Surds and fractional indices: 10 practice questions

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Name: _____ Date: _____

Attempt all questions and show your working. Suggested time: 15 to 20 minutes.

Give exact answers in simplest surd form unless a question says otherwise.

Section A: Consolidating (Questions 1-4)

Question 1

State whether each number is rational or irrational.

(a) √(49)

(b) √(20)

(c) 0.333...

(d) π

(e) 3/7

(f) √(9/16)

Question 2

Simplify each surd.

(a) √(12)

(b) √(50)

(c) √(72)

Question 3

Evaluate without a calculator.

(a) 16^(½)

(b) 27^(⅓)

(c) 32^(⅕)

Question 4

Simplify.

(a) $3\sqrt{5} + 4\sqrt{5}$

(b) $\sqrt{3} \times \sqrt{12}$

(c) $\sqrt{20} \div \sqrt{5}$

Section B: Standard (Questions 5-10)

Question 5

Simplify.

(a) $\sqrt{18} + \sqrt{32}$

(b) $2\sqrt{27} - \sqrt{48}$

(c) $\sqrt{45} + \sqrt{20} - \sqrt{80}$

Question 6

(a) Write $3\sqrt{2}$ as an entire surd (a single square root).

(b) Write $5\sqrt{3}$ as an entire surd.

(c) Without a calculator, write these numbers in order from smallest to largest: $4\sqrt{3}$, $3\sqrt{5}$, $2\sqrt{11}$, $5\sqrt{2}$.

Question 7

Expand and simplify.

(a) $\sqrt{3}(\sqrt{6} + 2)$

(b) $(2 + \sqrt{5})(3 - \sqrt{5})$

(c) $(\sqrt{7} + 2)(\sqrt{7} - 2)$

(d) $(\sqrt{3} + \sqrt{2})^2$

Question 8

Rationalise the denominator of each fraction and simplify.

(a) $\frac{6}{\sqrt{3}}$

(b) $\frac{10}{3\sqrt{5}}$

(c) $\frac{\sqrt{5}}{2\sqrt{10}}$

Question 9

Rationalise the denominator by multiplying by the conjugate, and simplify.

(a) $\frac{4}{\sqrt{5} - 1}$

(b) $(\sqrt{3} + 1)/(\sqrt{3} - 1)$

Question 10

A rational number is one that can be written as a/b, where a and b are integers and $b \neq 0$.

(a) Write 0.2727… as a fraction in simplest form.

(b) Write 0.1666… as a fraction in simplest form.

(c) Explain why every recurring decimal is a rational number.

Surds and fractional indices: answers

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Question 1

Answer: (a) rational (= 7) (b) irrational (c) rational (= ⅓) (d) irrational (e) rational (f) rational (= ¾)

Question 2

Answer: (a) $2\sqrt{3}$ (b) $5\sqrt{2}$ (c) $6\sqrt{2}$

Question 3

Answer: (a) 4 (b) 3 (c) 2

Question 4

Answer: (a) $7\sqrt{5}$ (b) 6 ($\sqrt{(36)}$) (c) 2 ($\sqrt{4}$)

Question 5

Answer: (a) $7\sqrt{2}$ ($3\sqrt{2} + 4\sqrt{2}$) (b) $2\sqrt{3}$ ($6\sqrt{3} - 4\sqrt{3}$) (c) $\sqrt{5}$ ($3\sqrt{5} + 2\sqrt{5} - 4\sqrt{5}$)

Question 6

Answer: (a) $\sqrt{(18)}$ (b) $\sqrt{(75)}$ (c) $2\sqrt{(11)}$, $3\sqrt{5}$, $4\sqrt{3}$, $5\sqrt{2}$ (as entire surds: $\sqrt{(44)}$, $\sqrt{(45)}$, $\sqrt{(48)}$, $\sqrt{(50)}$)

Question 7

Answer: (a) $3\sqrt{2} + 2\sqrt{3}$ ($\sqrt{(18)} + 2\sqrt{3}$) (b) $1 + \sqrt{5}$ ($6 - 2\sqrt{5} + 3\sqrt{5} - 5$) (c) 3 ($7 - 4$) (d) $5 + 2\sqrt{6}$

Question 8

Answer: (a) $2\sqrt{3}$ ($(6\sqrt{3})/(3)$) (b) $(2\sqrt{5})/(3)$ ($(10\sqrt{5})/(15)$) (c) $(\sqrt{2})/(4)$ ($(\sqrt{5})/(2\sqrt{(10)}) = (1)/(2\sqrt{2})$)

Question 9

Answer: (a) $\sqrt{5} + 1$ ($(4(\sqrt{5} + 1))/(5 - 1)$) (b) $2 + \sqrt{3}$ ($((\sqrt{3} + 1)^2)/(3 - 1) = (4 + 2\sqrt{3})/(2)$)

Question 10

Answer: (a) 3/11 (27/99) (b) ⅙ (c) A recurring decimal can always be written as a fraction of two integers (for example by multiplying by a power of 10 and subtracting to remove the repeating part), so it fits the definition of a rational number.