Calculating with Surds

1 Express $\sqrt{12}$ in its simplest form. **[1 mark]**

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

Answer _____ $2\sqrt{3}$ _____

2 Express $\sqrt{50}$ in its simplest form. **[1 mark]**

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

Answer _____ $5\sqrt{2}$ _____

3 Express $\sqrt{500}$ in its simplest form. **[1 mark]**

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

Answer _____ $10\sqrt{5}$ _____

4 Express $\sqrt{27}$ in its simplest form. **[1 mark]**

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

Answer _____ $3\sqrt{3}$ _____

5 Express $\sqrt{98}$ in its simplest form. **[1 mark]**

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

Answer _____ $7\sqrt{2}$ _____

6 Express $\sqrt{48}$ in its simplest form. **[1 mark]**

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

Answer _____ $4\sqrt{3}$ _____

For the entire booklet

$\frac{}{6}$

7 Express $5\sqrt{8}$ in its simplest form. **[1 mark]**

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

Answer _____ $10\sqrt{2}$ _____

8 Express $4\sqrt{18}$ in its simplest form. **[1 mark]**

$$4 \times \sqrt{9} \times \sqrt{2}$$
$$= 4 \times 3 \times \sqrt{2}$$

Answer _____ $12\sqrt{2}$ _____

9 Express $2\sqrt{200}$ in its simplest form. **[1 mark]**

$$2 \times \sqrt{100} \times \sqrt{2}$$
$$= 2 \times 10 \times \sqrt{2}$$

Answer _____ $20\sqrt{2}$ _____

10 Express $9\sqrt{20}$ in its simplest form. **[1 mark]**

$$9 \times \sqrt{4} \times \sqrt{5}$$
$$= 9 \times 2 \times \sqrt{5}$$

Answer _____ $18\sqrt{5}$ _____

11 Express $7\sqrt{640}$ in its simplest form. **[1 mark]**

$$7 \times \sqrt{64} \times \sqrt{10}$$
$$= 7 \times 8 \times \sqrt{10}$$

Answer _____ $56\sqrt{10}$ _____

12 Express $5\sqrt{80}$ in its simplest form. **[1 mark]**

$$5 \times \sqrt{16} \times \sqrt{5}$$
$$= 5 \times 4 \times \sqrt{5}$$

Answer _____ $20\sqrt{5}$ _____

13 Express $3\sqrt{72}$ in its simplest form. **[1 mark]**

$$3 \times \sqrt{36} \times \sqrt{2}$$
$$= 3 \times 6 \times \sqrt{2}$$

Answer _____ $18\sqrt{2}$ _____

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14 Work out $\sqrt{6} \times \sqrt{3}$ giving your answer in its simplest form. **[2 marks]**

$$\sqrt{18} = \sqrt{9} \times \sqrt{2}$$
$$= 3 \times \sqrt{2}$$

Answer ___$3\sqrt{2}$___

15 Work out $\sqrt{10} \times \sqrt{6}$ giving your answer in its simplest form. **[2 marks]**

$$\sqrt{60} = \sqrt{4} \times \sqrt{15}$$
$$= 2 \times \sqrt{15}$$

Answer ___$2\sqrt{15}$___

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

$$10\sqrt{40} = 10 \times \sqrt{4} \times \sqrt{10}$$
$$= 10 \times 2 \times \sqrt{10}$$

Answer ___$20\sqrt{10}$___

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

$$8\sqrt{24} = 8 \times \sqrt{4} \times \sqrt{6}$$
$$= 8 \times 2 \times \sqrt{6}$$

Answer ___$16\sqrt{6}$___

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

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

Answer ___60___

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19 Work out $\left(\sqrt{6}\right)^2$ giving your answer as an integer. **[2 marks]**

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

Answer _____ 6 _____

20 Work out $\left(\sqrt{5}\right)^4$ giving your answer as an integer. **[2 marks]**

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

Answer _____ 25 _____

21 Work out $\left(2\sqrt{3}\right)^3$ giving your answer in its simplest form. **[2 marks]**

$$2\sqrt{3} \times 2\sqrt{3} \times 2\sqrt{3} = 8\sqrt{27}$$
$$= 8 \times \sqrt{9} \times \sqrt{3}$$
$$= 8 \times 3 \times \sqrt{3}$$

Answer _____ $24\sqrt{3}$ _____

22 Work out $\left(\sqrt{2} \times \sqrt{3} \times \sqrt{5}\right)^2$ giving your answer as an integer. **[2 marks]**

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

Answer _____ 30 _____

23 Express $\left(\sqrt{3}\right)^7$ in the form $a\sqrt{3}$, where a is an integer. **[2 marks]**

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

Answer _____ $27\sqrt{3}$ _____

24 Work out $\sqrt{60} \div \sqrt{3}$ giving your answer in its simplest form. **[2 marks]**

$$\sqrt{20} = \sqrt{4} \times \sqrt{5}$$
$$= 2 \times \sqrt{5}$$

Answer _____ $2\sqrt{5}$ _____

25 Work out $8\sqrt{30} \div 4\sqrt{6}$ giving your answer in its simplest form. **[1 mark]**

Answer _____

26 Simplify fully $\dfrac{18\sqrt{150}}{9\sqrt{3}}$ **[2 marks]**

$$2\sqrt{50} = 2 \times \sqrt{25} \times \sqrt{2}$$
$$= 2 \times 5 \times \sqrt{2}$$

Answer _____ $10\sqrt{2}$ _____

27 Simplify fully $\dfrac{40\sqrt{40}}{5\sqrt{10}}$ **[2 marks]**

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

Answer _____ 16 _____

28 Simplify fully $\left(\dfrac{\sqrt{2}}{\sqrt{5}}\right)^2$ **[2 marks]**

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

Answer _____ $\dfrac{2}{5}$ _____

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29   Simplify $\sqrt{11} + \sqrt{11} + \sqrt{11}$ **[1 mark]**

Answer $3\sqrt{11}$

30   Simplify $3\sqrt{5} + 6\sqrt{5}$ **[1 mark]**

Answer $9\sqrt{5}$

31   Simplify $9\sqrt{7} + 3\sqrt{7} - \sqrt{7}$ **[1 mark]**

Answer $9\sqrt{7}$

32   Work out $\left(\sqrt{2} + 6\sqrt{2} - 2\sqrt{2}\right)^2$ giving your answer as an integer.   **[2 marks]**

$$\left(5\sqrt{2}\right)^2 = 5\sqrt{2} \times 5\sqrt{2}$$
$$= 25\sqrt{4}$$

Answer 50

33   Simplify $4\sqrt{3} + 6\sqrt{2} - \sqrt{3} + 8\sqrt{2}$ **[2 marks]**

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

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

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

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

Answer $4\sqrt{2}$

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

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

Answer $7\sqrt{3}$

36 Express $\sqrt{32} + \sqrt{8}$ in the form $a\sqrt{2}$, where a is an integer. **[3 marks]**

$$\sqrt{16} \times \sqrt{2} + \sqrt{4} \times \sqrt{2}$$
$$= 4\sqrt{2} + 2\sqrt{2}$$

Answer $6\sqrt{2}$

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

$$3 \times \sqrt{100} \times \sqrt{5} - \sqrt{4} \times \sqrt{5}$$
$$= 30\sqrt{5} - 2\sqrt{5}$$

Answer $28\sqrt{5}$

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

$$\sqrt{4} \times \sqrt{7} + \sqrt{25} \times \sqrt{7} - 3\sqrt{7}$$
$$= 2\sqrt{7} + 5\sqrt{7} - 3\sqrt{7}$$

Answer $4\sqrt{7}$

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39 Ross is doing a surds question.
Ross writes:

$\sqrt{300} + \sqrt{12} = \sqrt{312}$
    $= \sqrt{4} \times \sqrt{78}$
    $= 2 \times \sqrt{78}$
    $= 2\sqrt{78}$

$\sqrt{300} + \sqrt{12}$
$= \sqrt{100} \times \sqrt{3} + \sqrt{4} \times \sqrt{3}$
$= 10\sqrt{3} + 2\sqrt{3}$
$= 12\sqrt{3}$

Explain the mistake that Ross has made   **[1 mark]**

You cannot add √300 and √12 as they do not have the same number inside the root. Ross should simplify them first.

40 Work out $\dfrac{\sqrt{30} \times 5\sqrt{6}}{\sqrt{125} - \sqrt{20}}$ giving your answer as an integer.   **[4 marks]**

$$\frac{5\sqrt{180}}{\sqrt{25} \times \sqrt{5} - \sqrt{4} \times \sqrt{5}} = \frac{5 \times \sqrt{36} \times \sqrt{5}}{5\sqrt{5} - 2\sqrt{5}}$$

$$= \frac{5 \times 6 \times \sqrt{5}}{3\sqrt{5}}$$

$$= \frac{30\sqrt{5}}{3\sqrt{5}}$$

Answer   10

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