# "Full Coverage": Laws of Indices

This worksheet is designed to cover one question of each type seen in past papers, for each GCSE Higher Tier topic. This worksheet was automatically generated by the DrFrostMaths Homework Platform: students can practice this set of questions interactively by going to www.drfrostmaths.com/homework, logging on, *Practise → Past Papers/Worksheets* (or *Library → Past/Past Papers* for teachers), and using the 'Revision' tab.

## Question 1

**Categorisation: Calculate simple powers.**

*[Edexcel GCSE June2008-2F Q15b]*

(b) Work out the value of $2^6$

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## Question 2

**Categorisation: Understand the term 'reciprocal'.**

*[Edexcel GCSE June2007-3I Q18b, June2007-5H Q10b*]

Write down the reciprocal of 2

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## Question 3

**Categorisation: Evaluate a term when the power is 0.**

*[Edexcel GCSE June2003-5H Q16i]*

Work out $4^0$

.....

## Question 4

**Categorisation: Use the law $a^b \times a^c = a^{b+c}$**

*[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 3F Q24]*

$$p^2 \times p^n = p^6$$

Find the value of $n$ .

$n =$ .....

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## Question 5

**Categorisation: Use the law $a^b \div a^c = a^{b-c}$**

*[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 3H Q13b]*

Simplify $n^4 \div n^{\frac{1}{2}}$

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## Question 6

**Categorisation: Combine laws of indices and appreciate that $a = a^1$.**

*[Edexcel GCSE June2007-3I Q18aii, June2007-5H Q10aii*]

Write as a power of 7

$$\frac{7^2 \times 7^3}{7}$$

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## Question 7

**Categorisation: Use the law $(a^b)^c = a^{bc}$.**

*[Edexcel IGCSE May2015-3H Q9d]*

Simplify $(x^{-y})^{-z}$

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## Question 8

**Categorisation: Use the law $a^b \times a^c = a^{b+c}$ backwards, i.e. write an expression in the form $a^{b+c}$ as $a^b \times a^c$.**

*[Edexcel GCSE June2003-6H Q17ai]*

$x = 2^p$ , $y = 2^q$

Express $2^{p+q}$ in terms of $x$ and/or $y$ .

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## Question 9

**Categorisation: As above, but with the law $a^b \div a^c = a^{b-c}$**

*[Edexcel GCSE June2003-6H Q17aiii]*

$x = 2^p$ , $y = 2^q$

Express $2^{p-1}$ in terms of $x$ and/or $y$ .

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## Question 10

**Categorisation: Recognise that $a^{bc}$ could be written as either $\left(a^b\right)^c$ or $(a^c)^b$.**

*[Edexcel GCSE June2003-6H Q17aii]*

$x = 2^p$ , $y = 2^q$

Express $2^{2q}$ in terms of $x$ and/or $y$ .

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## Question 11

**Categorisation: Identify a missing power when negative indices are involved.**

*[Edexcel GCSE Nov2011-3H Q18b]*

$$2^y = \frac{1}{4}$$

Write down the value of $y$ .

$y =$ .....

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## Question 12

**Categorisation: Combine laws of indices with laws of surds, in particular recognizing that $\sqrt{a^b} = (a^b)^{\frac{1}{2}} = a^{\frac{1}{2}b}$, i.e. square rooting has the effect of halving the power.**

*[Edexcel GCSE June2003-3I Q24iii]*

Work out the value of

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

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## Question 13

**Categorisation: As above, but with other roots (e.g. cube root) and where prior simplification may be required.**

*[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 1H Q15a]*

Find the value of

$$\sqrt[4]{27 \times 3 \times 10^8}$$

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## Question 14

**Categorisation: Recognise that a square root can be written using a power of $\frac{1}{2}$, thus enabling the entire term to be written as a power, e.g. $25\sqrt{5} = 5^2 \times 5^{\frac{1}{2}} = 5^{\frac{5}{2}}$.**

*[Edexcel GCSE June2006-5H Q20b]*

$8\sqrt{8}$ can be written in the form $8^k$

Find the value of $k$ .

$k =$ .....

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## Question 15

**Categorisation: As above but a more complex mixture of terms.**

*[Edexcel IGCSE Jan2016(R)-3H Q13b]*

$$\frac{a\sqrt{a}}{\sqrt[3]{a^2}} = a^k$$

Work out the value of $k$ .

$k =$ .....

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## Question 16

**Categorisation: Use laws of indices to multiply algebraic terms.**

*[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 3H Q10]*

Simplify $3m^2r \times 4m^3r^6$

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## Question 17

**Categorisation: Use laws of indices to divide algebraic terms.**

*[Edexcel IGCSE Jan2016-3H Q4d]*

Expand and simplify

$$\frac{36k^3m^4}{30k^5m}$$

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## Question 18

**Categorisation: Raise a single term to a power.**

*[Edexcel IGCSE Jan2016(R)-3H Q13a]*

Simplify $\left(4h^{\frac{2}{3}}\right)^3$

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## Question 19

**Categorisation: Raise a single term to a fractional power.**

*[Edexcel GCSE June2010-4H Q22d]*

Simplify $(9w^2y^6)^{\frac{1}{2}}$

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## Question 20

**Categorisation: Change all terms to a consistent base where they are different, e.g. $\mathbf{9^x \times 3^2 = (3^2)^x \times 3^2 = 3^{2x} \times 3^2 = 3^{2x+2}}$.**

*[Edexcel GCSE Nov2007-5H Q16b]*

$$2^{30} \div 8^9 = 2^x$$

Work out the value of $x$ .

$x =$ .....

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## Question 21

**Categorisation: Recognise that $(a^b)^c = (a^c)^b$**

*[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 - 2H Q14]*

Given that $3^{-n} = 0.2$ , find the value of $(3^4)^n$

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## Question 22

**Categorisation: Raise a number to a fractional power with denominator 1.**

*[Edexcel GCSE June2006-5H Q20a*]

Write down the value of

$$8^{\frac{1}{3}}$$

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## Question 23

**Categorisation: Raise a number to any (positive) fraction.**

*[Edexcel GCSE June2003-5H Q16iii]*

Work out $16^{\frac{3}{2}}$

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## Question 24

**Categorisation: Raise a number to a negative integer power.**

*[Edexcel GCSE June2003-5H Q16ii]*

Work out $4^{-2}$

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## Question 25

**Categorisation: Raise a number to a negative an fractional power.**

*[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 - 1H Q10]*

Find the value of $64^{-\frac{2}{3}}$

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## Question 26

**Categorisation: Raise a fraction to a power.**

*[Edexcel GCSE June2010-3H Q24iii]*

Find the value of $\left(\frac{27}{8}\right)^{-\frac{2}{3}}$.

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## Question 27

**Categorisation: As above, but where the fraction can first be simplified.**

*[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 1H Q15b]*

Find the value of

$$\left(\frac{216}{1000}\right)^{-\frac{2}{3}}$$

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## Question 28

**Categorisation: Raise a fraction involving algebraic terms to a negative power.**

*[Edexcel GCSE Nov2014-1H Q22b]*

Simplify

$$\left(\frac{64x^6}{25y^2}\right)^{-\frac{1}{2}}$$

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## Question 29

**Categorisation: Raise a fraction involving algebraic terms to a positive power.**

*[Edexcel IGCSE Jan2016-4H Q17a]*

Simplify

$$\left(\frac{8e^6}{f^{12}}\right)^{\frac{1}{3}}$$

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## Question 30

**Categorisation: Use laws of indices in the context of simultaneous equations.**

*[Edexcel GCSE June2003-6H Q17b]*

$x = 2^p$ , $y = 2^q$

$xy = 32$
and $2xy^2 = 32$

Find the value of $p$ and the value of $q$ .

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## Question 31

**Categorisation: Order numbers each raised to a power.**

*[Edexcel GCSE June2010-4H Q22e]*

For $x > 1$ , write the following expressions in order of size:

$$x^0 \quad x^2 \quad x \quad x^{-2} \quad x^{\frac{1}{2}}$$

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## Question 32

**Categorisation: Use laws of indices in the context of standard form.**

*[Edexcel IGCSE Jan2016-4H Q25]*

$y = 16 \times 10^{8k}$ where $k$ is an integer.
Find an expression, in terms of $k$ , for $y^{\frac{5}{4}}$ Give your answer in standard form.

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# Answers

## Question 1

64

## Question 2

$\frac{1}{2}$

## Question 3

1

## Question 4

$n =$ 4

## Question 5

$n^{\frac{7}{2}}$

## Question 6

$7^4$

## Question 7

$x^{yz}$

## Question 8

$xy$

## Question 9

$\frac{x}{2}$

## Question 10

$y^2$

## Question 11

$y =$ -2

## Question 12

12

## Question 13

300

## Question 14

$k = 1.5$

## Question 15

$k = \frac{5}{6}$

## Question 16

$12m^5r^7$

## Question 17

$\frac{6m^3}{5k^2}$

## Question 18

$64h^2$

## Question 19

$3wy^3$

## Question 20

$x =$ 3

## Question 21

625

## Question 22

2

## Question 23

64

## Question 24

$\frac{1}{16}$

## Question 25

$\frac{1}{16}$

## Question 26

$\frac{4}{9}$

## Question 27

$\frac{25}{9}$

## Question 28

$\frac{5y}{8x^3}$

## Question 29

$\frac{2e^2}{f^4}$

## Question 30

$p = 6$ , $q = -1$

## Question 31

$x^{-2}$ , $x^0$ , $x^{\frac{1}{2}}$ , $x$ , $x^2$

## Question 32

$$3.2 \times 10^{10k+1}$$