Mathematics Ch 1: Real Numbers – Answer Key

Class 9 Mathematics (FBISE pattern) | Al Amal Learning Center

Tip: the boxed option is correct. Read why, then try the question again yourself.

SECTION A (MCQs)

Q	Question	A	B	C	D
1.	In the radical expression $\sqrt[5]{(32x^{10})}$, the index and the radicand are:	Index 32, radicand 5	**Index 5, radicand $32x^{10}$**	Index 10, radicand 32x	Index 5, radicand x^{10}

Why B? The **index** is the small number outside the radical sign and the **radicand** is the expression under it. In $\sqrt[5]{(32x^{10})}$ the index is **5** and the radicand is **$32x^{10}$**.

2.	$\sqrt[3]{(54x^7y^9)}$ simplifies to:	**$3x^2y^3\sqrt[3]{(2x)}$**	$3xy^3\sqrt[3]{(2x^2)}$	$3x^2y^3\sqrt[3]{(2x^2)}$	$9x^2y^3\sqrt[3]{(2x)}$

Why A? Split into perfect cubes: $54x^7y^9 = \mathbf{27} \cdot 2 \cdot \mathbf{x^6} \cdot x \cdot \mathbf{y^9}$. The cube root takes out $3 \cdot x^2 \cdot y^3$ and leaves $\sqrt[3]{(2x)}$. So the answer is **$3x^2y^3\sqrt[3]{(2x)}$**.

3.	$\sqrt{3} \cdot \sqrt[3]{2}$ written as a single radical is:	$\sqrt[6]{6}$	$\sqrt[5]{6}$	**$\sqrt[6]{108}$**	$\sqrt[6]{36}$

Why C? Use a **common index**: $3^{1/2} \cdot 2^{1/3} = 3^{3/6} \cdot 2^{2/6} = (3^3 \cdot 2^2)^{1/6} = \sqrt[6]{(27 \times 4)} = \mathbf{\sqrt[6]{108}}$.

4.	$\sqrt[4]{(81a^8b^4)}$ simplifies to:	$3a^4b$	$9a^2b$	$3a^2b^4$	**$3a^2b$**

Why D? $(81a^8b^4)^{1/4} = 81^{1/4} \cdot a^{8/4} \cdot b^{4/4} = \mathbf{3a^2b}$. ($81 = 3^4$, so its 4th root is 3.)

5.	$\sqrt{(\sqrt[3]{x})}$ (a square root of a cube root) is equal to:	$\sqrt[5]{x}$	**$\sqrt[6]{x}$**	$\sqrt[9]{x}$	x^6

Why B? $\sqrt{(\sqrt[3]{x})} = (x^{1/3})^{1/2} = x^{1/6} = \mathbf{\sqrt[6]{x}}$. **Multiply the indices**: $2 \times 3 = 6$.

6.	$\sqrt[6]{(8x^3)}$ is equal to:	$\sqrt[3]{(2x)}$	$\sqrt{(8x)}$	**$\sqrt{(2x)}$**	$\sqrt[3]{(4x)}$

Why C? $8x^3 = (2x)^3$, so $(8x^3)^{1/6} = (2x)^{3/6} = (2x)^{1/2} = \mathbf{\sqrt{(2x)}}$.

7.	$\sqrt[4]{(x^2y^6)}$ is equal to:	**$\sqrt{(xy^3)}$**	$\sqrt[3]{(xy^2)}$	$\sqrt{(x^2y^6)}$	$\sqrt[4]{(xy^3)}$

Why A? $(x^2y^6)^{1/4} = x^{2/4} \cdot y^{6/4} = x^{1/2} \cdot y^{3/2} = (xy^3)^{1/2} = \mathbf{\sqrt{(xy^3)}}$.

8.	$(27x^6)^{2/3}$ simplifies to:	$18x^4$	$9x^6$	$6x^4$	**$9x^4$**

Why D? $27^{2/3} = (\sqrt[3]{27})^2 = 3^2 = \mathbf{9}$ and $x^{6 \times 2/3} = \mathbf{x^4}$. So the answer is **$9x^4$**.

9.	$(16x^8y^{-4})^{3/4}$ written with positive exponents is:	$8x^6y^3$	**$8x^6 / y^3$**	$12x^6 / y^3$	$4x^6 / y^3$

Why B? $16^{3/4} = (\sqrt[4]{16})^3 = 2^3 = 8$, $x^{8 \times 3/4} = x^6$ and $y^{-4 \times 3/4} = y^{-3} = 1/y^3$. A **negative exponent** moves the factor to the denominator, giving **$8x^6 / y^3$**.

10.	$(a^{2/3} \cdot a^{1/2}) \div a^{1/6}$ simplifies to:	**a**	$a^{4/3}$	$a^{7/6}$	$a^{1/18}$

Why A? Same base: **add** exponents when multiplying and **subtract** when dividing. $2/3 + 1/2 = 7/6$, then $7/6 - 1/6 = 1$. So the answer is $a^1 = \mathbf{a}$.

11.	$\sqrt[3]{(x\sqrt{x})}$ simplifies to:	x	$x^{3/2}$	$\sqrt{x}$	$\sqrt[3]{x}$

Why C? $x\sqrt{x} = x^1 \cdot x^{1/2} = x^{3/2}$. Then $(x^{3/2})^{1/3} = x^{1/2} = \sqrt{x}$.

12.	$(8/27)^{-2/3}$ equals:	4/9	−4/9	2/3	9/4

Why D? A ***negative exponent flips*** the fraction: $(8/27)^{-2/3} = (27/8)^{2/3} = (\sqrt[3]{27} / \sqrt[3]{8})^2 = (3/2)^2 = 9/4$.

Scenario: (MCQs 13–16) A shoe factory has an asset of Rs. 1,500,000, of which 3/5 is the capital and the rest is the debt. (Asset = Capital + Debt)

Q	Question	A	B	C	D
13.	What is the capital of the factory?	Rs. 600,000	Rs. 750,000	Rs. 900,000	Rs. 300,000

Why C? Capital = 3/5 of the asset = 3/5 × 1,500,000 = 3 × 300,000 = **Rs. 900,000**.

14.	What is the debt of the factory?	Rs. 600,000	Rs. 900,000	Rs. 300,000	Rs. 1,000,000

Why A? Debt = Asset − Capital = 1,500,000 − 900,000 = **Rs. 600,000**. (Check: 2/5 × 1,500,000 = 600,000.)

15.	What is the ratio of capital to debt?	2 : 3	3 : 2	3 : 5	5 : 3

Why B? Capital : Debt = 900,000 : 600,000. Divide both by 300,000 to get **3 : 2**.

16.	If the factory pays Rs. 150,000 of its debt, what debt remains?	Rs. 750,000	Rs. 150,000	Rs. 600,000	Rs. 450,000

Why D? Remaining debt = 600,000 − 150,000 = **Rs. 450,000**.

Scenario: (MCQs 17–20) Hina is given the radical expression $E = \sqrt[6]{(64x^6y^{12})}$, where x and y are positive numbers.

Q	Question	A	B	C	D
17.	What are the index and the radicand of E?	Index 6, radicand $64x^6y^{12}$	Index 64, radicand 6	Index 12, radicand $64x^6$	Index 6, radicand 64

Why A? In $\sqrt[6]{(64x^6y^{12})}$ the index is **6** and the radicand is **$64x^6y^{12}$** (everything under the sign).

18.	E written as an exponential expression is:	$64x^6y^{12}$	$(64x^6y^{12})^6$	$(64x^6y^{12})^{1/6}$	$(64x^6y^{12})^{-6}$

Why C? A radical converts to an exponent by $\sqrt[n]{a} = a^{1/n}$. So $E = (64x^6y^{12})^{1/6}$.

19.	E in its simplest form is:	$8xy^2$	$2xy^2$	$2x^6y^{12}$	$2xy$

Why B? $E = 64^{1/6} \cdot x^{6/6} \cdot y^{12/6}$. Since $64 = 2^6$, $64^{1/6} = 2$. So $E = 2xy^2$.

20.	The value of E when x = 5 and y = 1 is:	5	25	2	10

Why D? Put x = 5 and y = 1 in $E = 2xy^2$: $2 \times 5 \times 1^2 = 10$.

SECTION B (Short Questions)

Q1 [3 marks]

Q: Simplify completely $\sqrt[4]{(48a^9b^5)}$.

Step	Working	Marks
1. Factorise	$48 = 16 \times 3 = 2^4 \times 3$, $a^9 = a^8 \cdot a$, $b^5 = b^4 \cdot b$	1
2. Take out 4th powers	$\sqrt[4]{(2^4 \cdot a^8 \cdot b^4 \cdot 3ab)}$: 2^4 gives **2**, a^8 gives $\mathbf{a^2}$, b^4 gives **b**	1
3. Write the result	Outside: $2a^2b$. Inside (left over): $3ab$	1

Answer: $2a^2b\ \sqrt[4]{(3ab)}$

Q1 OR [3 marks]

Q: Write $\sqrt{3} \cdot \sqrt[3]{2} \cdot \sqrt[4]{5}$ as a single radical.

Step	Working	Marks
1. Exponent form	$3^{1/2} \cdot 2^{1/3} \cdot 5^{1/4}$	1
2. Common index	LCM of 2, 3 and 4 is **12**. So $3^{6/12} \cdot 2^{4/12} \cdot 5^{3/12}$	1
3. Combine	$(3^6 \cdot 2^4 \cdot 5^3)^{1/12} = (729 \times 16 \times 125)^{1/12} = (1{,}458{,}000)^{1/12}$	1

Answer: $\sqrt[12]{(1{,}458{,}000)}$

Q2 [3 marks]

Q: Simplify $(2187a^5b^{17} / a^{12}b^3)^{1/7}$.

Step	Working	Marks
1. Write 2187 as a power	$2187 = 3^7$	1
2. Laws of exponents	Same base, so subtract: $a^{5-12} = a^{-7}$ and $b^{17-3} = b^{14}$	1
3. Apply the power 1/7	$(3^7 \cdot a^{-7} \cdot b^{14})^{1/7} = 3 \cdot a^{-1} \cdot b^2$	1

Answer: $3b^2 / a$

Q2 OR [3 marks]

Q: Simplify $(81x^8)^{3/4} \div (8x^{-6})^{-1/3}$.

Step	Working	Marks
1. First term	$(81x^8)^{3/4} = 81^{3/4} \cdot x^6 = 27x^6$	1
2. Second term	$(8x^{-6})^{-1/3} = 8^{-1/3} \cdot x^2 = (1/2) \cdot x^2$	1
3. Divide	$27x^6 \div (x^2/2) = 27x^6 \times 2/x^2 = 54x^4$	1

Answer: $54x^4$

Q3 [3 marks]

Q: Wajid drove 283.4 km on 16.2 litres of petrol and says he averaged about 1.75 km/L. Is his answer reasonable?

Step	Working	Marks
1. Round the numbers	283.4 ≈ 280 and 16.2 ≈ 16	1
2. Estimate	280 ÷ 16 = 17.5 km/L (exact: 283.4 ÷ 16.2 ≈ 17.49 km/L)	1
3. Compare	His 1.75 km/L is ***10 times too small***. The decimal point is in the wrong place.	1

Answer: Not reasonable. It should be about 17.5 km/L.

Q3 OR [3 marks]

Q: Convert −89.2 °C into Fahrenheit and Kelvin. F = (9/5)C + 32, K = C + 273

Step	Working	Marks
1. Put C in the formula	F = (9/5)(−89.2) + 32	1
2. Fahrenheit	= −160.56 + 32 = −128.56 °F	1
3. Kelvin	K = −89.2 + 273 = 183.8 K	1

Answer: −128.56 °F and 183.8 K

SECTION C (Long Question)

Q4 [2+2+2 marks]

(a) [2]

Q: Write $\sqrt[8]{(256a^8b^{16})}$ in exponential form and simplify.

Step	Working	Marks
1. Exponential form	$\sqrt[8]{(256a^8b^{16})} = (256a^8b^{16})^{1/8}$	1
2. Simplify	$= 256^{1/8} \cdot a^{8/8} \cdot b^{16/8}$. Since $256 = 2^8$, $256^{1/8} = 2$	1

Answer: $2ab^2$

(b) [2]

Q: Show that $\sqrt[6]{(x^4y^2)} = \sqrt[3]{(x^2y)}$.

Step	Working	Marks
1. LHS to exponents	$\sqrt[6]{(x^4y^2)} = (x^4y^2)^{1/6} = x^{4/6} \cdot y^{2/6}$	1
2. Reduce and regroup	$= x^{2/3} \cdot y^{1/3} = (x^2y)^{1/3} = \sqrt[3]{(x^2y)}$ = RHS ✓	1

Hence shown: LHS = RHS

(c) [2]

Q: Evaluate $(81/16)^{3/4} \times (8)^{-1/3}$.

Step	Working	Marks
1. First factor	$(81/16)^{3/4} = (3^4/2^4)^{3/4} = (3/2)^3 = 27/8$	1
2. Second factor and product	$8^{-1/3} = 1/\sqrt[3]{8} = 1/2$. So $27/8 \times 1/2 = 27/16$	1

Answer: 27/16

Q4 OR [2+2+2 marks]

Penalty = Rs. 480,000, shared by Farah, Maryam and Tehreem in the ratio 1 : 2 : 3.

(a) [2]

Q: Into how many equal parts is the penalty divided, and what is one part?

Step	Working	Marks
1. Number of parts	1 + 2 + 3 = **6 equal parts**	1
2. Value of one part	480,000 ÷ 6 = 80,000	1

Answer: 6 parts, one part = Rs. 80,000

(b) [2]

Q: Find the penalty paid by Farah and by Maryam.

Step	Working	Marks
1. Farah (1 part)	1 × 80,000 = 80,000	1
2. Maryam (2 parts)	2 × 80,000 = 160,000	1

Answer: Farah = Rs. 80,000, Maryam = Rs. 160,000

(c) [2]

Q: Find Tehreem's share and verify that the three shares add up to the penalty.

Step	Working	Marks
1. Tehreem (3 parts)	3 × 80,000 = 240,000	1
2. Verify	80,000 + 160,000 + 240,000 = 480,000 = the penalty ✓	1

Answer: Tehreem = Rs. 240,000, and the total is Rs. 480,000