

This worksheet is designed to give you extra practice on the laws of indices and using the laws of surds.

**1** Simplify each of the following expressions

- |                                       |                                    |                            |  |
|---------------------------------------|------------------------------------|----------------------------|--|
| (a) $m^2 \times m^{-3}$               | (b) $p^5 \times p^{-8} \times p^4$ | (c) $q \div pq^2 \times p$ | (d) $(xy)^2 \times x^{-2} \times y^{-2}$ |
| (e) $5e^4 f^{-3} \div 10e^{-3} f^3$   | (f) $xy(x^3y + 4x) - x^2y$         | (g) $\sqrt{y} \times y^2$  | (h) $(4w^{-3})^{-1} \times \sqrt{w^2}$   |
| (i) $\sqrt{a^{-3}b^{-2} \div a^{-1}}$ | (j) $(4ab)^2 \times (2a^2b)^{-1}$  | (k) $(a^2b - a^2b^{-1})^2$ | (l) $(x - x^{-1})^3$                     |

**2** Which of the following expressions are true? If it is true, explain why, and if it is false, explain the error that has been made.

(a)  $(2xy^2)^2 = 2x^2y^4$

(b)  $64^{-\frac{3}{2}} = \frac{1}{512}$

(c)  $\sqrt{125} = 5\sqrt{5}$

**3** Simplify the following expressions

- |                                   |   |                                      |                        |
|-----------------------------------|---|--------------------------------------|------------------------|
| (a) $\sqrt{8}$                    | (b) $\sqrt{27}$                         | (c) $\sqrt{48}$                      | (d) $\sqrt{60}$        |
| (e) $\sqrt{600}$                  | (f) $4\sqrt{6} + 10\sqrt{6} - \sqrt{2}$ | (g) $\sqrt{2}(\sqrt{8} - 4\sqrt{2})$ | (h) $(1 - \sqrt{3})^2$ |
| (i) $8^{\frac{1}{2}} + 3\sqrt{8}$ | (j) $(2 + \sqrt{5})(2 - \sqrt{5})$      | (k) $3\sqrt{48} - 2\sqrt{12}$        | (l) $(1 + \sqrt{2})^3$ |

**4** Simplify  $(4y^3)^{-\frac{1}{2}}$ , giving your answer in the form  $ay^p$ , where  $a$  and  $p$  are constants to be found.

**5** (a) Without using a calculator, find the value of  $\left(\frac{64}{27}\right)^{\frac{2}{3}}$ .

(b) Find the value of  $\left(\frac{64}{27}\right)^{-\frac{2}{3}}$ .

**6** (a) Express  $\frac{\sqrt{3^2} \times 3^{-\frac{1}{3}}}{\sqrt[3]{3^{-3}}}$  in the form  $3^p$ , where  $p$  is a rational number to be found.

(b) Hence, explain why

$$3 < \frac{\sqrt{3^2} \times 3^{-\frac{1}{3}}}{\sqrt[3]{3^{-3}}} < 9$$

**7** (a) Simplify  $\sqrt{56}$ .

(b) Express  $\sqrt{126}$  in the form  $a\sqrt{14}$ , where  $a$  is a constant to be found.

(c) Hence, show that

$$(5\sqrt{126} - 2\sqrt{56})^2 = 14$$

**END OF WORKSHEET**