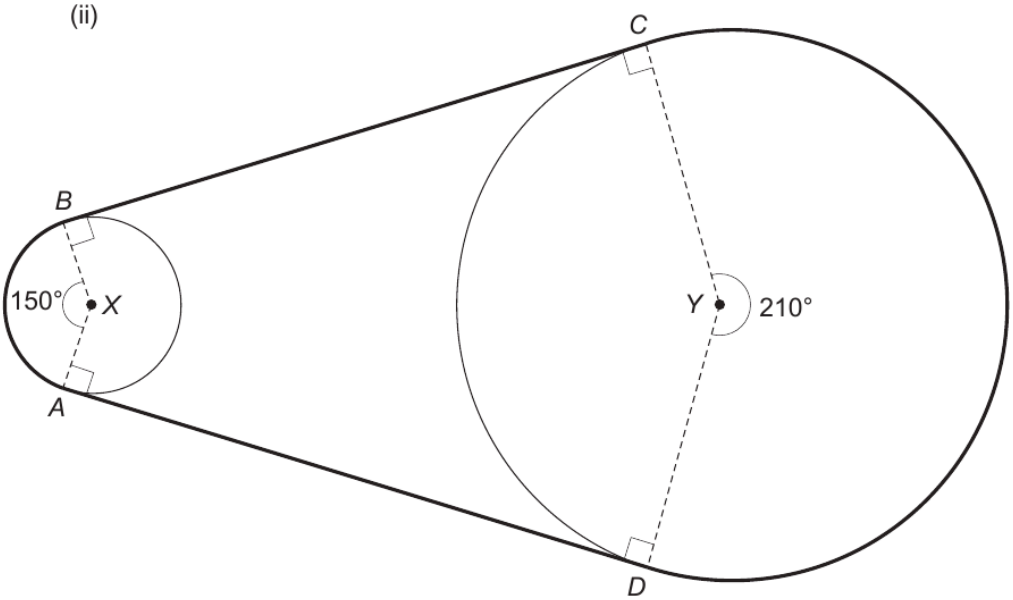

Diagram not drawn to scale

$A\hat{X}B = 150°$, reflex $C\hat{Y}D = 210°$, $BC = AD = 10\sqrt{15}$ cm.

Calculate the total length of the chain.

Give your answer in the form $a\sqrt{15} + b\pi$, where a and b are rational numbers. [5]

Examiner only

14. Factorise $2x^2 - 17x + 30$. [2]

15. (a) Circle the correct answer in each of the following questions:

(i) $\sqrt{20}$ is equal to [1]

$5\sqrt{2}$ $2\sqrt{5}$ 10 $5\sqrt{4}$ $4\sqrt{5}$

(ii) $\sqrt{2} + \sqrt{50}$ is equal to [1]

$\sqrt{52}$ 10 $6\sqrt{2}$ 26 $26\sqrt{2}$

(b) When $q = \sqrt{18}$, which **one** of the following produces a rational number?
Circle your answer. [1]

$\sqrt{q}$ $\frac{q}{2}$ $q - 2$ q^4 $18q$

[illegible]

[illegible] a [illegible] b [illegible] $([illegible] - \sqrt{[illegible]})^{[illegible]} = a + b\sqrt{[illegible]}$ [illegible]

a [illegible] b [illegible]

[illegible]