

TSST 2015-16

Powers and Indices

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Digit cards

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10^9	10^8	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}
B	Hm	Tm	M	HTh	TTh	Th	H	T	1s	t	h	th	tth	hth	m

0	1	2	3	4	5	6	7	8	9	+	-	x	÷	=	<	>	≤	≥
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

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10^9 10^8 10^7 10^6 10^5 10^4 10^3 10^2 10^1 10^0 10^{-1} 10^{-2} 10^{-3} 10^{-4} 10^{-5} 10^{-6}

B **Hm** **Tm** **M** **HTh** **TTh** **Th** **H** **T** **1s** **t** **h** **th** **tth** **hth** **m**

0 **1** **2** **3** **4** **5** **6** **7** **8** **9** **+** **-** **x** **÷** **=** **<** **>** **≤** **≥**

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Powers of 2

$$2 \times 2 \times 2 \times 2 =$$

$$2 \times 2 \times 2 =$$

$$2 \times 2 =$$

$$2 =$$

$$\frac{1}{2} =$$

$$\frac{1}{2} \times 2 =$$

$$\frac{1}{4} \times 2 \times 2 =$$

$$\frac{1}{8} \times 2 \times 2 \times 2 =$$

$$16 = 2^4$$

$$8 = 2^3$$

$$4 = 2^2$$

$$2 = 2^1$$

$$1 = 2^0$$

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

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

$$\frac{1}{8} = 2^{-3}$$

$$\frac{1}{16} = 2^{-4}$$

- 4
- 3
- 2
- 1
- 0
- 1
- 2
- 3
- 4

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Laws of Indices

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2^{-4} 2^{-3} 2^{-2} 2^{-1} 2^0 2^1 2^2 2^3 2^4

$\times = 1 \quad 2$

- $$? \times ? \times ? \times ? =$$
- $$? \times ? \times ? =$$
- $$? \times ? =$$
- $$2 =$$

2	2^1	$2^{\frac{1}{4}}$	$=$	$\sqrt[4]{2}$
2	2^1	$2^{\frac{1}{3}}$	$=$	$\sqrt[3]{2}$
2	2^1	$2^{\frac{1}{2}}$	$=$	$\sqrt{2}$
2	2^1	2^1	$=$	

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Roots and Square Roots

Indices: Notation, Conventions and Consistency

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Conventions are used in mathematics, different conventions could be agreed, but those now used mean that mathematics within itself is consistent.

Examples:

We use place value with base 10 that uses 10 different digits

Early computing used base 2, also called binary, where only 0 and 1 exist.

Computer programmers use Hexadecimal system (base 16) with 0 to 9, then A, B, C, D, E and F

English currency used a Pounds, Shillings and Pence (LSD) where 12d = 1 shilling, 20 shillings = £1

Imperial weights have 16 ounces to 1 pound, 112 pounds to 1 hundredweight and 20 hundredweight to 1 ton

Prime numbers have exactly 2 factors (so 1 is not prime)

$$a^0 = 1$$

Standard form, also called Standard Index Form : $a \times 10^n$, where a is $1 \leq a < 10$

Laws of Indices

$$a^m \times a^n = a^{(m+n)}$$

$$a^m \div a^n = a^{(m-n)}$$

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

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

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

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

- $a^m \times a^n = a^{m+n}$
- $(a^m)^n = a^{mn}$
- $a^m \div a^n = a^{m-n}$
- $a^{-m} = \frac{1}{a^m}$
- $a^{\frac{1}{n}} = \sqrt[n]{a}$
- $a^{\frac{m}{n}} = \sqrt[n]{a^m}$
- $a^0 = 1$

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Place value counters

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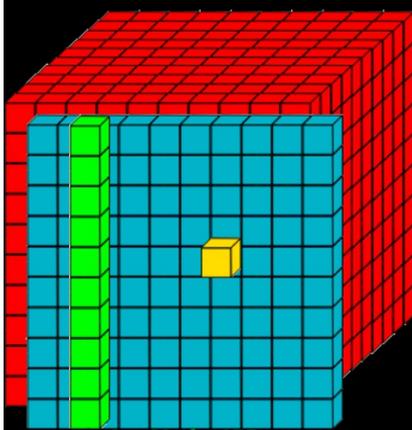
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2^{-4}

2^{-4}



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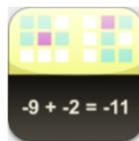
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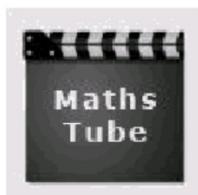


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- $? \times ? \times ? \times ? =$
- $? \times ? \times ? =$
- $? \times ? =$

Working page

$2 =$

$=$

2

$2^{\frac{1}{2} \frac{1}{3}}$

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

0 $\frac{1}{2}$

4 5 6 7 $\frac{1}{4}$

8 9 = $\frac{1}{8}$ $\frac{1}{16}$

$$\begin{array}{r} 1 \\ \hline 2 \times 2 \end{array}$$

$$\begin{array}{r} 1 \\ \hline 2 \times 2 \times 2 \end{array}$$

$$\begin{array}{r} 1 \\ \hline 2 \times 2 \times 2 \times 2 \end{array}$$

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$2 \ 2^1 \ 2^{\frac{1}{4}} = \sqrt[4]{2}$

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

$2 \ 2^1 \ 2^{\frac{1}{2}} = \sqrt{2}$

$2 \ 2^1 \ 2^1 =$

1

$\frac{1}{2}$

$\frac{1}{4}$

$\frac{1}{8}$

$\frac{1}{16}$

$\frac{1}{2}$

$\frac{1}{3}$

?

0

-1

-2

-3

-4

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Improving Learning in Mathematics: the Standards Box

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