Real Numbers — Made Easy!

Class 9 · Chapter 1 · Exercise 1.2 · Slow & Simple Notes

Read this first — this exercise has only 3 tools

Tool 1 removes a root from the BOTTOM of a fraction (Q.1). Tool 2 is 5 small power rules (Q.2 and Q.5). Tool 3 is one special pair — x and 1/x (Q.3 and Q.4). Learn the 3 tools and the whole exercise opens.

TOOL 1) THE CONJUGATE — a sign-changing twin

- The conjugate of $4 + \sqrt{3}$ is $4 - \sqrt{3}$ (only the middle sign changes)
- Multiply top and bottom by the conjugate — roots cancel by $(a-b)(a+b) = a^2 - b^2$
- Example: $(\sqrt{3})^2 = 3$ — the root disappears. That is the whole trick!

TOOL 3) THE BEST-FRIENDS PAIR x and 1/x

- For $x = 3 + \sqrt{8}$, its friend $1/x = 3 - \sqrt{8}$ (Q.3 shows why)
- Add them: roots cancel a clean number. Square the sum to grow bigger powers.

Slow trick: always ask — which tool is this? Conjugate? Power rule? Best friends?

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Q.1 Rationalize the Denominator

Rationalize = remove the root from the BOTTOM. One recipe, used again and again.

THE RECIPE (4 steps)

- 1) Look at the bottom. 2) Write its conjugate (flip the middle sign).
- 3) Multiply TOP and BOTTOM by that conjugate. 4) Simplify — roots cancel below.

(i) $13 / (4 + \sqrt{3})$

Step 1: The bottom is $(4 + \sqrt{3})$. Its conjugate is $(4 - \sqrt{3})$.

Conjugate means: same two things, but the sign in the MIDDLE flips — plus becomes minus.

Step 2: Multiply the top AND the bottom by $(4 - \sqrt{3})$.

Top becomes: $13 \times (4 - \sqrt{3})$. We do not open it — just write it as $13(4 - \sqrt{3})$.

Step 3: Bottom: $(4 + \sqrt{3})(4 - \sqrt{3})$. Use the rule $(a + b)(a - b) = a^2 - b^2$:

$= 4^2 - (\sqrt{3})^2 = 16 - 3 = 13$ (because $(\sqrt{3})^2 = 3$ — root squared = the number itself)

Step 4: Now we have $13(4 - \sqrt{3}) / 13$. The 13 above and the 13 below cancel.

Answer: $4 - \sqrt{3}$

WHY DOES THIS WORK?

Because $a^2 - b^2$ has NO root left in it. The conjugate is chosen exactly so the root kills itself.

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Q.1 (ii) and (iii) – Only One Root Below

When the bottom is a single root, life is even easier.

(ii) $(\sqrt{2} + \sqrt{5}) / \sqrt{3}$

Step 1: The bottom is only $\sqrt{3}$ — a single root, no plus or minus. So there is no conjugate.

Step 2: Just multiply the top and the bottom by $\sqrt{3}$ itself.

Step 3: Top, piece by piece: $\sqrt{2} \times \sqrt{3} = \sqrt{6}$ (multiply the insides: $2 \times 3 = 6$).

And $\sqrt{5} \times \sqrt{3} = \sqrt{15}$ (insides: $5 \times 3 = 15$). So the top becomes $\sqrt{6} + \sqrt{15}$.

Step 4: Bottom: $\sqrt{3} \times \sqrt{3} = 3$ (a root times itself gives the inside number).

Answer: $(\sqrt{6} + \sqrt{15}) / 3$

(iii) $(\sqrt{2} - 1) / \sqrt{5}$

Step 1: Same idea — the bottom is a single root $\sqrt{5}$. Multiply top and bottom by $\sqrt{5}$.

Step 2: Top: $\sqrt{2} \times \sqrt{5} = \sqrt{10}$ (insides: $2 \times 5 = 10$).

And the second piece: $-1 \times \sqrt{5} = -\sqrt{5}$. So the top becomes $\sqrt{10} - \sqrt{5}$.

Step 3: Bottom: $\sqrt{5} \times \sqrt{5} = 5$.

Answer: $(\sqrt{10} - \sqrt{5}) / 5$

MEMORY LINE

Root times root? Multiply the insides. Root times ITSELF? The root just goes away.

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Q.1 (iv) and (v) – Roots on Top Too

Now the top also has a root. Do not hurry — open the square slowly, piece by piece.

(iv) $(6 - 4\sqrt{2}) / (6 + 4\sqrt{2})$

Step 1: Conjugate of the bottom $(6 + 4\sqrt{2})$ is $(6 - 4\sqrt{2})$. Multiply top and bottom by it.

Step 2: The top becomes $(6 - 4\sqrt{2})^2$. Open the square with $(a - b)^2 = a^2 - 2ab + b^2$, where $a = 6$ and $b = 4\sqrt{2}$:

$a^2 = 6^2 = 36$. $2ab = 2 \times 6 \times 4\sqrt{2} = 48\sqrt{2}$. $b^2 = (4\sqrt{2})^2 = 16 \times 2 = 32$.

So the top $= 36 - 48\sqrt{2} + 32 = 68 - 48\sqrt{2}$ (36 and 32 are friends — add them).

Step 3: Bottom: $(6 + 4\sqrt{2})(6 - 4\sqrt{2}) = 6^2 - (4\sqrt{2})^2 = 36 - 32 = 4$.

Step 4: Divide every part of the top by 4: $68 \div 4 = 17$, $48 \div 4 = 12$.

Answer: $17 - 12\sqrt{2}$

(v) $(\sqrt{3} - \sqrt{2}) / (\sqrt{3} + \sqrt{2})$

Step 1: Conjugate of $(\sqrt{3} + \sqrt{2})$ is $(\sqrt{3} - \sqrt{2})$. Multiply top and bottom by it.

Step 2: Top: $(\sqrt{3} - \sqrt{2})^2 = (\sqrt{3})^2 - 2(\sqrt{3})(\sqrt{2}) + (\sqrt{2})^2 = 3 - 2\sqrt{6} + 2 = 5 - 2\sqrt{6}$.

The middle piece: $2 \times \sqrt{3} \times \sqrt{2} = 2\sqrt{6}$, because $\sqrt{3} \times \sqrt{2} = \sqrt{6}$ (insides $3 \times 2 = 6$).

Step 3: Bottom: $(\sqrt{3})^2 - (\sqrt{2})^2 = 3 - 2 = 1$.

Step 4: Dividing by 1 changes nothing.

Answer: $5 - 2\sqrt{6}$

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Q.1 (vi) — and the Square Rules

Last part of Q.1, then keep the square rules safe — you will use them all year.

(vi) $4\sqrt{3} / (\sqrt{7} + \sqrt{5})$

Step 1: Conjugate of $(\sqrt{7} + \sqrt{5})$ is $(\sqrt{7} - \sqrt{5})$. Multiply top and bottom by it.

Step 2: Bottom: $(\sqrt{7})^2 - (\sqrt{5})^2 = 7 - 5 = 2$.

Step 3: Top becomes $4\sqrt{3}(\sqrt{7} - \sqrt{5})$. Now divide by the bottom 2: $4 \div 2 = 2$.

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

If your teacher opens the bracket: $2\sqrt{3} \times \sqrt{7} = 2\sqrt{21}$ and $2\sqrt{3} \times \sqrt{5} = 2\sqrt{15}$, so it is also $2\sqrt{21} - 2\sqrt{15}$. Both forms are correct.

KEEP THESE SQUARE RULES SAFE

- $(a - b)^2 = a^2 - 2ab + b^2$ — there are always THREE pieces, never two
- $(4\sqrt{2})^2 = 4^2 \times (\sqrt{2})^2 = 16 \times 2 = 32$ — square BOTH parts, the 4 and the $\sqrt{2}$
- Memory line: conjugate in, roots out!

THE BIGGEST MISTAKE IN Q.1

Multiplying ONLY the bottom. Whatever you do to the bottom, do the SAME to the top — otherwise the value of the fraction changes and every mark is lost.

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Q.2 Simplify — Powers Made Friendly

Two habits win this question: flip for a minus power, and find the small hidden base.

(i) $(81/16)^{(-3/4)}$

Step 1: See the MINUS in the power? A negative power means FLIP the fraction: $(81/16)^{(-3/4)} = (16/81)^{(3/4)}$. The minus is gone after flipping.

Step 2: Break the big numbers: $16 = 2 \times 2 \times 2 \times 2 = 2^4$. $81 = 3 \times 3 \times 3 \times 3 = 3^4$.

So inside we really have $(2/3)$, and the whole thing is $((2/3))^{(3/4)}$.

Step 3: Power of a power — multiply them: $4 \times 3/4 = 3$. So it becomes $(2/3)^3$.

Step 4: $(2/3)^3 = 2^3 / 3^3 = 8 / 27$.

Answer: 8/27

(ii) $(3/4)^{(-2)} \div (4/9)^3 \times 16/27$

Step 1: Flip the first one: $(3/4)^{(-2)} = (4/3)^2$.

Step 2: Dividing by $(4/9)^3$ is the same as multiplying by its flip $(9/4)^3$. And $(9/4)^3 = 3 / 4^3$, because $9^3 = (3^2)^3 = 3^6$.

Step 3: Also break the last fraction: $16/27 = 4^2 / 3^3$.

Step 4: Now just COUNT. For the 4s (remember: a power below counts as minus): $2 - 3 + 2 = 1$ ⇒ $4^1 = 4$. For the 3s: $6 - 2 - 3 = 1$ ⇒ $3^1 = 3$.

Answer: 4 × 3 = 12

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Q.2 (iii) and (iv) – Decimals and Roots

A decimal is a fraction in a coat. A root is a power in a coat. Remove the coat first.

(iii) $(0.027)^{(-1/3)}$

Step 1: Change the decimal into a fraction. 0.027 has 3 digits after the point, so: 0.027 = 27/1000. Now the question is $(27/1000)^{(-1/3)}$.

Step 2: Minus power — flip it: $= (1000/27)^{(1/3)}$.

Step 3: Power 1/3 means CUBE ROOT (the root that asks: which number, times itself 3 times, gives this?)

Cube root of 1000 = 10, because 10 × 10 × 10 = 1000. Cube root of 27 = 3, because 3 × 3 × 3 = 27.

Answer: 10/3

(iv) 7th root of $[x^{14} y^{21} z^{35} / (y^{14} z^{7})]$

Step 1: First finish the division INSIDE the root. Division of powers = subtract: x: there is no x below, so x^1 stays. y: 21 − 14 = 7. z: 35 − 7 = 28.

So inside the root we now have only $x^1 y z^{28}$.

Step 2: A 7th root is the same as power 1/7 — it DIVIDES every power by 7: 14 ÷ 7 = 2, 7 ÷ 7 = 1, 28 ÷ 7 = 4.

Answer: $x^2 y z$ (y^1 is just written as y)

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Q.2 (v) — the Same-Base Game, Slowly

Letters in the powers look scary. The cure: make EVERYTHING base 5, then take out a common

(v) $[\,5(25)^{n+1} - 25(5)^{2n}\,] / [\,5(5)^{2n+3} - (25)^{n+1}\,]$

Step 1: 25 is just 5^2. Change every 25 into 5^2:

$(25)^{n+1} = (5^2)^{n+1} = 5^{(2n+2)}$ — power of a power, so $2 \times (n+1) = 2n + 2$.

Step 2: The TOP, piece by piece:

First piece: $5 \times 5^{(2n+2)} = 5^{(2n+3)}$ (same base multiply = add powers: $1 + 2n + 2$).

Second piece: $25 \times (5)^2 = 5^2 \times 5^2 = 5^{(2n+2)}$. So top = $5^{(2n+3)} - 5^{(2n+2)}$.

Step 3: Take OUT the smaller power $5^{(2n+2)}$ as a common friend:

Top = $5^{(2n+2)} \times (5 - 1) = 5^{(2n+2)} \times 4$. (One $5^{(2n+3)}$ holds 5 copies of $5^{(2n+2)}$.)

Step 4: The BOTTOM, the same way: $5 \times 5^{(2n+3)} = 5^{(2n+4)}$ = 25 copies of $5^{(2n+2)}$, minus 1 copy:

Bottom = $5^{(2n+2)} \times (25 - 1) = 5^{(2n+2)} \times 24$.

Step 5: The big friend $5^{(2n+2)}$ is on top AND bottom — cancel it.

Answer: 4 / 24 = 1/6

> **THE ONE IDEA OF (v)**
> Do not fear the letters. Convert, take out the common power, cancel. The letters disappear by themselves.

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Q.2 (vi) and (vii) — Base 2 and a Neat Division

Same game again — this time everything becomes base 2.

(vi) $[(16)^1 + 20(4^2)] / [(2)^3 \times 8^2]$

Step 1: Change the bases: $16 = 2$, $4 = 2^2$, $8 = 2^3$.

Step 2: Top piece 1: $(2)^1 = 2^{(4x+4)}$. And $2^{(4x+4)} = 2 \times 2 = 16 \times 2$ — remember this 16!

Top piece 2: $4^2 = (2^2)^2 = 2$, so it is 20×2.

Step 3: Take out the friend 2: Top $= 2 \times (16 + 20) = 36 \times 2$.

Step 4: Bottom: add the powers: $(x - 3) + 3(x + 2) = x - 3 + 3x + 6 = 4x + 3$.

So bottom $= 2^{(4x+3)} = 2 \times 2^3 = 8 \times 2$.

Step 5: Cancel the friend 2. Left with 36/8. Divide both by 4:

Answer: 9/2

(vii) $(64)^{(-2/3)} \div (9)^{(-3/2)}$

Step 1: $64 = 4 \times 4 \times 4 = 4^3$. So $(4^3)^{(-2/3)}$: multiply the powers, $3 \times (-2/3) = -2$.

That gives $4^{(-2)} = 1/16$ (minus power = flip: $1/4^2$).

Step 2: $9 = 3^2$. So $(3^2)^{(-3/2)}$: multiply, $2 \times (-3/2) = -3$. That gives $3^{(-3)} = 1/27$.

Step 3: Divide: $(1/16) \div (1/27)$. Dividing by a fraction = multiply by its flip:

$= (1/16) \times (27/1) = 27/16$.

Answer: 27/16

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Q.2 (viii) and (ix) — the Letters Cancel!

Watch closely: in both parts, the letter n disappears completely. That is normal — do not panic

(viii) $[\ 3^n \times 9^{n+1}\ ] / [\ 3^{n+1} \times 9^{n-1}\ ]$

Step 1: $9 = 3^2$. So $9^{n+1} = 3^{(2n+2)}$ and $9^{n-1} = 3^{(2n-2)}$.

Step 2: Top — same base, multiply means ADD powers: $n + (2n + 2) = 3n + 2$.

Step 3: Bottom — add: $(n - 1) + (2n - 2) = 3n - 3$.

Step 4: Divide — SUBTRACT powers: $(3n + 2) - (3n - 3) = 5$. See? The n went home.

Answer: $3 = 3 \times 3 \times 3 \times 3 \times 3 = 243$

(ix) $[\ 5^{n+3} - 6(5^{n+1})\ ] / [\ 9(5^n) - 4(5^n)\ ]$

Step 1: Use the SPLIT trick: a power like 5^3 splits into 5×5^2: $5^3 = 5 \times 125$ and $5^1 = 5 \times 5$.

Step 2: Top = $125 \times 5 - 6 \times 5 \times 5 = 125 \times 5 - 30 \times 5 = 95 \times 5$.

Step 3: Bottom = $9 \times 5 - 4 \times 5 = (9 - 4) \times 5 = 5 \times 5$.

Step 4: Every piece holds the friend 5 — cancel it top and bottom:

Answer: $95 / 5 = 19$

> SPLIT TRICK — KEEP IT FOREVER
>
> $5^3 = 5 \times 5^2$. Any power with a + in it can split like this. It turns scary letters into simple counting.

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Q.3 If $x = 3 + 8$ — the Best-Friends Trick

Six parts, but only ONE golden step at the start. Find the friend first.

STEP 0 — Find the friend $1/x$

$1/x = 1 / (3 + \sqrt{8})$. Rationalize it (Tool 1 from Q.1!): multiply top and bottom by $(3 - \sqrt{8})$:

$= (3 - \sqrt{8}) / (9 - 8) = (3 - \sqrt{8}) / 1 = 3 - \sqrt{8}$.

So $1/x = 3 - \sqrt{8}$. The bottom became 1 — that is why this pair is magic.

(i) $x + 1/x$

Write both friends side by side: $(3 + \sqrt{8}) + (3 - \sqrt{8})$.

The $+\sqrt{8}$ and the $-\sqrt{8}$ cancel each other. Left: $3 + 3$.

Answer: 6

(ii) $x - 1/x$

Write it: $(3 + \sqrt{8}) - (3 - \sqrt{8})$. Careful — the minus sign flips everything after it:

$= 3 + \sqrt{8} - 3 + \sqrt{8}$. Now the 3s cancel, and $\sqrt{8} + \sqrt{8} = 2\sqrt{8}$.

Answer: $2\sqrt{8}$

(iii) $x^2 + 1/x^2$

Do NOT square x itself — that way is long and full of roots. Use the friend instead:

Square answer (i): $(x + 1/x)^2 = 6^2 = 36$. But $(a + b)^2 = a^2 + 2ab + b^2$, and here $ab = x \times 1/x = 1$, so:

$36 = x^2 + 2 + 1/x^2$. Take the 2 away from both sides:

Answer: $x^2 + 1/x^2 = 34$

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Q.3 (iv), (v), (vi) — Re-use Your Own Answers!

Exam secret: later parts of Q.3 are FREE — they are built from parts (i) and (ii).

(iv) $x^2 - 1/x^2$

Use the rule $a^2 - b^2 = (a + b)(a - b)$, with $a = x$ and $b = 1/x$:

$x^2 - 1/x^2 = (x + 1/x) \times (x - 1/x)$.

But we already KNOW both brackets! From (i): 6. From (ii): $2\sqrt{8}$.

So: $= 6 \times 2\sqrt{8} = 12\sqrt{8}$. ($6 \times 2 = 12$, and the $\sqrt{8}$ just comes along.)

Answer: $12\sqrt{8}$

(v) $x^4 + 1/x^4$

Same squaring trick as (iii), one floor up. Square answer (iii):

$(x^2 + 1/x^2)^2 = 34^2$. And $34^2 = 34 \times 34 = 1156$ ($34 \times 30 = 1020$, $34 \times 4 = 136$, add: 1156).

Expanding the square gives $x + 2 + 1/x$, so: $1156 = x + 1/x + 2$.

Take the 2 away:

Answer: $x + 1/x = 1154$

(vi) $(x - 1/x)^2$

The easiest part of the whole exercise! From (ii), $x - 1/x = 2\sqrt{8}$. Just square it:

$(2\sqrt{8})^2 = 2^2 \times (\sqrt{8})^2 = 4 \times 8 = 32$. (Square both parts: the 2 and the $\sqrt{8}$. $(\sqrt{8})^2 = 8$.)

Answer: 32

SEE THE CHAIN?

6 and $2\sqrt{8}$ build EVERYTHING: square them, multiply them. Never start a part of Q.3 from zero — start from (i) and (ii).

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Q.4 Find p and q — Piece by Piece

Question: $(8 - 3\sqrt{2}) / (4 + 3\sqrt{2}) = p + q\sqrt{2}$. Find p and q.

Plan: first clean the fraction with Tool 1, then COMPARE the two sides like matching socks.

Step 1: Conjugate of $(4 + 3\sqrt{2})$ is $(4 - 3\sqrt{2})$. Multiply top and bottom by it.

Step 2: The TOP — multiply it out in FOUR small pieces:

$8 \times 4 = 32$. $8 \times (-3\sqrt{2}) = -24\sqrt{2}$. $(-3\sqrt{2}) \times 4 = -12\sqrt{2}$.

$(-3\sqrt{2}) \times (-3\sqrt{2}) = +9 \times (\sqrt{2} \times \sqrt{2}) = 9 \times 2 = 18$. (Minus × minus = plus, and $\sqrt{2} \times \sqrt{2} = 2$.)

Collect the family: numbers $32 + 18 = 50$. Roots: $-24\sqrt{2} - 12\sqrt{2} = -36\sqrt{2}$. Top = $50 - 36\sqrt{2}$.

Step 3: The BOTTOM: $4^2 - (3\sqrt{2})^2 = 16 - 18 = -2$. (Careful — it is negative! $(3\sqrt{2})^2 = 9 \times 2 = 18$.)

Step 4: Divide BOTH parts by −2: $50 \div (-2) = -25$. $(-36\sqrt{2}) \div (-2) = +18\sqrt{2}$ (minus ÷ minus = plus).

So the fraction = $-25 + 18\sqrt{2}$. Compare with $p + q\sqrt{2}$ — plain part with plain part, root part with root part:

Answer: p = −25 and q = 18

Q.5 Simplify — the Final Boss (same rules!)

(i) $[(25)^{(3/2)} \times (243)^{(3/5)}] / [(16)^{(5/4)} \times (8)^{(4/3)}]$

Change all four numbers into small bases, one at a time:

$(25)^{(3/2)}$: $25 = 5^2$, and $2 \times 3/2 = 3$, so $= 5^3 = 125$. $(243)^{(3/5)}$: $243 = 3 (3\times3\times3\times3\times3)$, and $5 \times 3/5 = 3$, so $= 3^3 = 27$.

$(16)^{(5/4)}$: $16 = 2$, and $4 \times 5/4 = 5$, so $= 2 = 32$. $(8)^{(4/3)}$: $8 = 2^3$, and $3 \times 4/3 = 4$, so $= 2 = 16$.

Now plain numbers: $(125 \times 27) / (32 \times 16)$. $125 \times 27 = 3375$ ($125 \times 20 = 2500$ and $125 \times 7 = 875$). $32 \times 16 = 512$.

Answer: 3375 / 512

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Q.5 (ii) and (iii) — Slow and Steady

Two longer ones. Breathe. One small piece at a time, exactly like before.

(ii) [54 × cube-root of (27)^(2x)] / [9^(x+1) + 216(3)^(2x−1)]

Step 1: The TOP root. 27 = 3^3, so (27)^(2x) = 3^(6x). A cube root divides the power by 3:

cube root of 3^(6x) = 3^(2x). So the whole top = 54 × 3^(2x).

Step 2: Bottom piece 1: 9^(x+1) = $(3^2)^{(x+1)}$ = 3^(2x+2) = 3^(2x) × 3^2 = 9 × 3^(2x).

Step 3: Bottom piece 2: 3^(2x−1) means ONE power less than 3^(2x) — that is 3^(2x) ÷ 3.

So 216 × 3^(2x−1) = (216 ÷ 3) × 3^(2x) = 72 × 3^(2x).

Step 4: Bottom = 9 × 3^(2x) + 72 × 3^(2x) = (9 + 72) × 3^(2x) = 81 × 3^(2x).

Step 5: The friend 3^(2x) is top AND bottom — cancel it. Left: 54/81. Divide both by 27:

Answer: 2/3

(iii) √ [(216)^(2/3) × (25)^(1/2) / (0.04)^(−3/2)]

Work INSIDE the big root first, one piece at a time:

Piece 1: (216)^(2/3). 216 = 6 × 6 × 6 = 6^3. Power 2/3: first cube root (power ÷ 3) gives 6, then square it: 6^2 = 36.

Piece 2: (25)^(1/2) = √25 = 5.

Piece 3: (0.04)^(−3/2). First 0.04 = 4/100 = 1/25. The minus power flips it: (25)^(3/2) = $(\sqrt{25})^3$ = 5^3 = 125.

Inside now: (36 × 5) / 125 = 180/125. Make it smaller — divide top and bottom by 5: 36/25.

Last step, the big root itself: √(36/25) = √36 / √25 = 6/5.

Answer: 6/5

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Q.5 (iv) – Spot the Pattern!

The last question is not calculation — it is RECOGNITION. Read it like a detective.

(iv) (a^(1/3) + b^(2/3)) (a^(2/3) – a^(1/3) b^(2/3) + b^(4/3))

First remember the identity: $A^3 + B^3 = (A + B)(A^2 – AB + B^2)$.

Now look at the question's FIRST bracket: (a^(1/3) + b^(2/3)). It has the shape (A + B), if:

A = a^(1/3) and B = b^(2/3).

Check the SECOND bracket against $(A^2 – AB + B^2)$, piece by piece:

$A^2 = (a^{(1/3)})^2 = a^{(2/3)}$ $AB = a^{(1/3)} \times b^{(2/3)}$ $B^2 = (b^{(2/3)})^2 = b^{(4/3)}$

All three pieces match! So the whole product is simply $A^3 + B^3$:

$= (a^{(1/3)})^3 + (b^{(2/3)})^3$. Powers: 1/3 × 3 = 1, and 2/3 × 3 = 2.

Answer: a + b^2 (It is b^2, not b — because B was b^(2/3), not b^(1/3). Read carefully!)

1-Page Revision – Read Before the Test!

1. Rationalize: multiply top AND bottom by the conjugate (flip the middle sign).
2. $(a–b)(a+b) = a^2 – b^2$ kills the roots below. $(\sqrt{a})^2 = a$. Root × root = multiply insides.
3. Negative power = flip. Fraction power = root. Power of power = multiply. Split: $5^3 = 5 \times 125$.
4. 81 = 3, 243 = 3, 25 = 5^2, 27 = 3^3, 16 = 2, 64 = 4^3, 216 = 6^3 — see the small base!
5. $x = 3 + \sqrt{8}$ $1/x = 3 – \sqrt{8}$, sum = 6, difference = $2\sqrt{8}$. Square the sum for $x^2 + 1/x^2$.
6. $p + q\sqrt{2}$ questions: rationalize first, then match the plain part and the √ part.
7. $(a – b)^2$ always has THREE pieces: $a^2 – 2ab + b^2$. The middle piece is where marks hide.

TRY YOURSELF

A) Rationalize: 5 / √5

B) Simplify: (27/8)^(–2/3)

C) Simplify: (81)^(3/4)

D) Rationalize: 1 / (3 – √2)

Answers: A) √5 B) 4/9 C) 27 D) (3 + √2)/7

Exercise 1.2 – done! Tool by tool, step by step, you can beat any of these.

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