

Calculus Surds Practice #1

Simplify fully:

1. $5\sqrt{20} + 4\sqrt{45}$

2. $2\sqrt{10} \times 3\sqrt{20}$

3. $\frac{\sqrt{75}}{\sqrt{48}}$

4. $\frac{\sqrt{81}}{\sqrt{27}}$

5. $\frac{\sqrt{8x^3}}{4\sqrt{2x}}$

Expand and simplify fully:

6. $\sqrt{28}(3 + 4\sqrt{7})$

7. $(3 + \sqrt{7})(3 - \sqrt{7})$

8. $(\sqrt{2} + \sqrt{3})(\sqrt{8} + \sqrt{12})$

9. $(x + \sqrt{8})(x - \sqrt{2})$

10. $(x - \sqrt{5})(x - \sqrt{20})$

Rationalise the denominator, then simplify fully:

11. $\frac{3\sqrt{3}}{\sqrt{2}}$

12. $\frac{\sqrt{35}}{3\sqrt{5}}$

13. $\frac{\sqrt{7}}{4 + \sqrt{7}}$

14. $\frac{4 + \sqrt{18}}{3 - \sqrt{2}}$

15. $\frac{2 + \sqrt{5}}{2 - \sqrt{5}}$

Prove that:

16. $\frac{5(a - 3\sqrt{a})}{a - 9} = \frac{5\sqrt{a}}{3 + \sqrt{a}}$

Answers: Calculus Surds Practice #1

Simplify fully:

$$1. \quad 5\sqrt{20} + 4\sqrt{45} = 5\sqrt{4}\sqrt{5} + 4\sqrt{9}\sqrt{5} = 10\sqrt{5} + 12\sqrt{5} = 22\sqrt{5}$$

$$2. \quad 2\sqrt{10} \times 3\sqrt{20} = 6\sqrt{200} = 6\sqrt{100}\sqrt{2} = 60\sqrt{2}$$

$$3. \quad \frac{\sqrt{75}}{\sqrt{48}} = \frac{\sqrt{25}\sqrt{3}}{\sqrt{16}\sqrt{3}} = \frac{5\sqrt{3}}{4\sqrt{3}} = \frac{5}{4}$$

$$4. \quad \frac{\sqrt{81}}{\sqrt{27}} = \frac{3 \times 3}{3\sqrt{3}} = \frac{3\sqrt{3}\sqrt{3}}{3\sqrt{3}} = \sqrt{3}$$

$$5. \quad \frac{\sqrt{8x^3}}{4\sqrt{2x}} = \frac{\sqrt{4}\sqrt{x^2}\sqrt{2x}}{4\sqrt{2x}} = \frac{2x\sqrt{2x}}{4\sqrt{2x}} = \frac{x}{2}$$

Expand and simplify fully:

$$6. \quad \sqrt{28}(3 + 4\sqrt{7}) = 3\sqrt{28} + 4\sqrt{196} = 6\sqrt{7} + 56$$

$$7. \quad (3 + \sqrt{7})(3 - \sqrt{7}) = 9 - 3\sqrt{7} + 3\sqrt{7} - 7 = 2$$

$$8. \quad (\sqrt{2} + \sqrt{3})(\sqrt{8} + \sqrt{12}) = \sqrt{16} + \sqrt{24} + \sqrt{24} + \sqrt{36} = 10 + 4\sqrt{6}$$

$$9. \quad (x + \sqrt{8})(x - \sqrt{2}) = x^2 - \sqrt{2}x + \sqrt{8}x - \sqrt{16} = x^2 + \sqrt{2}x - 4$$

$$10. \quad (x - \sqrt{5})(x - \sqrt{20}) = x^2 - \sqrt{20}x - \sqrt{5}x + \sqrt{100} = x^2 - 3\sqrt{5}x + 10$$

Rationalise the denominator, then simplify fully:

$$11. \quad \frac{3\sqrt{3}}{\sqrt{2}} = \frac{3\sqrt{3}\sqrt{2}}{\sqrt{2}\sqrt{2}} = \frac{3\sqrt{6}}{2} = \frac{3\sqrt{6}}{2}$$

$$12. \quad \frac{\sqrt{35}}{3\sqrt{5}} = \frac{\sqrt{35}\sqrt{5}}{3\sqrt{5}\sqrt{5}} = \frac{5\sqrt{7}}{15} = \frac{\sqrt{7}}{3}$$

$$13. \quad \frac{\sqrt{7}}{4 + \sqrt{7}} = \frac{\sqrt{7}(4 - \sqrt{7})}{(4 + \sqrt{7})(4 - \sqrt{7})} = \frac{4\sqrt{7} - \sqrt{49}}{16 - 7} = \frac{4\sqrt{7} - 7}{9}$$

$$14. \quad \frac{4 + \sqrt{18}}{3 - \sqrt{2}} = \frac{(4 + \sqrt{18})(3 + \sqrt{2})}{(3 - \sqrt{2})(3 + \sqrt{2})} = \frac{12 + 4\sqrt{2} + 3\sqrt{18} + \sqrt{36}}{9 - 2} = \frac{18 + 13\sqrt{2}}{7}$$

$$15. \quad \frac{2 + \sqrt{5}}{2 - \sqrt{5}} = \frac{(2 + \sqrt{5})(2 + \sqrt{5})}{(2 - \sqrt{5})(2 + \sqrt{5})} = \frac{4 + 2\sqrt{5} + 2\sqrt{5} + \sqrt{25}}{4 - 5} = -9 - 4\sqrt{5}$$

Proof:

$$16. \quad \text{much easier in reverse: } \frac{5\sqrt{a}}{3 + \sqrt{a}} = \frac{5\sqrt{a}(3 - \sqrt{a})}{(3 + \sqrt{a})(3 - \sqrt{a})}$$

$$= \frac{15\sqrt{a} - 5\sqrt{a}\sqrt{a}}{9 - a}$$

$$= \frac{15\sqrt{a} - 5a}{9 - a}$$

$$= \frac{5(a - 3\sqrt{a})}{a - 9}$$