Calculus Surds Practice #3

Simplify fully:

1. $4\sqrt{12} - 5\sqrt{75}$

2. $2\sqrt{8} \times 3\sqrt{72}$

3. $\dfrac{\sqrt{192}}{\sqrt{27}}$

4. $\dfrac{\sqrt{18}}{\sqrt{324}}$

5. $\dfrac{\sqrt{16x^5}}{\sqrt{8x^2}}$

Expand and simplify fully:

6. $\sqrt{3}(1 + 2\sqrt{147})$

7. $(5 + \sqrt{50})(3 - \sqrt{18})$

8. $(2\sqrt{3} + \sqrt{5})(3\sqrt{12} + \sqrt{20})$

9. $(x - \sqrt{7})(x - \sqrt{63})$

10. $(x - \sqrt{2a})(x - \sqrt{2a})$

Rationalise the denominator, then simplify fully:

11. $\dfrac{\sqrt{3} + 6\sqrt{2}}{\sqrt{72}}$

12. $\dfrac{1}{3 - \sqrt{2}}$

13. $\dfrac{\sqrt{3}}{2 - \sqrt{3}}$

14. $\dfrac{\sqrt{2}\,x}{5 + \sqrt{2}}$

15. $\dfrac{1 + \sqrt{75}}{7 - \sqrt{3}}$

Prove that:

16. $\dfrac{x}{\sqrt{2} + \sqrt{3}} = \sqrt{3}\,x - \sqrt{2}\,x$

Answers: Calculus Surds Practice #3

Simplify fully:

1. $4\sqrt{12} - 5\sqrt{75} \quad = 4\sqrt{4}\sqrt{3} - 5\sqrt{25}\sqrt{3} \quad = 8\sqrt{3} - 25\sqrt{3} \quad = {}^{-}17\sqrt{3}$

2. $2\sqrt{8} \times 3\sqrt{72} \quad = 6\sqrt{576} \quad = 6\sqrt{4}\sqrt{4}\sqrt{4}\sqrt{9} \quad = 144$

3. $\dfrac{\sqrt{192}}{\sqrt{27}} \quad = \dfrac{\sqrt{64}\sqrt{3}}{\sqrt{9}\sqrt{3}} \quad = \dfrac{8\sqrt{2}}{3\sqrt{2}} \quad = \dfrac{8}{3}$

4. $\dfrac{\sqrt{18}}{\sqrt{324}} \quad = \dfrac{\sqrt{9}\sqrt{2}}{\sqrt{81}\sqrt{4}} \quad = \dfrac{3\sqrt{2}}{9\sqrt{2}\sqrt{2}} \quad = \dfrac{1}{3\sqrt{2}}$

5. $\dfrac{\sqrt{16x^5}}{\sqrt{8x^2}} \quad = \dfrac{\sqrt{16}\sqrt{x^2}\sqrt{x^2}\sqrt{x}}{\sqrt{4}\sqrt{2}\sqrt{x^2}} \quad = \dfrac{2\sqrt{2}\sqrt{2}\,x\sqrt{x}}{2\sqrt{2}} \quad = x\sqrt{2x}$

Expand and simplify fully:

6. $\sqrt{3}(1 + 2\sqrt{147}) \quad = \sqrt{3} + 2\sqrt{441} \quad = \sqrt{3} + 42$

7. $(5 + \sqrt{50})(3 - \sqrt{18}) \quad = 15 - 5\sqrt{18} + 3\sqrt{50} - \sqrt{900} \quad = {}^{-}15$

8. $(2\sqrt{3} + \sqrt{5})(3\sqrt{12} + \sqrt{20}) \quad = 6\sqrt{36} + 2\sqrt{60} + 3\sqrt{60} + \sqrt{100} \quad = 46 + 10\sqrt{15}$

9. $(x - \sqrt{7})(x - \sqrt{63}) \quad = x^2 - \sqrt{9}\sqrt{7}\,x - \sqrt{7}\,x + \sqrt{9}\sqrt{49} \quad = x^2 - 4\sqrt{7}\,x + 21$

10. $(x - \sqrt{2a})(x - \sqrt{2a}) \quad = x^2 - \sqrt{2a}\,x - \sqrt{2a}\,x + \sqrt{4a^2} \quad = x^2 - 2\sqrt{2a}\,x + 2a$

Rationalise the denominator, then simplify fully:

11. $\dfrac{\sqrt{3} + 6\sqrt{2}}{\sqrt{72}} \quad = \dfrac{\sqrt{3}\sqrt{72} + 6\sqrt{2}\sqrt{72}}{\sqrt{72}\sqrt{72}} \quad = \dfrac{6\sqrt{6} + 6\sqrt{144}}{72} \quad = \dfrac{\sqrt{6} + 12}{12}$

12. $\dfrac{1}{3 - \sqrt{2}} \quad = \dfrac{3 + \sqrt{2}}{(3 - \sqrt{2})(3 + \sqrt{2})} \quad = \dfrac{3 + \sqrt{2}}{9 + 3\sqrt{2} - 3\sqrt{2} - 2} \quad = \dfrac{3 + \sqrt{2}}{7}$

13. $\dfrac{\sqrt{3}}{2 - \sqrt{3}} \quad = \dfrac{\sqrt{3}(2 + \sqrt{3})}{(2 - \sqrt{3})(2 + \sqrt{3})} \quad = \dfrac{2\sqrt{3} + 3}{4 + 2\sqrt{3} - 2\sqrt{3} - 3} \quad = 3 + 2\sqrt{3}$

14. $\dfrac{\sqrt{2}\,x}{5 + \sqrt{2}} \quad = \dfrac{(\sqrt{2}\,x)(5 - \sqrt{2})}{(5 + \sqrt{2})(5 - \sqrt{2})} \quad = \dfrac{5x\sqrt{2} - 2x}{25 - 5\sqrt{2} + 5\sqrt{2} - 2} \quad = \dfrac{(5\sqrt{2} - 2)x}{23}$

15. $\dfrac{1 + \sqrt{75}}{7 - \sqrt{3}} \quad = \dfrac{(1 + \sqrt{75})(7 + \sqrt{3})}{(7 - \sqrt{3})(7 + \sqrt{3})} \quad = \dfrac{7 + \sqrt{3} + 7\sqrt{75} + \sqrt{225}}{49 - 3} \quad = \dfrac{11 + 18\sqrt{3}}{23}$

Proof:

16. $\dfrac{x}{\sqrt{2} + \sqrt{3}} \quad = \dfrac{x(\sqrt{2} - \sqrt{3})}{(\sqrt{2} + \sqrt{3})(\sqrt{2} - \sqrt{3})} \quad = \dfrac{x(\sqrt{2} - \sqrt{3})}{2 - 3}$

$\quad = \dfrac{x(\sqrt{2} - \sqrt{3})}{-1} \quad = \dfrac{x(\sqrt{3} - \sqrt{2})}{1} \quad = \sqrt{3}\,x - \sqrt{2}\,x$