Surds and Brackets

SCAN ME

REVISE THIS TOPIC

For the entire booklet

1 Expand and simplify $\sqrt{3}(\sqrt{6} + 5)$ **[2 marks]**

$\sqrt{18} + 5\sqrt{3}$

$= \sqrt{9} \times \sqrt{2} + 5\sqrt{3}$

$= 3 \times \sqrt{2} + 5\sqrt{3}$

Answer $3\sqrt{2} + 5\sqrt{3}$

2 Expand and simplify $\sqrt{5}(3 - \sqrt{10})$ **[2 marks]**

$3\sqrt{5} - \sqrt{50}$

$= 3\sqrt{5} - \sqrt{25} \times \sqrt{2}$

$= 3\sqrt{5} - 5 \times \sqrt{2}$

Answer $3\sqrt{5} - 5\sqrt{2}$

3 Expand and simplify $\sqrt{8}(\sqrt{2} + \sqrt{5})$ **[2 marks]**

$\sqrt{16} + \sqrt{40}$

$= 4 + \sqrt{4} \times \sqrt{10}$

$= 4 + 2 \times \sqrt{10}$

Answer $4 + 2\sqrt{10}$

4 Expand and simplify $\sqrt{6}(\sqrt{8} + \sqrt{2})$ **[3 marks]**

$\sqrt{48} + \sqrt{12}$

$= \sqrt{16} \times \sqrt{3} + \sqrt{4} \times \sqrt{3}$

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

Answer $6\sqrt{3}$

5 Expand and simplify $(\sqrt{2} + 1)(\sqrt{2} + 3)$ **[2 marks]**

$2 + 3\sqrt{2} + \sqrt{2} + 3$

Answer $5 + 4\sqrt{2}$

6 Expand and simplify $(\sqrt{5} - 2)(\sqrt{5} + 6)$ **[2 marks]**

$5 + 6\sqrt{5} - 2\sqrt{5} - 12$

Answer $4\sqrt{5} - 7$

7 Expand and simplify $(7 - \sqrt{2})(\sqrt{2} + 10)$ **[2 marks]**

$7\sqrt{2} + 70 - 2 - 10\sqrt{2}$

Answer $68 - 3\sqrt{2}$

8 Expand and simplify $(\sqrt{11} + 1)^2$ **[2 marks]**

$(\sqrt{11} + 1)(\sqrt{11} + 1)$

$= 11 + \sqrt{11} + \sqrt{11} + 1$

Answer $12 + 2\sqrt{11}$

9 Expand and simplify $(3\sqrt{6} + 4)(2\sqrt{6} - 5)$ **[3 marks]**

$6\sqrt{36} - 15\sqrt{6} + 8\sqrt{6} - 20$

$= 6 \times 6 - 7\sqrt{6} - 20$

$= 36 - 7\sqrt{6} - 20$

Answer $16 - 7\sqrt{6}$

10 Expand and simplify $(\sqrt{6} + \sqrt{2})(\sqrt{6} - \sqrt{2})$ **[2 marks]**

$6 - \sqrt{12} + \sqrt{12} - 2$

$= 6 - 2$

Answer 4

11 $(\sqrt{5} + \sqrt{2})(\sqrt{10} - 2) = k\sqrt{2}$ where k is an integer. **[3 marks]**

Work out the value of k.

$\sqrt{50} - 2\sqrt{5} + \sqrt{20} - 2\sqrt{2}$

$= \sqrt{25} \times \sqrt{2} - 2\sqrt{5} + \sqrt{4} \times \sqrt{5} - 2\sqrt{2}$

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

$= 3\sqrt{2}$

$k =$ 3

12 $(2\sqrt{3} + 5)(3\sqrt{3} + 5) = a + b\sqrt{3}$ where a and b are integers. **[3 marks]**

Work out the values of a and b.

$6\sqrt{9} + 10\sqrt{3} + 15\sqrt{3} + 25$

$= 18 + 25\sqrt{3} + 25$

$= 43 + 25\sqrt{3}$

$a =$ 43 $b =$ 25

19

13 $\sqrt{2}(\sqrt{8} + 5) + 5(3 - \sqrt{18}) = x - y\sqrt{2}$ where x and y are integers.
Work out the values of x and y. **[4 marks]**

$\sqrt{16} + 5\sqrt{2} + 15 - 5\sqrt{18}$

$= 4 + 5\sqrt{2} + 15 - 5 \times \sqrt{9} \times \sqrt{2}$

$= 4 + 5\sqrt{2} + 15 - 5 \times 3 \times \sqrt{2}$

$= 4 + 5\sqrt{2} + 15 - 15\sqrt{2}$

$= 19 - 10\sqrt{2}$

$x =$ 19 $y =$ 10

14 $3\sqrt{5}(\sqrt{15} + \sqrt{5}) + \sqrt{6}(\sqrt{8} + \sqrt{24}) = p + q\sqrt{3}$ where p and q are integers.
Work out the values of p and q. **[4 marks]**

$3\sqrt{75} + 3\sqrt{25} + \sqrt{48} + \sqrt{144}$

$= 3 \times \sqrt{25} \times \sqrt{3} + 3 \times 5 + \sqrt{16} \times \sqrt{3} + 12$

$= 15\sqrt{3} + 15 + 4\sqrt{3} + 12$

$= 27 + 19\sqrt{3}$

$p =$ 27 $q =$ 19

15 Expand and simplify $(\sqrt{3} + 4)^3$ **[4 marks]**

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

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

$= (19 + 8\sqrt{3})(\sqrt{3} + 4)$

$= 19\sqrt{3} + 76 + 24 + 32\sqrt{3}$

$= 100 + 51\sqrt{3}$

Answer $100 + 51\sqrt{3}$

16 Show clearly that $(\sqrt{3} + 2)^2 + (5 - 2\sqrt{3})^2 - (8 - \sqrt{3})^2$ is equal to an integer.

[5 marks]

$(\sqrt{3}+2)^2 = 3 + 2\sqrt{3} + 2\sqrt{3} + 4 = 7 + 4\sqrt{3}$

$(5-2\sqrt{3})^2 = 25 - 10\sqrt{3} - 10\sqrt{3} + 12 = 37 - 20\sqrt{3}$

$(8-\sqrt{3})^2 = 64 - 8\sqrt{3} - 8\sqrt{3} + 3 = 67 - 16\sqrt{3}$

$(7+4\sqrt{3}) + (37-20\sqrt{3}) - (67-16\sqrt{3})$

$= 7 + 4\sqrt{3} + 37 - 20\sqrt{3} - 67 + 16\sqrt{3}$

$= -23$ (integer)

17 $\dfrac{\sqrt{10}(\sqrt{2} + \sqrt{10}) + \sqrt{3}(5\sqrt{12} + \sqrt{15})}{(\sqrt{7} + \sqrt{2})(\sqrt{7} - \sqrt{2})} = a + \sqrt{5}$ where a is an integer.

Work out the value of a

[6 marks]

$\dfrac{\sqrt{20} + 10 + 5\sqrt{36} + \sqrt{45}}{7 - 2\sqrt{7} + 2\sqrt{7} - 2} = \dfrac{2\sqrt{5} + 10 + 30 + 3\sqrt{5}}{5}$

$= \dfrac{40 + 5\sqrt{5}}{5}$

$= 8 + \sqrt{5}$

$a =$ 8

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