# Indices and Standard form

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DIFINITION:

Indices: Indices are numbers which are raised to a power. Example: $2^x$, $x^{-5}$ etc...

**Laws of indices:**

$$a^0 = 1$$

**Example:**

$$5^0 = 1$$

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$$a^{-n} = \frac{1}{a}$$

**Example:**

$$5^{-2} = \frac{1}{5^2} = \frac{1}{25}$$

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$$a^m \ \ x \ \ a^n = a^{m+n}$$

**Example:**

$$5^{-2} \ x \ 5^{100} = 5^{-2+100} = 5^{98}$$

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$$\frac{a^m}{a^n} = a^{m-n}$$

Example:

$$\frac{10^1}{10^6} = 10^{1-6}$$

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$(a^m)^n = a^{mn}$

**Example:**

$(2^5)^3 = 2^{5x3} = 2^{15}$

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$a^{\frac{m}{n}} = \sqrt[n]{a^m}$

**Example:**

$64^{\frac{2}{3}} = \sqrt[3]{(64)^2}$

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**Solved Board paper questions:**

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14  (a)  Write down the value of $x^{-1}$, $x^0$, $x^{\frac{1}{2}}$, and $x^2$ when $x = \frac{1}{4}$.

Answer (a)  $x^{-1}$ ....................................

$x^0 =$ ....................................

$x^{\frac{1}{2}} =$ ....................................

$x^2 =$ ....................................  [2]

(b)  Write $y^{-1}$, $y^0$, $y^2$ and $y^3$ in increasing order of size when $y < -1$.

Answer (b) ..........<............<.............<.........  [2]

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4 Simplify

$$\frac{2}{3}p^{12} \times \frac{3}{4}p^{8}.$$

*Answer* ............................................................... [2]

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8 Simplify $(27x^3)^{\frac{2}{3}}$.

*Answer* ........................................ [2]

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5 Write $2^8 \times 8^2 \times 4^{-2}$ in the form $2^n$.

*Answer* ........................................ [2]

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6 $3^x \times 9^4 = 3^n$.

Find $n$ in terms of $x$.

*Answer n =* ........................... [2]

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3  Calculate  $81^{0.25} \div 4^{-2}$.

*Answer* .................................. [2]

4  (a)  Find $m$ when  $4^m \times 4^2 = 4^{12}$.

*Answer(a) m =* .................................. [1]

(b)  Find $p$ when  $6^p \div 6^5 = \sqrt{6}$.

*Answer(b) p =* .................................. [1]

Standard form:

Standard form is a way of expressing a number in the form: $A \times 10^n$; where $1 \leq A < 10$

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Standard Form is a convenient method for writing out very large or very small numbers.

The general form is :

$A \times 10^n$; where $1 \leq A < 10$

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Example 1 - What is 149550 in standard form?

Take the first number(1) and place a decimal point after it. Continue writing down the other numbers behind. This is 'A'.

A = 1.49550

Now count the number of numerals there are after the decimal point. There are 5.This is our value for 'n' in the expression.

Therefore 149550 becomes $1.4955 \times 10^5$

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<u>Example 2</u> - What is 0.0000218 in standard form?

Write out the first number after the line of zeros(2), and place a decimal point after it. Continue writing down the other numbers behind. This is 'N'.

A = 2.18

Now count the number of zeros between the original decimal point and the first number(2).

Add '1'. This number gives you the value of 'n'. In this case 4+1=5.

But because we are dealing with a number less than one, the index 'n' is negative.

The index is '-5'.

**0.0000218 becomes** $2.18 \times 10^{-5}$

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