



Attempt questions first; check the separate key afterward. Real numbers, rational and irrational numbers, and prime factorisation. Show reasoning.

A. Very short answers - 1 mark each

1. Distinguish rational and irrational numbers with examples.
2. Express 0.375 as a fraction in lowest terms.
3. Express 0.272727... as a rational number.
4. Find three rational numbers between $\frac{1}{3}$ and $\frac{1}{2}$.
5. Is $\sqrt{7}$ rational?
6. Can the HCF of two positive integers exceed either integer?
7. State the fundamental theorem of arithmetic.
8. Find HCF of consecutive positive integers.

B. Short answers / practice - 2 marks each

9. Simplify $\sqrt{50} + \sqrt{18} - \sqrt{8}$.
10. Rationalise $\frac{1}{\sqrt{5}+2}$.
11. Evaluate $27^{(2/3)}$ and $16^{(-3/4)}$.
12. Can 6^n end in zero for positive integer n ? Justify.
13. Represent $\sqrt{5}$ on a number line using a right triangle.
14. Find the smallest perfect square divisible by 12 and 18.
15. Prove that $\sqrt{2}$ is irrational.
16. Prove that $\sqrt{3}$ is irrational.
17. Prove that $5 + \sqrt{2}$ is irrational.
18. Simplify $(\sqrt{7} + \sqrt{3})(\sqrt{7} - \sqrt{3})$.
19. Rationalise $\frac{3}{(2\sqrt{3})}$.
20. Explain terminating, recurring and non-recurring decimal expansions.

C. Application / reasoning - 3 marks each

21. Is 0.101001000100001... rational? Explain the nonrepeating pattern.
22. Find the decimal expansion of $\frac{7}{8}$ and classify it.
23. Prove that $\sqrt{5}$ is irrational.
24. Simplify $(\sqrt{3} + \sqrt{2})^2$.
25. Can a nonzero rational number times an irrational number be rational? Justify.
26. Can the sum of two irrational numbers be rational? Give an example.
27. Express 0.454545... as a fraction.
28. Simplify $\sqrt{75} - \sqrt{27} + \sqrt{12}$.
29. Rationalise $\frac{2}{(\sqrt{3}+1)}$.
30. Give two irrational numbers whose product is rational.
31. Evaluate $81^{(3/4)} \div 9^{(1/2)}$.

D. Extended practice - 5 marks each

32. Prove that $\sqrt{2}$ is irrational, then show that $5\sqrt{2}$ is irrational.
33. Prove that $3 - 2\sqrt{5}$ is irrational.
34. Locate $\sqrt{2}$ and $\sqrt{3}$ on a number line geometrically and compare them.
35. Prove that $\sqrt{2} + \sqrt{3}$ is irrational by squaring a supposed rational sum.

ANSWER KEY - Numerical / closed questions

- 2) $\frac{3}{8}$. 3) $\frac{3}{11}$. 4) Examples: $\frac{3}{8}$, $\frac{2}{5}$, $\frac{5}{12}$. 5) No. 6) No. 8) 1. 9) $6\sqrt{2}$. 10) $\sqrt{5} - 2$. 11) 9; $\frac{1}{8}$. 12) No; no factor 5. 14) 36. 18) 4. 19) $\frac{\sqrt{3}}{2}$. 21) No; irrational. 22) 0.875; terminating. 24) $5 + 2\sqrt{6}$. 25) No. 26) Yes; $\sqrt{2} + (-\sqrt{2}) = 0$. 27) $\frac{5}{11}$. 28) $4\sqrt{3}$. 29) $\sqrt{3} - 1$. 30) Example: $\sqrt{2}, \sqrt{8}$; product 4. 31) 9. 34) $\sqrt{2} < \sqrt{3}$.