

EXAM-DAY · 90-MIN REVISION CARD

## Number Systems

Print this · Fold it · Carry to the exam-hall gate · Revise once · Then walk in.

### FORMULAS & KEY RESULTS

$N \subset W \subset Z \subset Q \subset R$ . Rational =  $p/q$  ( $p, q$  integers,  $q \neq 0$ ). Irrational = cannot be written as  $p/q$ .

Decimal test: terminating OR non-terminating-recurring  $\Rightarrow$  RATIONAL. Non-terminating-non-recurring  $\Rightarrow$  IRRATIONAL.

Between any two rationals lie INFINITELY many rationals AND irrationals (the number line is 'dense').

$$\sqrt{a} \times \sqrt{b} = \sqrt{ab}; \sqrt{a} / \sqrt{b} = \sqrt{a/b}; (\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a - b.$$

$(a + b)(a - b) = a^2 - b^2$  — the identity that powers rationalisation.

Conjugate of  $(a + b\sqrt{x})$  is  $(a - b\sqrt{x})$ . Multiply num & denom by it to rationalise.

Locate  $\sqrt{n}$  on number line: OA =  $(n-1)/2$  style via OA =  $a$ , AB = 1  $\Rightarrow$  OB =  $\sqrt{a^2+1}$ ; or semicircle/spiral.

Laws of exponents ( $a > 0$ ,  $p, q$  rational):  $a^p \cdot a^q = a^{(p+q)}$ ;  $a^p / a^q = a^{(p-q)}$ ;  $(a^p)^q = a^{(pq)}$ ;  $a^p \cdot b^p = (ab)^p$ .

$$a^{(1/n)} = \sqrt[n]{a}; a^{(m/n)} = (\sqrt[n]{a})^m = \sqrt[n]{a^m}; a^0 = 1; a^{-p} = 1/a^p.$$

### TOP 5 PYQ PATTERNS

#### 1 Rationalise $1/(a + b\sqrt{x})$ and simplify

3 marks · 90% of years  
Multiply by the CONJUGATE  $(a - b\sqrt{x})$ ; use  $a^2 - b^2$  to clear the surd; reduce.

#### 2 Express recurring decimal in p/q form

3 marks · 65% of years  
Let  $x$  = decimal;  $\times 10$  (or  $\times 100$ ) to shift; subtract to cancel tail; solve; reduce.

#### 3 Classify number / decimal as rational or irrational with reason

2 marks · 80% of years  
Recurring/terminating  $\Rightarrow$  rational. Non-terminating-non-recurring ( $\sqrt{\text{non-perfect-square}}$ ,  $\pi$ )  $\Rightarrow$  irrational.

#### 4 Simplify using laws of exponents for real bases

3 marks · 70% of years  
Convert roots to fractional powers; ADD exponents when multiplying same base; reduce the fraction.

#### 5 Represent $\sqrt{x}$ on the number line OR find numbers between two given numbers

3 marks · 55% of years  
Pythagoras/semicircle construction with compass arc; for 'between', average or insert decimals with non-repeating tails.

### 90-MIN REVISION FLOW

#### 0-15 min

Classify these 6 as rational/irrational with one-line reason: (a)  $0.\bar{7}$  (b)  $\sqrt{7}$  (c)  $22/7$  (d)  $\pi$  (e)  $3.142857142857\dots$  (f)  $\sqrt{16}$ .

#### 15-30 min

Convert to p/q: (a)  $0.\bar{6}$  (b)  $1.\bar{3}$  (c)  $0.4\bar{7}$  (d)  $0.\bar{001}$ . Reduce each to lowest terms.

#### 30-45 min

Rationalise: (a)  $1/\sqrt{5}$  (b)  $1/(3+\sqrt{2})$  (c)  $(5+\sqrt{3})/(2-\sqrt{3})$  (d)  $1/(\sqrt{7}-\sqrt{6})$ . Show the conjugate step every time.

#### 45-60 min

Simplify using laws of exponents: (a)  $2^{(2/3)} \cdot 2^{(1/3)}$  (b)  $(3^{(1/2)})^4$  (c)  $(64)^{(1/2)} \cdot (64)^{(1/3)} \dots$  (d)  $7^{(1/2)} / 7^{(1/3)}$ .

#### 60-75 min

Construct on a number line:  $\sqrt{2}$ ,  $\sqrt{3}$  (spiral), and  $\sqrt{5}$  (single Pythagoras). Use compass arcs, not estimation.

#### 75-90 min

Take the 15-MCQ Quick Drill under a 20-minute timer. Target  $\geq 12/15$ , then re-read each wrong answer's notes-slide.

**Confidence, not anxiety.** You've practised this all year. Trust your steps. Don't change strategy on exam morning.  
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