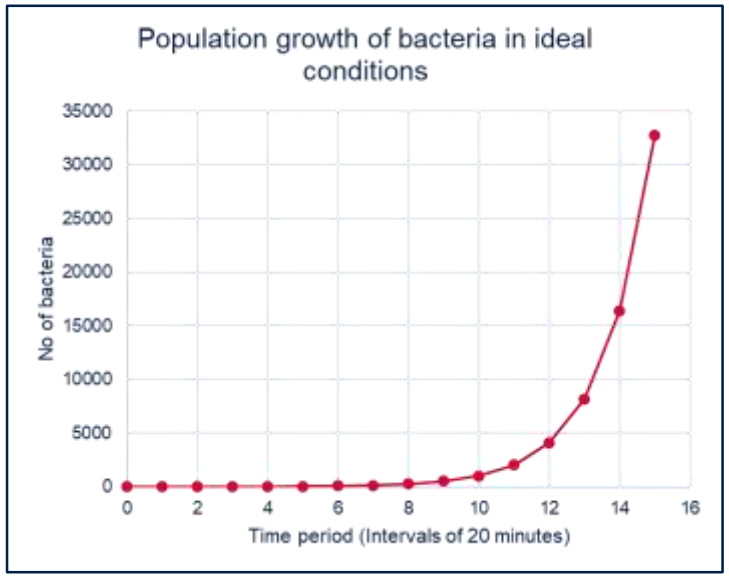
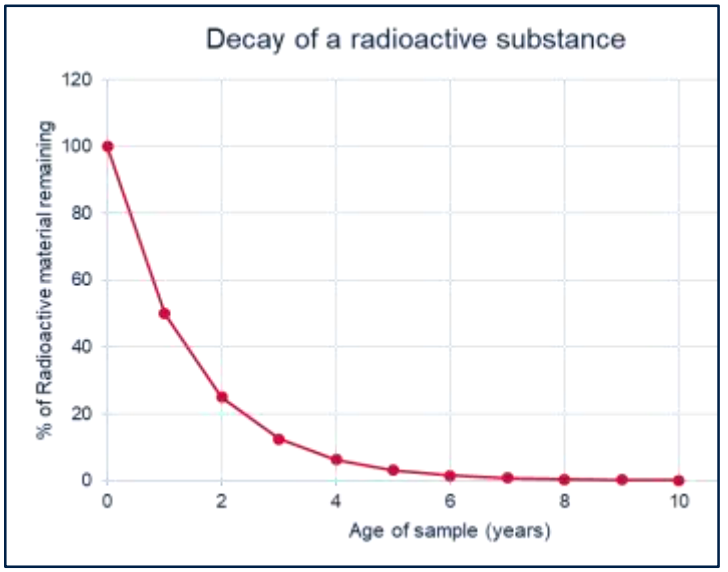
Advanced Mathematics Support Programme®

Did you know?

Indices are also referred to as Exponents





e.g. $2^3 = 8$

3 is the 'exponent'

$2^3 = 2 \times 2 \times 2$

It tells us how many times a number is multiplied by itself

This is where exponential graphs come from!

Indices 1

Simplify the following:

1. $x^3 \times x^8 =$

2. $\frac{9^8}{9} =$

3. $(2^3)^5 =$

4. $\frac{4^4 \times 4}{(4^2)^3} =$

5. $16^{\frac{1}{2}} =$

6. What is the reciprocal of 16?

7. What is 4^{-3} ?

8. What is $\left(\frac{2}{5}\right)^{-1}$?

Indices 1

Solutions on the next slide….

Indices 1 Solutions

Simplify the following:

1. $x^3 \times x^8 = x^{11}$

2. $\frac{9^8}{9} = 9^7$

3. $(2^3)^5 = 2^{15}$

4. $\frac{4^4 \times 4}{(4^2)^3} = \frac{4^5}{4^6} = 4^{-1} = \frac{1}{4}$

5. $16^{\frac{1}{2}} = \sqrt{16} = 4$

6. What is the reciprocal of 16?

$\frac{1}{16}$

7. $4^{-3} = \frac{1}{4^3} = \frac{1}{64}$

8. $\left(\frac{2}{5}\right)^{-1} = \frac{5}{2}$

Unsure about any of these? Search Laws of indices. Next try Skills check 2….

Indices 2

Simplify the following:

1. $t^5 \times t^4 =$

2. $\frac{8^7}{8^2} =$

3. $(3^4)^2 =$

4. $\frac{5^7 \times 5}{(5^3)^3} =$

5. $8^{\frac{1}{3}} =$

6. $y^0 =$

7. What is 3^{-4} ?

8. What is $\left(\frac{2}{3}\right)^{-2}$

You can do this for fun - or move on if you correctly completed Skills check 1.

Indices 2

Solutions on the next slide….

Indices 2 Solutions

Simplify the following:

1. $t^5 \times t^4 = t^9$

2. $\dfrac{8^7}{8^2} = 8^5$

3. $(3^4)^2 = 3^8$

4. $\dfrac{5^7 \times 5}{(5^3)^3} = \dfrac{5^8}{5^9} = 5^{-1} = \dfrac{1}{5}$

5. $8^{\frac{1}{3}} = \sqrt[3]{8} = 2$

6. $y^0 = 1$

7. $3^{-4} = \dfrac{1}{3^4} = \dfrac{1}{81}$

8. $\left(\dfrac{2}{3}\right)^{-2} = \left(\dfrac{3}{2}\right)^{2} = \dfrac{9}{4}$

Roots and Indices Maze

Can you find the route to the opposite side of the table?

- Begin in the highlighted box
- Move horizontally or vertically one box at a time… no diagonal moves allowed!
- You may only land on boxes which are equivalent in value to the highlighted one

$2^6 \times 2^3$	$3^2 \times 2^3$	$(\sqrt{16})^2$	$(2^3)^3$	$8^3 \div 8$	$4^4 \times 4^{-3}$	$(\sqrt[3]{8})^4$	8×4^2
$\sqrt{8^3}$	$(2^3)^2$	$8^7 \times 8^{-5}$	4^3	$2^{-2} \times 2^7$	64^0	$2^5 \times 2^3$	$4^7 \div 2^3$
$(\sqrt{64})^3$	8^2	$2^2 \times 2^3$	$2^3 \times 2^3$	$(2^3)^3$	$(\sqrt[3]{8})^6$	$4^6 \times 4^{-3}$	$2^2 \times 4^2$
2^6	$(\sqrt{64})^2$	$4^6 \times 4^{-2}$	$(\sqrt{16})^3$	$(2^2)^4$	$8^3 \div 2^3$	$2^{-3} \times 2^7$	$(2^2)^4$
3^5	$2^6 \times 2^1$	8^3	$4^5 \div 2^4$	$(-4)^{-3}$	$(2^2)^3$	$(\sqrt{8})^3$	$4^6 \div 2^6$
$4^3 \times 4^{-3}$	$(2^5)^1$	$(\sqrt[3]{64})^2$	$2^3 \times 8$	$2^{-1} \times 2^7$	$(\frac{1}{4})^{-3}$	16^2	64

Hint: What is the value of 2^6

Roots and Indices Maze

Solution on the next slide….

Roots and Indices Maze

Did you find the route to the opposite side of the table?

$2^6 \times 2^3$	$3^2 \times 2^3$	$(\sqrt{16})^2$	$(2^3)^3$	$8^3 \div 8$	$4^4 \times 4^{-3}$	$(\sqrt[3]{8})^4$	8×4^2
$\sqrt{8^3}$	$(2^3)^2$	$8^7 \times 8^{-5}$	4^3	$2^{-2} \times 2^7$	64^0	$2^5 \times 2^3$	$4^7 \div 2^3$
$(\sqrt{64})^3$	8^2	$2^2 \times 2^3$	$2^3 \times 2^3$	$(2^3)^3$	$(\sqrt[3]{8})^6$	$4^6 \times 4^{-3}$	$2^2 \times 4^2$
2^6	$(\sqrt{64})^2$	$4^6 \times 4^{-2}$	$(\sqrt{16})^3$	$(2^2)^4$	$8^3 \div 2^3$	$2^{-3} \times 2^7$	$(2^2)^4$
3^5	$2^6 \times 2^1$	8^3	$4^5 \div 2^4$	$(-4)^{-3}$	$(2^2)^3$	$(\sqrt{8})^3$	$4^6 \div 2^6$
$4^3 \times 4^{-3}$	$(2^5)^1$	$(\sqrt[3]{64})^2$	$2^3 \times 8$	$2^{-1} \times 2^7$	$(\frac{1}{4})^{-3}$	16^2	64

Matching Pairs

Match each of the expressions with their simplified version

$\left(\frac{9}{16}\right)^{\frac{1}{2}}$

2^{-3}

$(4)^{\frac{3}{2}}$

$64^{-\frac{1}{3}}$

$(-5)^{-2}$

$\frac{1}{4}$

$\frac{3}{4}$

$\frac{3}{2}$

$\frac{1}{8}$

$\left(\frac{4}{9}\right)^{-\frac{1}{2}}$

$(16)^{-\frac{3}{2}}$

$\frac{1}{25}$

8

$\frac{1}{64}$

$\frac{1}{16}$

4^{-2}

Matching Pairs

Solution on the next slide….

Matching Pairs

Solution

$\left(\frac{9}{16}\right)^{\frac{1}{2}}$	$\frac{3}{4}$
$(4)^{\frac{3}{2}}$	8
$(-5)^{-2}$	$\frac{1}{25}$
$(16)^{-\frac{3}{2}}$	$\frac{1}{64}$
$\frac{1}{8}$	2^{-3}
$\frac{1}{4}$	$64^{-\frac{1}{3}}$
$\frac{3}{2}$	$\left(\frac{4}{9}\right)^{-\frac{1}{2}}$
$\frac{1}{16}$	4^{-2}

Where does it belong?

Five numbers are arranged in order from least to greatest

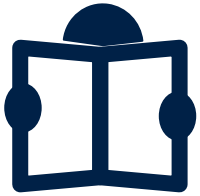
$$x\ , x^3, x^4, x^2, x^0$$

Where does $-x^{-1}$ belong in the list above?

Hint

Solution

Still want more?



Read how maths is used in different careers. For indices and exponential growth check out *Population Dynamics*, *Epidemics Analysis* and *Carbon Dating* in particular.

Discover the power of indices! Here you will see how they could be used to knock down very tall buildings!!

Watch this Numberphile video and learn how to impress friends and family by finding the fifth root of a number in the blink of an eye.

Contact the AMSP

01225 716 492

admin@amsp.org.uk

amsp.org.uk

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