

## Surds - Answers

1.

$$(a) \sqrt{12} = \sqrt{4} \times \sqrt{3} \\ = \underline{\underline{2\sqrt{3}}}$$

$$(b) \sqrt{18} = \sqrt{9} \times \sqrt{2} \\ = \underline{\underline{3\sqrt{2}}}$$

$$(c) \sqrt{20} = \sqrt{4} \times \sqrt{5} \\ = \underline{\underline{2\sqrt{5}}}$$

$$(d) \sqrt{50} = \sqrt{25} \times \sqrt{2} \\ = \underline{\underline{5\sqrt{2}}}$$

$$(e) \sqrt{48} = \sqrt{16} \times \sqrt{3} \\ = \underline{\underline{4\sqrt{3}}}$$

$$(f) \sqrt{72} = \sqrt{36} \times \sqrt{2} \\ = \underline{\underline{6\sqrt{2}}}$$

$$(g) 3\sqrt{24} = 3 \times \sqrt{4} \times \sqrt{6} \\ = 3 \times 2 \times \sqrt{6} \\ = \underline{\underline{6\sqrt{6}}}$$

$$(h) 5\sqrt{27} = 5 \times \sqrt{9} \times \sqrt{3} \\ = 5 \times 3 \times \sqrt{3} \\ = \underline{\underline{15\sqrt{3}}}$$

2.

$$(a) 2\sqrt{12} + 5\sqrt{75} - \sqrt{27} \\ = 2\sqrt{4} \times \sqrt{3} + 5\sqrt{25} \times \sqrt{3} - \sqrt{9} \times \sqrt{3} \\ = 4\sqrt{3} + 25\sqrt{3} - 3\sqrt{3} \\ = \underline{\underline{26\sqrt{3}}}$$

(b)

$$\sqrt{8} - 6\sqrt{18} + 3\sqrt{72} - 5\sqrt{50} \\ = \sqrt{4}\sqrt{2} - 6\sqrt{9} \times \sqrt{2} + 3\sqrt{36}\sqrt{2} \\ \quad - 5\sqrt{25}\sqrt{2} \\ = 2\sqrt{2} - 18\sqrt{2} + 18\sqrt{2} \\ \quad - 25\sqrt{2} \\ = \underline{\underline{-23\sqrt{2}}}$$

(c)

$$2\sqrt{45} - 3\sqrt{20} + \sqrt{125} \\ = 2\sqrt{9}\sqrt{5} - 3\sqrt{4}\sqrt{5} \\ \quad + \sqrt{25}\sqrt{5} \\ = 6\sqrt{5} - 6\sqrt{5} + 5\sqrt{5} \\ = \underline{\underline{5\sqrt{5}}}$$

3.

$$(a) \sqrt{18} = \sqrt{9} \times \sqrt{2} \\ = \underline{\underline{3\sqrt{2}}}$$

$$(b) \sqrt{50} = \sqrt{25} \times \sqrt{2} \\ = \underline{\underline{5\sqrt{2}}}$$

$$(c) \quad 3\sqrt{72} = 3 \times \sqrt{36} \times \sqrt{2}$$

$$= \underline{\underline{18\sqrt{2}}}$$

4.

$$(a) \quad (5+\sqrt{2})(2-\sqrt{2})$$

$$= 10 - 5\sqrt{2} + 2\sqrt{2} - 2$$

$$= \underline{\underline{8 - 3\sqrt{2}}}$$

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

$$= 6 - 3\sqrt{5} - 2\sqrt{5} + 5$$

$$= \underline{\underline{11 - 5\sqrt{5}}}$$

$$(c) \quad 4(2-\sqrt{3}) = \underline{\underline{8 - 4\sqrt{3}}}$$

$$(d) \quad 2(7+\sqrt{3}) - 4(1-\sqrt{3})$$

$$= 14 + 2\sqrt{3} - 4 + 4\sqrt{3}$$

$$= \underline{\underline{10 + 6\sqrt{3}}}$$

$$(e) \quad (3+2\sqrt{5})(2+4\sqrt{5})$$

$$= 6 + 12\sqrt{5} + 4\sqrt{5} + 8\sqrt{5} \times \sqrt{5}$$

$$= 6 + 16\sqrt{5} + 40$$

$$= \underline{\underline{46 + 16\sqrt{5}}}$$

$$(f) \quad (1-3\sqrt{2})(1+5\sqrt{2})$$

$$= 1 + 5\sqrt{2} - 3\sqrt{2} - 15 \times \sqrt{2} \times \sqrt{2}$$

$$= 1 + 2\sqrt{2} - 15 \times 2$$

$$= \underline{\underline{-29 + 2\sqrt{2}}}$$

5.

$$(a) \quad (3+2\sqrt{7})(1-\sqrt{7})$$

$$= 3 - 3\sqrt{7} + 2\sqrt{7} - 2 \times \sqrt{7} \times \sqrt{7}$$

$$= 3 - \sqrt{7} - 2 \times 7$$

$$= 3 - \sqrt{7} - 14$$

$$= \underline{\underline{-11 - \sqrt{7}}}$$

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

$$= 6 \times 3 - 4\sqrt{3} - 15\sqrt{3} + 10$$

$$= 18 - 19\sqrt{3} + 10$$

$$= \underline{\underline{28 - 19\sqrt{3}}}$$

$$(c) \quad (3+\sqrt{5})^2$$

$$= (3+\sqrt{5})(3+\sqrt{5})$$

$$= 9 + 3\sqrt{5} + 3\sqrt{5} + 5$$

$$= \underline{\underline{14 + 6\sqrt{5}}}$$

$$(d) \quad (5-2\sqrt{3})^2$$

$$= (5-2\sqrt{3})(5-2\sqrt{3})$$

$$= 25 - 10\sqrt{3} - 10\sqrt{3}$$

$$+ 4 \times 3$$

$$= 25 - 20\sqrt{3} + 12$$

$$= \underline{\underline{37 - 20\sqrt{3}}}$$

6.

$$(a) \frac{2}{\sqrt{5}} = \frac{2 \times \sqrt{5}}{\sqrt{5} \times \sqrt{5}}$$

$$= \frac{2\sqrt{5}}{5}$$

$$\underline{\underline{= \frac{2\sqrt{5}}{5}}}$$

$$(b) \frac{3}{\sqrt{7}} = \frac{3 \times \sqrt{7}}{\sqrt{7} \times \sqrt{7}}$$

$$= \frac{3\sqrt{7}}{7}$$

$$\underline{\underline{= \frac{3\sqrt{7}}{7}}}$$

$$(c) \frac{\sqrt{2}}{5\sqrt{3}} = \frac{\sqrt{2} \times \sqrt{3}}{5\sqrt{3} \times \sqrt{3}}$$

$$= \frac{\sqrt{6}}{15}$$

$$\underline{\underline{= \frac{\sqrt{6}}{15}}}$$

$$(d) \frac{\sqrt{3}}{4\sqrt{2}} = \frac{\sqrt{3} \times \sqrt{2}}{4 \times \sqrt{2} \times \sqrt{2}}$$

$$= \frac{\sqrt{6}}{8}$$

$$\underline{\underline{= \frac{\sqrt{6}}{8}}}$$

$$(e) \frac{2}{5+\sqrt{3}} = \frac{2(5-\sqrt{3})}{(5+\sqrt{3})(5-\sqrt{3})}$$

$$= \frac{2(5-\sqrt{3})}{25-3}$$

$$= \frac{12(5-\sqrt{3})}{22''}$$

$$= \frac{5-\sqrt{3}}{11}$$

$$\underline{\underline{= \frac{5-\sqrt{3}}{11}}}$$

$$(f) \frac{3}{4-\sqrt{2}} = \frac{3(4+\sqrt{2})}{(4-\sqrt{2})(4+\sqrt{2})}$$

$$= \frac{3(4+\sqrt{2})}{16-2}$$

$$= \frac{3(4+\sqrt{2})}{14}$$

$$\underline{\underline{= \frac{3(4+\sqrt{2})}{14}}}$$

$$(g) \frac{2+\sqrt{3}}{4-\sqrt{3}} = \frac{(2+\sqrt{3})(4+\sqrt{3})}{(4-\sqrt{3})(4+\sqrt{3})}$$

$$= \frac{8+2\sqrt{3}+4\sqrt{3}+3}{16-3}$$

$$= \frac{11+6\sqrt{3}}{13}$$

$$\underline{\underline{= \frac{11+6\sqrt{3}}{13}}}$$

$$(h) \frac{2\sqrt{5}-3}{4\sqrt{5}+3} = \frac{(2\sqrt{5}-3)(4\sqrt{5}-3)}{(4\sqrt{5}+3)(4\sqrt{5}-3)}$$

$$= \frac{40-6\sqrt{5}-12\sqrt{5}+9}{80-9}$$

$$= \frac{49-18\sqrt{5}}{71}$$

$$\underline{\underline{= \frac{49-18\sqrt{5}}{71}}}$$

$$7. \frac{5-\sqrt{3}}{2+\sqrt{3}} = \frac{(5-\sqrt{3})(2-\sqrt{3})}{(2+\sqrt{3})(2-\sqrt{3})}$$

$$= \frac{10-5\sqrt{3}-2\sqrt{3}+3}{4-3}$$

$$= \underline{\underline{13-7\sqrt{3}}}$$

$$(a=13, b=-7)$$

$$9. (a) \frac{6}{\sqrt{2}} = \frac{6\sqrt{2}}{\sqrt{2} \times \sqrt{2}}$$

$$= \frac{6\sqrt{2}}{2}$$

$$= \underline{\underline{3\sqrt{2}}}$$

$$(b) \text{Area} = \frac{1}{2} \times \frac{6}{\sqrt{2}} \times \frac{6}{\sqrt{2}}$$

$$= \frac{1}{2} \times \frac{36}{2}$$

$$= \underline{\underline{9 \text{ cm}^2}}$$

$$8. (a) \tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\tan \theta = \frac{3-\sqrt{3}}{\sqrt{3}}$$

$$= \frac{(3-\sqrt{3})(\sqrt{3})}{\sqrt{3} \times \sqrt{3}}$$

$$= \frac{3\sqrt{3}-3}{3}$$

$$= \frac{3(\sqrt{3}-1)}{3}$$

$$= \underline{\underline{\sqrt{3}-1}}$$

$$(b) x^2 = (3-\sqrt{3})^2 + (\sqrt{3})^2$$

$$= (3-\sqrt{3})(3-\sqrt{3}) + 3$$

$$= 9-3\sqrt{3}-3\sqrt{3}+3+3$$

$$= \underline{\underline{15-6\sqrt{3}}}$$