



Surds and Brackets



REVISE THIS TOPIC



For the entire booklet

1 Expand and simplify $\sqrt{3}(\sqrt{6} + 5)$

$$\begin{aligned} & \sqrt{18} + 5\sqrt{3} \\ &= \sqrt{9} \times \sqrt{2} + 5\sqrt{3} \\ &= 3 \times \sqrt{2} + 5\sqrt{3} \end{aligned}$$

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

(Total for Question 1 is 2 marks)

2 Expand and simplify $\sqrt{5}(3 - \sqrt{10})$

$$\begin{aligned} & 3\sqrt{5} - \sqrt{50} \\ &= 3\sqrt{5} - \sqrt{25} \times \sqrt{2} \\ &= 3\sqrt{5} - 5 \times \sqrt{2} \end{aligned}$$

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

(Total for Question 2 is 2 marks)

3 Expand and simplify $\sqrt{8}(\sqrt{2} + \sqrt{5})$

$$\begin{aligned} & \sqrt{16} + \sqrt{40} \\ &= 4 + \sqrt{4} \times \sqrt{10} \\ &= 4 + 2 \times \sqrt{10} \end{aligned}$$

$$\underline{4 + 2\sqrt{10}}$$

(Total for Question 3 is 2 marks)

4 Expand and simplify $\sqrt{6}(\sqrt{8} + \sqrt{2})$

$$\begin{aligned} & \sqrt{48} + \sqrt{12} \\ &= \sqrt{16} \times \sqrt{3} + \sqrt{4} \times \sqrt{3} \\ &= 4\sqrt{3} + 2\sqrt{3} \end{aligned}$$

$$\underline{6\sqrt{3}}$$

(Total for Question 4 is 3 marks)



5 Expand and simplify $(\sqrt{2} + 1)(\sqrt{2} + 3)$

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

$$\underline{5 + 4\sqrt{2}}$$

(Total for Question 5 is 2 marks)

6 Expand and simplify $(\sqrt{5} - 2)(\sqrt{5} + 6)$

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

$$\underline{4\sqrt{5} - 7}$$

(Total for Question 6 is 2 marks)

7 Expand and simplify $(7 - \sqrt{2})(\sqrt{2} + 10)$

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

$$\underline{68 - 3\sqrt{2}}$$

(Total for Question 7 is 2 marks)

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

$$\begin{aligned}
 &(\sqrt{11} + 1)(\sqrt{11} + 1) \\
 &= 11 + \sqrt{11} + \sqrt{11} + 1
 \end{aligned}$$

$$\underline{12 + 2\sqrt{11}}$$

(Total for Question 8 is 2 marks)



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

$$\begin{aligned}
 &6\sqrt{36} - 15\sqrt{6} + 8\sqrt{6} - 20 \\
 &= 6 \times 6 - 7\sqrt{6} - 20 \\
 &= 36 - 7\sqrt{6} - 20
 \end{aligned}$$

$$16 - 7\sqrt{6}$$

(Total for Question 9 is 3 marks)

10 Expand and simplify $(\sqrt{6} + \sqrt{2})(\sqrt{6} - \sqrt{2})$

$$\begin{aligned}
 &6 - \sqrt{12} + \sqrt{12} - 2 \\
 &= 6 - 2
 \end{aligned}$$

$$4$$

(Total for Question 10 is 2 marks)

11 $(\sqrt{5} + \sqrt{2})(\sqrt{10} - 2) = k\sqrt{2}$ where k is an integer.
Work out the value of k .

$$\begin{aligned}
 &\sqrt{50} - 2\sqrt{5} + \sqrt{20} - 2\sqrt{2} \\
 &= \sqrt{25} \times \sqrt{2} - 2\sqrt{5} + \sqrt{4} \times \sqrt{5} - 2\sqrt{2} \\
 &= 5\sqrt{2} - \cancel{2\sqrt{5}} + \cancel{2\sqrt{5}} - 2\sqrt{2} \\
 &= 3\sqrt{2}
 \end{aligned}$$

$$k = 3$$

(Total for Question 11 is 3 marks)

12 $(2\sqrt{3} + 5)(3\sqrt{3} + 5) = a + b\sqrt{3}$ where a and b are integers.
Work out the values of a and b .

$$\begin{aligned}
 &6\sqrt{9} + 10\sqrt{3} + 15\sqrt{3} + 25 \\
 &= 18 + 25\sqrt{3} + 25 \\
 &= 43 + 25\sqrt{3}
 \end{aligned}$$

$$a = 43$$

$$b = 25$$

(Total for Question 12 is 3 marks)



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 .

$$\begin{aligned}
 & \sqrt{16} + 5\sqrt{2} + 15 - 5\sqrt{18} \\
 = & 4 + 5\sqrt{2} + 15 - 5 \times \sqrt{9} \times \sqrt{2} \\
 = & 4 + 5\sqrt{2} + 15 - 5 \times 3 \times \sqrt{2} \\
 = & 4 + 5\sqrt{2} + 15 - 15\sqrt{2} \\
 = & 19 - 10\sqrt{2}
 \end{aligned}$$

$$\begin{aligned}
 x &= \underline{\hspace{2cm} 19 \hspace{2cm}} \\
 y &= \underline{\hspace{2cm} 10 \hspace{2cm}}
 \end{aligned}$$

(Total for Question 13 is 4 marks)

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 .

$$\begin{aligned}
 & 3\sqrt{75} + 3\sqrt{25} + \sqrt{48} + \sqrt{144} \\
 = & 3 \times \sqrt{25} \times \sqrt{3} + 3 \times 5 + \sqrt{16} \times \sqrt{3} + 12 \\
 = & 15\sqrt{3} + 15 + 4\sqrt{3} + 12 \\
 = & 27 + 19\sqrt{3}
 \end{aligned}$$

$$\begin{aligned}
 p &= \underline{\hspace{2cm} 27 \hspace{2cm}} \\
 q &= \underline{\hspace{2cm} 19 \hspace{2cm}}
 \end{aligned}$$

(Total for Question 14 is 4 marks)

15 Expand and simplify $(\sqrt{3} + 4)^3$

$$\begin{aligned}
 & (\sqrt{3} + 4)(\sqrt{3} + 4)(\sqrt{3} + 4) \\
 = & (3 + 4\sqrt{3} + 4\sqrt{3} + 16)(\sqrt{3} + 4) \\
 = & (19 + 8\sqrt{3})(\sqrt{3} + 4) \\
 = & 19\sqrt{3} + 76 + 24 + 32\sqrt{3} \\
 = & 100 + 51\sqrt{3}
 \end{aligned}$$

$$\underline{\hspace{2cm} 100 + 51\sqrt{3} \hspace{2cm}}$$

(Total for Question 15 is 4 marks)



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

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

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

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

$$\begin{aligned}
 & (7 + 4\sqrt{3}) + (37 - 20\sqrt{3}) - (67 - 16\sqrt{3}) \\
 &= 7 + 4\sqrt{3} + 37 - 20\sqrt{3} - 67 + 16\sqrt{3} \\
 &= -23 \text{ (integer)}
 \end{aligned}$$

(Total for Question 16 is 5 marks)

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

Work out the value of a

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

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

$$= 8 + \sqrt{5}$$

$a = \dots\dots\dots 8$

(Total for Question 17 is 6 marks)

