ExamPath

CLASS 9 MATHEMATICS · FBISE · UNIT 1 · SECTIONS B AND C PRACTICE

Unit 1: Real Numbers: short and long questions

Write your working in the boxes. Model answers are on the last pages. These are practice questions written by ExamPath, not official FBISE questions or marking schemes.

Section B style: short questions (3 marks each)

B1 · 3 marks · Laws of exponents

Simplify $(27x^6y^{-3})^{2/3} \div (9x^2y^{-4})^{1/2}$, where $x, y > 0$.

B2 · 3 marks · Radicals

Rationalise the denominator and simplify: $4/(\sqrt{5} - 1)$.

B3 · 3 marks · Rational numbers

Express the recurring decimal 0.363636... (the block 36 repeats forever) as a fraction p/q in its lowest terms.

B4 · 3 marks · Radicals

Simplify $\sqrt{75} - \sqrt{48} + \sqrt{12}$.

B5 · 3 marks · The number line

Describe how to locate $\sqrt{5}$ on the number line.

B6 · 3 marks · Order of real numbers

Arrange in ascending order: $\sqrt{3}$, 1.7, 12/7 and 1.7373... (73 repeating).

Section C style: long questions (6 marks each)

C1 · 6 marks · Laws of exponents and radicals

(a) Show that $(x^a)^{b-c} \cdot (x^b)^{c-a} \cdot (x^c)^{a-b} = 1$, where $x > 0$. (3 marks)

(b) If $x = 2 + \sqrt{3}$, find the value of $x + 1/x$. (3 marks)

C2 · 6 marks · Radicals and exponents

(a) Simplify $1/(\sqrt{3} + \sqrt{2}) + 1/(\sqrt{3} - \sqrt{2})$. (3 marks)

(b) Simplify $(2^{n+2} - 2^n) \div 2^{n+1}$. (3 marks)

C3 · 6 marks · Radicals in real life

A square garden has an area of 72 m^2.

(a) Find the length of one side in simplest radical form. (2 marks)

(b) Find the length of its diagonal. (2 marks)

(c) Fencing costs Rs 150 per metre. Using $\sqrt{2} \approx 1.414$, find the cost of fencing the whole boundary, to the nearest rupee. (2 marks)

Model answers

B1.

1. $(27x^6y^{-3})^{2/3} = 27^{2/3} \cdot x^{6 \times 2/3} \cdot y^{-3 \times 2/3} = 9x^4y^{-2}$
2. $(9x^2y^{-4})^{1/2} = 9^{1/2} \cdot x^{2 \times 1/2} \cdot y^{-4 \times 1/2} = 3xy^{-2}$
3. Divide: $9x^4y^{-2} \div 3xy^{-2} = 3x^{4-1}y^{-2-(-2)} = 3x^3y^0$

Answer: $3x^3$

Watch out: Apply the outside power to the number as well as to each variable: $27^{2/3} = (\sqrt[3]{27})^2 = 9$.

B2.

1. Multiply the top and bottom by the conjugate $(\sqrt{5} + 1)$.
2. Denominator: $(\sqrt{5} - 1)(\sqrt{5} + 1) = 5 - 1 = 4$
3. So $4(\sqrt{5} + 1)/4 = \sqrt{5} + 1$

Answer: $\sqrt{5} + 1$

Watch out: Use the conjugate $(\sqrt{5} + 1)$, not $\sqrt{5}$ alone; multiplying by $\sqrt{5}$ does not remove the root from the denominator.

B3.

1. Let $x = 0.363636...$
2. The block "36" has 2 digits, so multiply by 100: $100x = 36.363636...$
3. Subtract: $100x - x = 36$, so $99x = 36$ and $x = 36/99 = 4/11$

Answer: 4/11

Watch out: Multiply by 10 for each digit in the repeating block (here 100), then subtract to remove the repeating part.

B4.

1. $\sqrt{75} = \sqrt{(25 \times 3)} = 5\sqrt{3}$
2. $\sqrt{48} = \sqrt{(16 \times 3)} = 4\sqrt{3}$
3. $\sqrt{12} = \sqrt{(4 \times 3)} = 2\sqrt{3}$
4. $5\sqrt{3} - 4\sqrt{3} + 2\sqrt{3} = 3\sqrt{3}$

Answer: $3\sqrt{3}$

Watch out: Only like surds can be added: first write each one as a multiple of the same root, $\sqrt{3}$.

B5.

1. Draw a number line and mark O at 0 and A at 2.
2. At A, draw AB perpendicular to the line with AB = 1 unit.
3. By Pythagoras, $OB = \sqrt{(2^2 + 1^2)} = \sqrt{5}$.
4. With centre O and radius OB, draw an arc to cut the number line at P. Then $OP = \sqrt{5}$.

Answer: The point P where the arc meets the line represents $\sqrt{5}$ (about 2.24).

Watch out: Choose the two sides so that the squares add up to 5: $2^2 + 1^2 = 5$.

B6.

1. Write each as a decimal: $\sqrt{3} \approx 1.7321$, $12/7 = 1.714285...$, $1.7373...$, and 1.7.
2. Compare digit by digit: $1.7000 < 1.7143 < 1.7321 < 1.7373$

Answer: $1.7 < 12/7 < \sqrt{3} < 1.7373...$

Watch out: Write enough decimal places (at least 4) before comparing numbers that start with the same digits.

C1.

1. (a) Multiply the powers: $x^{a(b-c)} \cdot x^{b(c-a)} \cdot x^{c(a-b)}$
2. Add the exponents: $ab - ac + bc - ab + ac - bc = 0$
3. So the expression equals $x^0 = 1$.
4. (b) $1/x = 1/(2 + \sqrt{3})$. Multiply by the conjugate: $(2 - \sqrt{3})/((2 + \sqrt{3})(2 - \sqrt{3})) = (2 - \sqrt{3})/(4 - 3) = 2 - \sqrt{3}$
5. $x + 1/x = (2 + \sqrt{3}) + (2 - \sqrt{3}) = 4$

Answer: (a) 1 (b) 4

Watch out: In (b), always rationalise $1/x$ first; the $\sqrt{3}$ terms then cancel.

C2.

1. (a) $1/(\sqrt{3} + \sqrt{2}) = (\sqrt{3} - \sqrt{2})/((\sqrt{3})^2 - (\sqrt{2})^2) = (\sqrt{3} - \sqrt{2})/1 = \sqrt{3} - \sqrt{2}$
2. $1/(\sqrt{3} - \sqrt{2}) = (\sqrt{3} + \sqrt{2})/(3 - 2) = \sqrt{3} + \sqrt{2}$
3. Sum: $(\sqrt{3} - \sqrt{2}) + (\sqrt{3} + \sqrt{2}) = 2\sqrt{3}$
4. (b) Take out the common factor 2^n: $2^{n+2} - 2^n = 2^n(2^2 - 1) = 3 \cdot 2^n$
5. $2^{n+1} = 2 \cdot 2^n$, so the expression $= 3 \cdot 2^n \div (2 \cdot 2^n) = 3/2$

Answer: (a) $2\sqrt{3}$ (b) 3/2

Watch out: In (b), $2^{n+2} - 2^n$ is not 2^2: subtracting powers does not subtract exponents. Factorise first.

C3.

1. (a) Side $= \sqrt{72} = \sqrt{(36 \times 2)} = 6\sqrt{2}$ m
2. (b) Diagonal = side $\times \sqrt{2} = 6\sqrt{2} \times \sqrt{2} = 6 \times 2 = 12$ m (by Pythagoras: $\sqrt{(72 + 72)} = \sqrt{144}$)
3. (c) Perimeter $= 4 \times 6\sqrt{2} = 24\sqrt{2} \approx 24 \times 1.414 = 33.936$ m
4. Cost $= 33.936 \times 150 =$ Rs $5090.4 \approx$ Rs 5090

Answer: (a) $6\sqrt{2}$ m (b) 12 m (c) about Rs 5090

Watch out: The side $6\sqrt{2}$ m is irrational, but the diagonal 12 m is rational: multiplying two irrational numbers can give a rational result.

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