



Calculating with Surds



REVISE THIS TOPIC



For the entire booklet

1 Express $\sqrt{12}$ in its simplest form.

$$\sqrt{12} = \sqrt{4} \times \sqrt{3}$$

$$2\sqrt{3}$$

(Total for Question 1 is 1 mark)

2 Express $\sqrt{50}$ in its simplest form.

$$\sqrt{50} = \sqrt{25} \times \sqrt{2}$$

$$5\sqrt{2}$$

(Total for Question 2 is 1 mark)

3 Express $\sqrt{500}$ in its simplest form.

$$\sqrt{500} = \sqrt{100} \times \sqrt{5}$$

$$10\sqrt{5}$$

(Total for Question 3 is 1 mark)

4 Express $\sqrt{27}$ in its simplest form.

$$\sqrt{27} = \sqrt{9} \times \sqrt{3}$$

$$3\sqrt{3}$$

(Total for Question 4 is 1 mark)

5 Express $\sqrt{98}$ in its simplest form.

$$\sqrt{98} = \sqrt{49} \times \sqrt{2}$$

$$7\sqrt{2}$$

(Total for Question 5 is 1 mark)

6 Express $\sqrt{48}$ in its simplest form.

$$\sqrt{48} = \sqrt{16} \times \sqrt{3}$$

$$4\sqrt{3}$$

(Total for Question 6 is 1 mark)



7 Express $5\sqrt{8}$ in its simplest form.

$$5 \times \sqrt{4} \times \sqrt{2}$$

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

$$10\sqrt{2}$$

(Total for Question 7 is 1 mark)

8 Express $4\sqrt{18}$ in its simplest form.

$$4 \times \sqrt{9} \times \sqrt{2}$$

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

$$12\sqrt{2}$$

(Total for Question 8 is 1 mark)

9 Express $2\sqrt{200}$ in its simplest form.

$$2 \times \sqrt{100} \times \sqrt{2}$$

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

$$20\sqrt{2}$$

(Total for Question 9 is 1 mark)

10 Express $9\sqrt{20}$ in its simplest form.

$$9 \times \sqrt{4} \times \sqrt{5}$$

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

$$18\sqrt{5}$$

(Total for Question 10 is 1 mark)

11 Express $7\sqrt{640}$ in its simplest form.

$$7 \times \sqrt{64} \times \sqrt{10}$$

$$= 7 \times 8 \times \sqrt{10}$$

$$56\sqrt{10}$$

(Total for Question 11 is 1 mark)

12 Express $5\sqrt{80}$ in its simplest form.

$$5 \times \sqrt{16} \times \sqrt{5}$$

$$= 5 \times 4 \times \sqrt{5}$$

$$20\sqrt{5}$$

(Total for Question 12 is 1 mark)

13 Express $3\sqrt{72}$ in its simplest form.

$$3 \times \sqrt{36} \times \sqrt{2}$$

$$= 3 \times 6 \times \sqrt{2}$$

$$18\sqrt{2}$$

(Total for Question 13 is 1 mark)



14 Work out $\sqrt{6} \times \sqrt{3}$ giving your answer in its simplest form.

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

$$3\sqrt{2}$$

(Total for Question 14 is 2 marks)

15 Work out $\sqrt{10} \times \sqrt{6}$ giving your answer in its simplest form.

$$\begin{aligned}\sqrt{60} &= \sqrt{4} \times \sqrt{15} \\ &= 2 \times \sqrt{15}\end{aligned}$$

$$2\sqrt{15}$$

(Total for Question 15 is 2 marks)

16 Work out $2\sqrt{5} \times 5\sqrt{8}$ giving your answer in its simplest form.

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

$$20\sqrt{10}$$

(Total for Question 16 is 2 marks)

17 Work out $4\sqrt{2} \times 2\sqrt{12}$ giving your answer in its simplest form.

$$\begin{aligned}8\sqrt{24} &= 8 \times \sqrt{4} \times \sqrt{6} \\ &= 8 \times 2 \times \sqrt{6}\end{aligned}$$

$$16\sqrt{6}$$

(Total for Question 17 is 2 marks)

18 Work out $2\sqrt{20} \times 3\sqrt{5}$ giving your answer as an integer.

$$6\sqrt{100} = 6 \times 10$$

$$60$$

(Total for Question 18 is 2 marks)



19 Work out $(\sqrt{6})^2$ giving your answer as an integer.

$$\sqrt{6} \times \sqrt{6} = \sqrt{36}$$

.....
6

(Total for Question 19 is 2 marks)

20 Work out $(\sqrt{5})^4$ giving your answer as an integer.

$$\begin{aligned} &\sqrt{5} \times \sqrt{5} \times \sqrt{5} \times \sqrt{5} \\ = &5 \quad \times \quad 5 \end{aligned}$$

.....
25

(Total for Question 20 is 2 marks)

21 Work out $(2\sqrt{3})^3$ giving your answer in its simplest form.

$$\begin{aligned} 2\sqrt{3} \times 2\sqrt{3} \times 2\sqrt{3} &= 8\sqrt{27} \\ &= 8 \times \sqrt{9} \times \sqrt{3} \\ &= 8 \times 3 \times \sqrt{3} \end{aligned}$$

.....
 $24\sqrt{3}$

(Total for Question 21 is 2 marks)

22 Work out $(\sqrt{2} \times \sqrt{3} \times \sqrt{5})^2$ giving your answer as an integer.

$$(\sqrt{30})^2 = \sqrt{30} \times \sqrt{30}$$

.....
30

(Total for Question 22 is 2 marks)

23 Express $(\sqrt{3})^7$ in the form $a\sqrt{3}$, where a is an integer.

$$\begin{aligned} &\sqrt{3} \times \sqrt{3} \times \sqrt{3} \times \sqrt{3} \times \sqrt{3} \times \sqrt{3} \times \sqrt{3} \\ = &3 \quad \times \quad 3 \quad \times \quad 3 \quad \times \quad \sqrt{3} \end{aligned}$$

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

(Total for Question 23 is 2 marks)



24 Work out $\sqrt{60} \div \sqrt{3}$ giving your answer in its simplest form.

$$\begin{aligned}\sqrt{20} &= \sqrt{4} \times \sqrt{5} \\ &= 2 \times \sqrt{5}\end{aligned}$$

$$2\sqrt{5}$$

(Total for Question 24 is 2 marks)

25 Work out $8\sqrt{30} \div 4\sqrt{6}$ giving your answer in its simplest form.

$$2\sqrt{5}$$

(Total for Question 25 is 1 mark)

26 Simplify fully $\frac{18\sqrt{150}}{9\sqrt{3}}$

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

$$10\sqrt{2}$$

(Total for Question 26 is 2 marks)

27 Simplify fully $\frac{40\sqrt{40}}{5\sqrt{10}}$

$$8\sqrt{4} = 8 \times 2$$

$$16$$

(Total for Question 27 is 2 marks)

28 Simplify fully $\left(\frac{\sqrt{2}}{\sqrt{5}}\right)^2$

$$\left(\sqrt{\frac{2}{5}}\right)^2 = \sqrt{\frac{2}{5}} \times \sqrt{\frac{2}{5}}$$

$$\frac{2}{5}$$

(Total for Question 28 is 2 marks)



29 Simplify $\sqrt{11} + \sqrt{11} + \sqrt{11}$

$$3\sqrt{11}$$

(Total for Question 29 is 1 mark)

30 Simplify $3\sqrt{5} + 6\sqrt{5}$

$$9\sqrt{5}$$

(Total for Question 30 is 1 mark)

31 Simplify $9\sqrt{7} + 3\sqrt{7} - \sqrt{7}$

$$9\sqrt{7}$$

(Total for Question 31 is 1 mark)

32 Work out $(\sqrt{2} + 6\sqrt{2} - 2\sqrt{2})^2$ giving your answer as an integer.

$$\begin{aligned}
 (5\sqrt{2})^2 &= 5\sqrt{2} \times 5\sqrt{2} \\
 &= 25\sqrt{4}
 \end{aligned}$$

$$50$$

(Total for Question 32 is 2 marks)

33 Simplify $\underline{4\sqrt{3}} + \underline{6\sqrt{2}} - \underline{\sqrt{3}} + \underline{8\sqrt{2}}$

$$3\sqrt{3} + 14\sqrt{2}$$

$$3\sqrt{3} + 14\sqrt{2}$$

(Total for Question 33 is 2 marks)



34 Express $\sqrt{18} + \sqrt{2}$ in the form $a\sqrt{2}$, where a is an integer.

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

$$4\sqrt{2}$$

(Total for Question 34 is 2 marks)

35 Express $2\sqrt{3} + \sqrt{75}$ in the form $a\sqrt{3}$, where a is an integer.

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

$$7\sqrt{3}$$

(Total for Question 35 is 2 marks)

36 Express $\sqrt{32} + \sqrt{8}$ in the form $a\sqrt{2}$, where a is an integer.

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

$$6\sqrt{2}$$

(Total for Question 36 is 3 marks)

37 Express $3\sqrt{500} - \sqrt{20}$ in the form $a\sqrt{5}$, where a is an integer.

$$\begin{aligned} & 3 \times \sqrt{100} \times \sqrt{5} - \sqrt{4} \times \sqrt{5} \\ &= 30\sqrt{5} - 2\sqrt{5} \end{aligned}$$

$$28\sqrt{5}$$

(Total for Question 37 is 3 marks)

38 Express $\sqrt{28} + \sqrt{175} - 3\sqrt{7}$ in the form $a\sqrt{7}$, where a is an integer.

$$\begin{aligned} & \sqrt{4} \times \sqrt{7} + \sqrt{25} \times \sqrt{7} - 3\sqrt{7} \\ &= 2\sqrt{7} + 5\sqrt{7} - 3\sqrt{7} \end{aligned}$$

$$4\sqrt{7}$$

(Total for Question 38 is 3 marks)



39 Ross is doing a surds question.

Ross writes:

$$\begin{aligned}
 \sqrt{300} + \sqrt{12} &= \sqrt{312} \\
 &= \sqrt{4} \times \sqrt{78} \\
 &= 2 \times \sqrt{78} \\
 &= 2\sqrt{78}
 \end{aligned}$$

$$\begin{aligned}
 &\sqrt{300} + \sqrt{12} \\
 &= \sqrt{100} \times \sqrt{3} + \sqrt{4} \times \sqrt{3} \\
 &= 10\sqrt{3} + 2\sqrt{3} \\
 &= 12\sqrt{3}
 \end{aligned}$$

Explain the mistake that Ross has made

You cannot add $\sqrt{300}$ and $\sqrt{12}$ as they do not have the same number inside the roots.
 Ross should simplify them first.

(Total for Question 39 is 1 mark)

40 Work out $\frac{\sqrt{30} \times 5\sqrt{6}}{\sqrt{125} - \sqrt{20}}$ giving your answer as an integer.

$$\begin{aligned}
 \frac{5\sqrt{180}}{\sqrt{25} \times \sqrt{5} - \sqrt{4} \times \sqrt{5}} &= \frac{5 \times \sqrt{36} \times \sqrt{5}}{5\sqrt{5} - 2\sqrt{5}} \\
 &= \frac{5 \times 6 \times \sqrt{5}}{3\sqrt{5}} \\
 &= \frac{30\cancel{\sqrt{5}}}{3\cancel{\sqrt{5}}}
 \end{aligned}$$

10

(Total for Question 40 is 4 marks)

