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

	$2 \times 2 \times 2 \times 2$	=	16	2^4	4
	$2 \times 2 \times 2$	=	8	2^3	3
	2×2	=	4	2^2	2
	2	=	2	2^1	1
		=	1	2^0	0
	$\frac{1}{2}$	=	$\frac{1}{2}$	2^{-1}	-1
$\frac{1}{2}$	$\frac{1}{2 \times 2}$	=	$\frac{1}{4}$	2^{-2}	-2
$\frac{1}{4}$	$\frac{1}{2 \times 2 \times 2}$	=	$\frac{1}{8}$	2^{-3}	-3
$\frac{1}{8}$ $\frac{1}{16}$	$\frac{1}{2 \times 2 \times 2 \times 2}$	=	$\frac{1}{16}$	2^{-4}	-4

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}

x = 1 2

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

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 $1 \le a < 10$

Laws of Indices

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

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

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

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

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

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

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

Place value counters

1000 100 10 1

Dienes base 10 materials

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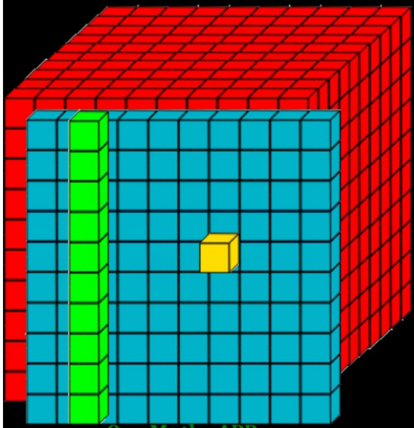
2^{-4}

2^{-4}



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Working page

? x ? x ? x ? =

? x ? x ? =

? x ? =

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 | $2^1 =$

1 | 0

$\frac{1}{2}$ | -1

$\frac{1}{4}$ | -2

$\frac{1}{8}$ | -3

$\frac{1}{16}$ | -4

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

$\sqrt[4]{\ }$ $\sqrt[3]{\ }$ $\sqrt{\ }$? $\sqrt{\ }$

2 $\frac{1}{2}$ $\frac{1}{3}$ $2^{\frac{1}{4}}$

$\frac{1}{2}$

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

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

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

0 | $\frac{1}{2}$

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

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

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Improving Learning in Mathematics: the Standards Box

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