

Indices and Surds

Exercise 2S Skills Practice

DO NOT USE A CALCULATOR FOR THIS EXERCISE

1 Evaluate

a $\sqrt{121}$ b $\sqrt[3]{64}$ c $\sqrt{400}$ d $\sqrt{\frac{1}{4}}$ e $\sqrt{\frac{4}{49}}$ f $\sqrt[4]{81}$
 g $\sqrt[3]{\frac{1}{1000}}$ h $\sqrt{1\frac{7}{9}}$ i $\sqrt{2\frac{1}{4}}$ j $\sqrt[3]{\frac{27}{64}}$ k $\sqrt{13\frac{4}{9}}$ l $\sqrt[3]{15\frac{3}{8}}$

2 Simplify

a $x^2 \times x^5$ b $3xy \times 2x^4$ c $a^{\frac{1}{2}} \times a^{\frac{5}{4}}$
 d $(x^4)^2$ e $(b^{-2})^3$ f $m^7 \div m$
 g $5a^6b \times 9a^2b$ h $(8x^3y) \div (2y^5)$ i $y^{\frac{4}{3}} \div y^{\frac{1}{6}}$
 j $x \times x^{\frac{3}{2}} \times x^{\frac{1}{3}}$ k $(5a^2b)^4$ l $3x^4 \times 8x^{\frac{3}{2}}$
 m $(21p^{\frac{5}{2}}) \div (3p)$ n $5x^2 \times \sqrt{x}$ o $2x^4 \times 5x \times 3x^{-8}$
 p $(8y^5 \times x^2y) \div (16y^3)$ q $(12x^{\frac{3}{2}}) \div (16x^4)$ r $(3ab^2)^3 \times (2a^3b)^2$

3 Evaluate

a 4^3 b $36^{\frac{1}{2}}$ c $27^{\frac{1}{3}}$ d $9^{\frac{3}{2}}$ e 5^0 f $8^{\frac{2}{3}}$
 g $4^{-\frac{1}{2}}$ h $(\frac{9}{16})^{\frac{1}{2}}$ i $64^{-\frac{1}{3}}$ j $9^{-\frac{5}{2}}$ k $(\frac{1}{8})^{\frac{1}{3}}$ l $(\frac{25}{81})^{\frac{1}{2}}$
 m $27^{\frac{4}{3}}$ n $(\frac{4}{9})^{\frac{3}{2}}$ o $(\frac{8}{27})^{-\frac{1}{3}}$ p $(\frac{1}{64})^{\frac{2}{3}}$ q $(1\frac{9}{16})^{\frac{1}{2}}$ r $(\frac{16}{81})^{-\frac{1}{4}}$
 s $32^{\frac{3}{5}}$ t $16^{0.75}$ u $(-8)^{\frac{1}{3}}$ v $(12\frac{1}{4})^{-\frac{1}{2}}$ w $(2\frac{1}{4})^{\frac{3}{2}}$ x $(-\frac{1}{27})^{-\frac{1}{3}}$

4 Express each of the following in index notation.

a \sqrt{x} b $\sqrt[3]{5}$ c $\sqrt[5]{x}$ d $(\sqrt{10})^3$ e $\sqrt{7^3}$ f $(\sqrt{y})^3$
 g $\sqrt{a^5}$ h $\frac{1}{2^3}$ i $\frac{1}{y^4}$ j $\sqrt[3]{b^2}$ k $\sqrt[5]{b^3}$ l $\frac{3}{\sqrt{x}}$

5 Express each of the following in the form 2^y , where y is a function of x .

a 4^x b 2×2^x c 8^{2x} d 4^{3x-1} e $8 \times 2^{x-1}$ f $8^{\frac{2}{3}x}$

6 Simplify

a $\sqrt{12}$ b $\sqrt{18}$ c $\sqrt{50}$
 d $\sqrt{20}$ e $\sqrt{162}$ f $\sqrt{98}$
 g $\sqrt{108}$ h $\sqrt{1000}$ i $\sqrt{363}$
 j $\sqrt{27} + \sqrt{12}$ k $\sqrt{125} - \sqrt{80}$ l $\sqrt{75} + \sqrt{147}$
 m $5\sqrt{18} + \sqrt{8}$ n $4\sqrt{28} - \sqrt{63}$ o $\sqrt{32} + 3\sqrt{50} - \sqrt{18}$

7 Rationalise each denominator and simplify

a $\frac{2}{\sqrt{2}}$

b $\frac{1}{\sqrt{3}}$

c $\frac{3}{2\sqrt{2}}$

d $\frac{5}{\sqrt{45}}$

e $\frac{2\sqrt{7}}{\sqrt{21}}$

f $\frac{6\sqrt{8}}{5\sqrt{98}}$

8 Solve each equation.

a $3^{2x-1} = 9$

b $16^{3x} = 4^{x+2}$

c $6^{x+3} = 36^x$

d $8^{x-1} = 4^x$

e $64^{3x} = 16^{x-2}$

f $27^{\frac{x}{2}} = 9^{2x+3}$

9 Express each of the following as simply as possible with a rational denominator.

a $\frac{1}{2-\sqrt{3}}$

b $\frac{3}{\sqrt{2}+1}$

c $\frac{5}{\sqrt{6}+1}$

d $\frac{1}{3-\sqrt{5}}$

e $\frac{\sqrt{2}}{1+\sqrt{2}}$

f $\frac{1}{3-2\sqrt{2}}$

g $\frac{4}{3+3\sqrt{5}}$

h $\frac{\sqrt{3}}{5+2\sqrt{3}}$

i $\frac{3\sqrt{7}}{4-\sqrt{7}}$

j $\frac{1+\sqrt{3}}{\sqrt{3}-1}$

k $\frac{2\sqrt{2}}{3\sqrt{2}+4}$

l $\frac{\sqrt{27}+2}{3-\sqrt{3}}$

m $\frac{6+\sqrt{5}}{\sqrt{5}-1}$

n $\frac{1-2\sqrt{3}}{3\sqrt{3}+4}$

o $\frac{3\sqrt{8}+1}{7-5\sqrt{2}}$

ANSWERS

Exercise 2S Skills Practice

1 a 11 b 4 c 20 d $1\frac{1}{2}$ e $2\frac{2}{7}$ f 3
g $1\frac{1}{10}$ h $4\frac{1}{3}$ i $3\frac{1}{2}$ j $3\frac{1}{4}$ k $11\frac{1}{3}$ l $5\frac{1}{2}$

2 a x^7 b $6x^5y$ c $a^{7/4}$ d x^8
e b^{-6} f m^6 g $45a^8b^2$ h $4x^3y^{-4}$
i $y^{7/6}$ j $x^{27/10}$ k $625a^8b^4$ l $24x^{11/2}$
m $7p^{3/2}$ n $5x^{3/2}$ o $30x^{-3}$ p $1\frac{1}{2}x^2y^3$
q $3\frac{1}{4}x^{-5/2}$ r $108a^9b^8$

3 a 64 b 6 c 3 d 27 e 1 f 4
g $1\frac{1}{2}$ h $3\frac{3}{4}$ i $1\frac{1}{4}$ j $1\frac{1}{243}$ k $1\frac{1}{2}$ l $5\frac{5}{9}$
m 81 n $8\frac{8}{27}$ o $3\frac{3}{2}$ p $1\frac{1}{16}$ q $5\frac{5}{4}$ r $3\frac{3}{2}$
s 8 t 8 u -2 v $2\frac{2}{7}$ w $243\frac{243}{32}$ x -3

4 a $x^{1/2}$ b $5^{1/3}$ c $x^{1/5}$ d $10^{3/2}$ e $7^{3/2}$
f $y^{3/2}$ g $a^{5/2}$ h 2^{-3} i y^{-4} j $b^{2/3}$
k $b^{3/5}$ l $3x^{-1/2}$

5 a 2^{2x} b 2^{x+1} c 2^{6x} d 2^{6x-2} e 2^{x+2} f 2^{2x}

6 a $2\sqrt{3}$ b $3\sqrt{2}$ c $5\sqrt{2}$ d $2\sqrt{5}$ e $9\sqrt{2}$ f $7\sqrt{2}$
g $6\sqrt{3}$ h $10\sqrt{10}$ i $11\sqrt{3}$ j $5\sqrt{3}$ k $\sqrt{5}$
l $12\sqrt{3}$ m $17\sqrt{2}$ n $5\sqrt{7}$ o $16\sqrt{2}$

7 a $\sqrt{2}$ b $1\frac{1}{3}\sqrt{3}$ c $3\frac{3}{4}\sqrt{2}$
d $1\frac{1}{3}\sqrt{5}$ e $2\frac{2}{3}\sqrt{3}$ f $12\frac{12}{35}$

8 a $3\frac{3}{2}$ b $2\frac{2}{5}$ c 3 d 3 e $4\frac{4}{7}$ f $12\frac{12}{5}$

9 a $2+\sqrt{3}$ b $3\sqrt{2}-3$ c $\sqrt{6}-1$
d $1\frac{1}{4}(3+\sqrt{5})$ e $2-\sqrt{2}$ f $3+2\sqrt{2}$
g $1\frac{1}{3}(\sqrt{5}-1)$ h $1\frac{1}{13}(5\sqrt{3}-6)$ i $1\frac{1}{3}(4\sqrt{7}+7)$
j $2+\sqrt{3}$ k $6-4\sqrt{2}$ l $1\frac{1}{6}(15+11\sqrt{3})$
m $1\frac{1}{4}(11+7\sqrt{5})$ n $\sqrt{3}-2$ o $-67-47\sqrt{2}$