1.2 Indices, surds, standard form and sets

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS surd • fractional powers

Indices, surds, standard form and sets

Objective

Use powers, roots, the index laws including fractional powers; calculate exactly with surds including rationalising; use standard form, calculator discipline and set notation (rows N5–N10 with the Extension additions).

1 Key knowledge and worked examples

Indices and surds. $27^{1/3} = 3$ and $8^{2/3} = 4$ (root first, then power). Surds: $\sqrt{50} - \sqrt{18} + \sqrt{8} = 4\sqrt{2}$; rationalise with conjugates: $\frac{5}{3-\sqrt{2}} = \frac{5(3+\sqrt{2})}{7}$.

Standard form and sets. $A \times 10^n$ with $1 \leq A < 10$: $604000 = 6.04 \times 10^5$. Sets: $n(A)$ counts, A' complements, $\cup$ unions, $\cap$ intersects – 30 students, 18 cricket, 15 tennis, 7 both: regions 11, 7, 8, 4.

$0.000072 = 7.2 \times 10^{-5}$

7.2 is the coefficient; -5 is the power

The coefficient is between 1 and 10

Original native-lesson illustration; labels belong to its worked example.

2 Practice

2.1 Work out $27^{1/3}$ and $8^{2/3}$ [2]

2.2 Simplify $\sqrt{50} - \sqrt{18} + \sqrt{8}$ [3]

2.3 Rationalise $\dfrac{5}{3-\sqrt{2}}$ [3]

2.4 Write 0.00047 in standard form [1]

2.5 For $A = \{1, 2, 3, 4, 5\}$, $B = \{4, 5, 6, 7\}$: find $n(A \cup B)$ [2]

3 Exam-style questions

3.1 *(Original, 1E surd family.)* Show that $\dfrac{12}{\sqrt{2}} + \sqrt{18}$ can be written in the form $c\sqrt{2}$, and find c. [3]

3.2 *(Original.)* Work out $(3 \times 10^5) \times (4 \times 10^{-3})$, giving the answer in standard form. [2]

3.3 *(Original, specification line not sampled by the specimens: fractional powers.)* Work out $\left(\dfrac{16}{25}\right)^{1/2}$ and $\left(\dfrac{8}{27}\right)^{2/3}$. [4]

Solutions

2.1 3 and 4.

2.2 $5\sqrt{2} - 3\sqrt{2} + 2\sqrt{2} = 4\sqrt{2}$.

2.3 Multiply by the conjugate: $\dfrac{5(3+\sqrt{2})}{9-2} = \dfrac{5(3+\sqrt{2})}{7}$.

2.4 4.7×10^{-4}.

2.5 $A \cup B = \{1, \ldots, 7\}$, so $n(A \cup B) = 7$.

3.1 $\dfrac{12}{\sqrt{2}} = \dfrac{12\sqrt{2}}{2} = 6\sqrt{2}$ and $\sqrt{18} = 3\sqrt{2}$, so the total is $9\sqrt{2}$: $c = 9$.

3.2 $12 \times 10^2 = 1.2 \times 10^3$.

3.3 $\sqrt{\frac{16}{25}} = \frac{4}{5}$. For the second, take the cube root first: $\left(\frac{8}{27}\right)^{1/3} = \frac{2}{3}$, then square: $\frac{4}{9}$.

Local review guidance: roots before powers in fractional indices; exact surd forms; set answers give the count, not the list. This is authored classroom guidance.