

# TABLE OF BRAILLE MATHEMATICAL SIGNS WITH UNICODE REFERENCES

[The following is the table of braille signs from *Braille Mathematics Notation (2005)*, with the addition of extra columns giving the unicode number and unicode description of the print sign, where available.]

The braille signs in the following table should generally be used to represent the corresponding print signs whatever their meaning. In a few cases, however, more than one braille sign has the same print equivalent (e.g. the signs for  $\cdot$ ,  $<$ ): for these the correct braille sign should be used according to the meaning or use stated in brackets.

| Sign   | Meaning  | Unicode  | Unicode Description |
|--|--|----------|---------------------|
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | + (plus)   | U+002B   | Plus sign           |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | − (minus)  | U+2212   | Minus sign          |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | × (multiplied by, cross)                         | U+00D7   | Multiplication sign |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | ÷ (divided by)                                   | U+00F7   | Division sign       |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$ | ± (plus or minus)                                | U+00B1   | Plus-minus sign     |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$ | ∓ (minus or plus)                                | U+2213   | Minus or plus sign  |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | / (oblique stroke, fraction line sign)           | U+002F   | Solidus             |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | continued fraction symbol                        | —        | —                   |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | · (multiplication dot, and (in logic))           | U+22C5   | Dot operator        |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | *, o, etc. (an operation sign,<br>e.g. $x * y$ ) | * U+2217 | Asterisk operator   |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | *, o, etc. (a second operation sign)             | o U+2218 | Ring operator       |
| $\overline{\overline{\bullet\bullet}}$   | √ (root)   | U+221A   | Square root         |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | = (equals)                                       | U+003D   | Equals sign         |
| $\overline{\overline{\bullet\bullet}}\overline{\overline{\bullet\bullet}}$                                     | ≡ (equivalent to)                                | U+2261   | Identical to        |
| $\overline{\overline{\bullet\bullet}}$   | ~ (swung dash)                                   | U+223C   | Tilde operator      |

*Table of Braille Mathematical Signs*

| Sign                                     | Meaning  | Unicode   | Unicode Description   |
|--|--|---|---|
| $\overset{\cdot}{\sim}$                  | $\approx$  | U+2243  | Asymptotically equal to   |
| $\overset{\cdot}{\cong}$                 | $\approx$ , $\cong$ , or $\doteq$ (approximately equal to)   | $\approx$ U+2248<br>$\cong$ U+224F<br>$\doteq$ U+2251                             | Almost equal to<br>Difference between<br>Geometrically equal to |
| $\overset{\cdot}{\cong}$                 | $\cong$  | U+2245  | Approximately equal to  |
| $\propto$                                | $\propto$ (varies as, proportional to)   | U+221D  | Proportional to   |
| $\overset{\cdot}{\triangle}$             | $\overset{\cdot}{\triangle}$ , $\overset{\cdot}{=}$ <sub>Def</sub> , $\overset{\cdot}{=}$ <sub>def</sub> (is defined as) | $\overset{\cdot}{\triangle}$ U+225C<br>$\overset{\cdot}{=}$ <sub>def</sub> U+225D | Delta equal to<br>Equal to by definition                        |
| $\overset{\cdot}{\pitchfork}$            | $\pitchfork$ (is projective with)  | U+2305  | Projective  |
| $<$                                      | $<$ (less than)  | U+003C  | Less than sign  |
| $\leq$                                   | $\leq$ (less than or equal to)   | U+2264  | Less than or equal to   |
| $>$                                      | $>$ (greater than)   | U+003E  | Greater than sign   |
| $\geq$                                   | $\geq$ (greater than or equal to)  | U+2265  | Greater than or equal to  |
| $\ll$                                    | $\ll$ (much less than)   | U+226A  | Much less than  |
| $\gg$                                    | $\gg$ (much greater than)  | U+226B  | Much greater than   |
| $\overset{\cdot}{>}, \overset{\cdot}{<}$ | $\overset{\cdot}{>}, \overset{\cdot}{<}$ (greater than or less than)   | $\overset{\cdot}{>}$ U+2AA5<br>$\overset{\cdot}{<}$ U+2277                        | Greater-than beside less-than<br>Greater-than or less-than      |
| $\overset{\cdot}{\lesseqgtr}$            | $\overset{\cdot}{\lesseqgtr}$ (less than or approximately equal to)  | U+2272  | Less than or equivalent to                                      |
| $\overset{\cdot}{\gtrless}$              | $\overset{\cdot}{\gtrless}$ (greater than or approximately equal to)   | U+2273  | Greater than or equivalent to                                   |
| $\cdot$                                  | numeral sign   | —   | —   |
| $\cdot$                                  | $\cdot$ (decimal point)  | U+002E  | Full stop   |

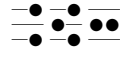
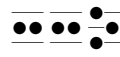
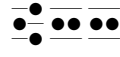
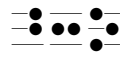
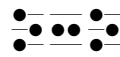
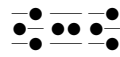
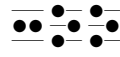
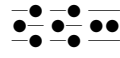
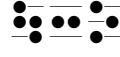
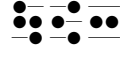

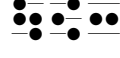


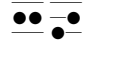
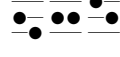
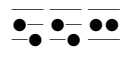
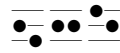
*Table of Braille Mathematical Signs*

| Sign   | Meaning   | Unicode             | Unicode Description          |
|--|---|---------------------|------------------------------|
| $\overline{\bullet-}$                                      | , (comma or space marking thousands, etc.)  | U+002C<br>or U+0020 | Comma or Space               |
| $\overline{\bullet}$                                       | · (recurring decimal sign)  | U+0307              | Combining dot above          |
| $\overline{\bullet\bullet}$                                | ¯ (bar over negative number, e.g. $\bar{2}.345$ )   | U+0304              | Combining macron             |
| $\overline{\bullet-}$<br>$\bullet-$                        | (   | U+0028              | Left parenthesis             |
| $\overline{\bullet\bullet}$<br>$\bullet-$                  | )   | U+0029              | Right parenthesis            |
| $\overline{\bullet\bullet}$<br>$\bullet\bullet$            | [   | U+005B              | Left square bracket          |
| $\overline{\bullet\bullet}$<br>$\bullet\bullet$            | ]   | U+005D              | Right square bracket         |
| $\overline{\bullet-}$<br>$\bullet-$                        | {   | U+007B              | Left curly bracket           |
| $\overline{\bullet-}$<br>$\bullet-$                        | }   | U+007D              | Right curly bracket          |
| $\overline{\bullet\bullet}$<br>$\overline{\bullet\bullet}$ | < (angle bracket)   | U+2329              | Left-pointing angle bracket  |
| $\overline{\bullet\bullet}$<br>$\overline{\bullet\bullet}$ | > (angle bracket)   | U+232A              | Right-pointing angle bracket |
| $\overline{\bullet\bullet}$<br>$\bullet\bullet$            | (vertical bar: modulus, determinant, such that, divides, restricted to, evaluated at, etc.) | U+007C<br>U+2223    | Vertical line<br>Divides     |
| $\overline{\bullet\bullet}$<br>$\overline{\bullet\bullet}$ | (double vertical bar: norm)   | U+2016              | Double vertical line         |
| $\bullet\bullet$<br>$\bullet\bullet$                       | matrix bracket  | —                   | —                            |
| $\overline{\bullet-}$<br>$\overline{\bullet-}$             | ∴ (therefore)   | U+2234              | Therefore                    |
| $\overline{\bullet-}$<br>$\overline{\bullet-}$             | ∵ (since)   | U+2235              | Because                      |
| $\overline{\bullet\bullet}$<br>$\overline{\bullet\bullet}$ | ∩ (intersection)  | U+2229              | Intersection                 |
| $\overline{\bullet\bullet}$<br>$\overline{\bullet\bullet}$ | ∪ (union)   | U+222A              | Union                        |
| $\overline{\bullet\bullet}$<br>$\overline{\bullet\bullet}$ | ∧ (and, meet, vector product)   | U+2227              | Logical and                  |
















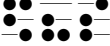




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| Sign | Meaning  | Unicode | Unicode Description                |
|------|--|---------|------------------------------------|
|      | $\vee$ (or, join)  | U+2228  | Logical or                         |
|      | $\setminus$ (set difference)   | U+2216  | Set minus                          |
|      | $\subset$ (contained in)   | U+2282  | Subset of                          |
|      | $\supset$ (contains)   | U+2283  | Superset of                        |
|      | $\subseteq$ (contained in or equal to)   | U+2286  | Subset of or equal to              |
|      | $\supseteq$ (contains or equal to)   | U+2287  | Superset of or equal to            |
|      | $\in$ (is an element of)   | U+2208  | Element of                         |
|      | $\ni$ (reverse of $\in$ )  | U+220B  | Contains as member                 |
|      | $\neg$ (not)   | U+00AC  | Not sign                           |
|      | $\&$ (ampersand, and)  | U+0026  | Ampersand                          |
|      | $\forall$ (for all)  | U+2200  | For all                            |
|      | $\exists$ (there exists)   | U+2203  | There exists                       |
|      | $\emptyset$ (empty set)  | U+2205  | Empty set                          |
|      | $\vdash$ (is a theorem)  | U+22A2  | Right tack                         |
|      | $\dashv$ (reverse of $\vdash$ )  | U+22A3  | Left tack                          |
|      | $\models$ (is valid)   | U+22A8  | True                               |
|      | $\vDash$ (reverse of $\models$ )   | U+2AE4  | Vertical bar double left turnstile |
|      | $\rightarrow$  | U+2192  | Rightwards arrow                   |
|      | $\leftarrow$   | U+2190  | Leftwards arrow                    |
|      | $\rightarrow$ (superscript or subscript arrow indicating vector e.g. $\overrightarrow{AB}$ ) | U+20D7  | Combining right arrow above        |

Table of Braille Mathematical Signs

| Sign  | Meaning   | Unicode  | Unicode Description  |
|---|---|--|--|
|    | $\overleftarrow{\quad}$ (superscript or subscript arrow indicating vector e.g. $\overleftarrow{AB}$ ) | U+20D6   | Combining left arrow above   |
|    | $\longrightarrow$ (arrow with long shaft)   | U+27F6   | Long rightwards arrow  |
|    | $\longleftarrow$ (arrow with long shaft)  | U+27F5   | Long leftwards arrow   |
|    | $\mapsto$   | U+21A6   | Rightwards arrow from bar  |
|    | $\rightrightarrows$   | U+21A3   | Rightwards arrow with tail   |
|    | $\leftrightsquigarrow$  | U+21A2   | Leftwards arrow with tail  |
|    | $\longleftrightarrow$   | U+21A0   | Rightwards two headed arrow  |
|  | $\longleftrightarrow$   | U+219E   | Leftwards two headed arrow   |
|  | $\Rightarrow$   | U+21D2   | Rightwards double arrow  |
|  | $\Leftarrow$  | U+21D0   | Leftwards double arrow   |
|  | $\leftrightarrow$   | U+2194   | Left right arrow   |
|  | $\Leftrightarrow$   | U+21D4   | Left right double arrow  |
|  | $\rightharpoonup$   | U+21C0   | Rightwards harpoon with barb upwards   |
|  | $\leftharpoonup$  | U+21BC   | Leftwards harpoon with barb upwards  |
|  | $\rightharpoonleft$   | U+21C1   | Rightwards harpoon with barb downwards   |
|  | $\rightleftharpoons$ , $\overleftrightarrow{\quad}$   | $\rightleftharpoons$ U+21CC<br>$\overleftrightarrow{\quad}$ U+21C4 | Rightwards harpoon over leftwards harpoon<br>Rightwards arrow over leftwards arrow |
|  | $\overrightarrow{\quad}$ , $\overleftarrow{\quad}$  | $\overleftrightarrow{\quad}$ U+2944                                | Short rightwards arrow above leftwards arrow                                       |
|  | $\overrightarrow{\quad}$ , $\overleftarrow{\quad}$  | $\overleftrightarrow{\quad}$ U+2942                                | Rightwards arrow above short leftwards arrow                                       |

*Table of Braille Mathematical Signs*

| Sign  | Meaning  | Unicode                                  | Unicode Description                 |
|---|--|--|-------------------------------------|
|    | $\uparrow, \nearrow$                                 | $\uparrow$ U+2191<br>$\nearrow$ U+2197   | Upwards arrow<br>North East arrow   |
|    | $\downarrow, \searrow$                               | $\downarrow$ U+2193<br>$\searrow$ U+2198 | Downwards arrow<br>South East arrow |
|    | sin  | —  | —                                   |
|    | $\sin^{-1}, \arcsin$                                 | —  | —                                   |
|    | cos  | —  | —                                   |
|    | $\cos^{-1}, \arccos$                                 | —  | —                                   |
|    | tan  | —  | —                                   |
|    | $\tan^{-1}, \arctan$                                 | —  | —                                   |
|    | sec  | —  | —                                   |
|  | $\sec^{-1}, \operatorname{arcsec}$                   | —  | —                                   |
|  | cosec  | —  | —                                   |
|  | $\operatorname{cosec}^{-1}, \operatorname{arccosec}$ | —  | —                                   |
|  | cot  | —  | —                                   |
|  | $\cot^{-1}, \operatorname{arccot}$                   | —  | —                                   |
|  | sinh   | —  | —                                   |
|  | $\sinh^{-1}, \operatorname{arcsinh}$                 | —  | —                                   |
|  | cosh   | —  | —                                   |
|  | $\cosh^{-1}, \operatorname{arccosh}$                 | —  | —                                   |
|  | tanh   | —  | —                                   |
|  | $\tanh^{-1}, \operatorname{arctanh}$                 | —  | —                                   |

*Table of Braille Mathematical Signs*

| Sign | Meaning   | Unicode | Unicode Description         |
|------|---|---------|-----------------------------|
|      | sech  | —       | —                           |
|      | $\operatorname{sech}^{-1}$ , arcsech            | —       | —                           |
|      | cosech  | —       | —                           |
|      | $\operatorname{cosech}^{-1}$ , arccosech        | —       | —                           |
|      | coth  | —       | —                           |
|      | $\operatorname{coth}^{-1}$ , arccoth            | —       | —                           |
|      | log   | —       | —                           |
|      | $\log^{-1}$ , antilog                           | —       | —                           |
|      | colog   | —       | —                           |
|      | grad (gradient)                                 | —       | —                           |
|      | curl or rot                                     | —       | —                           |
|      | div (divergence)                                | —       | —                           |
|      | $\nabla$ (nabla, del)                           | U+2207  | Nabla                       |
|      | $\sphericalangle$ , $\hat{\phantom{a}}$ (angle) | U+2220  | Angle                       |
|      | ○ (circle symbol)                               | U+25CB  | White circle                |
|      | △ (triangle symbol, symmetric difference)       | U+25B3  | White up-pointing triangle  |
|      | □ (square symbol, vector or wave operator)      | U+25A1  | White square                |
|      | ◁ (is a normal subgroup of)                     | U+22B2  | Normal subgroup of          |
|      | ▷ (reverse of ◁)                                | U+22B3  | Contains as normal subgroup |

*Table of Braille Mathematical Signs*

| Sign | Meaning   | Unicode                           | Unicode Description                              |
|------|---|-----------------------------------|--|
|      | $\trianglelefteq$ (is a normal subgroup of or equal to)                                 | U+22B4                            | Normal subgroup of or equal to                   |
|      | $\trianglerighteq$ (reverse of $\trianglelefteq$ )                                      | U+22B5                            | Contains as normal subgroup of or equal to)      |
|      | $\parallel$ (parallel symbol)   | U+2225                            | Parallel to                                      |
|      | $\perp$ (perpendicular symbol)  | U+27C2                            | Perpendicular                                    |
|      | $\int$ (integral)   | U+222B                            | Integral   |
|      | $\oint$ (closed line integral)  | U+222E                            | Contour integral                                 |
|      | $\infty$ (infinity)   | U+221E                            | Infinity   |
|      | ■, □, //, etc. (end of proof)   | ■ U+220E<br>□ U+25A1<br>// U+002F | End of proof<br>White square<br>Solidus (double) |
|      | # (hash)  | U+0023                            | Number sign                                      |
|      | ! (factorial)   | U+0021                            | Exclamation mark                                 |
|      | . (point notation of partial correlation or regression in statistics, e.g. $x_{12.3}$ ) | U+22C5                            | Dot operator                                     |
|      | $\amalg$ (coproduct)  | U+2210                            | N-ary coproduct                                  |
|      | $\partial$ (curly $d$ , partial derivative $d$ )  | U+2202                            | Partial differential                             |
|      | ' (dash, prime, e.g. $x'$ )   | U+2032                            | Prime  |
|      | * (star, e.g. $x^*$ )   | U+002A                            | Asterisk   |
|      | $\bar{\phantom{x}}$ (bar, e.g. $\bar{x}$ )  | U+0304                            | Combining macron                                 |
|      | $\hat{\phantom{x}}$ (hat, e.g. $\hat{x}$ )  | U+0302                            | Combining circumflex accent                      |
|      | $\check{\phantom{x}}$ (inverted hat, e.g. $\check{x}$ )                                 | U+030C                            | Combining caron                                  |



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| Sign | Meaning  | Unicode | Unicode Description        |
|------|--|---------|----------------------------|
|      | ~ (tilde, e.g. $\tilde{x}$ )                       | U+0303  | Combining tilde            |
|      | † (dagger, e.g. $x^\dagger$ )                      | U+2020  | Dagger                     |
|      | ⌋ (actuarial symbol: years, e.g. $\bar{x}$ )       | U+20E7  | Combining annuity symbol   |
|      | · (differentiation dot, e.g. $\dot{x}$ )           | U+0307  | Combining dot above        |
|      | ¨ (double differentiation dots, e.g. $\ddot{x}$ )  | U+0308  | Combining diaeresis        |
|      | … (triple differentiation dots, e.g. $\dddot{x}$ ) | U+20DB  | Combining three dots above |
|      | ° (degrees)  | U+00B0  | Degree sign                |
|      | ' (minutes)  | U+2032  | Prime                      |
|      | " (seconds)  | U+2033  | Double prime               |
|      | $c$ (radians)                                      | —       | —                          |
|      | Å (ångström)                                       | U+212B  | Angstrom sign              |
|      | £ (pound sterling)                                 | U+00A3  | Pound sign                 |
|      | \$ (dollar)  | U+0024  | Dollar sign                |
|      | ¢ (cent)   | U+00A2  | Cent sign                  |
|      | € (euro)   | U+20AC  | Euro sign                  |
|      | % (percent)  | U+0025  | Percent sign               |
|      | unit separation sign                               | —       | —                          |
|      | mathematical hyphen                                | —       | —                          |
|      | separation sign                                    | —       | —                          |
|      | index separation sign                              | —       | —                          |

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| Sign | Meaning                               | Unicode | Unicode Description |
|------|---------------------------------------|---------|---------------------|
|      | differential operator separation sign | —       | —                   |
|      | superscript sign                      | —       | —                   |
|      | subscript sign                        | —       | —                   |
|      | top index sign                        | —       | —                   |
|      | bottom index sign                     | —       | —                   |
|      | index termination sign                | —       | —                   |
|      | matrix line indicator                 | —       | —                   |
|      | ‘word’ indicator                      | —       | —                   |
|      | small Latin letter sign               | —       | —                   |
|      | capital Latin letter sign             | —       | —                   |
|      | small bold Latin letter sign          | —       | —                   |
|      | capital bold Latin letter sign        | —       | —                   |
|      | small Greek letter sign               | —       | —                   |
|      | capital Greek letter sign             | —       | —                   |
|      | double capital Greek letter sign      | —       | —                   |
|      | small letter sign                     | —       | —                   |
|      | capital letter sign                   | —       | —                   |
|      | small letter sign                     | —       | —                   |
|      | capital letter sign                   | —       | —                   |
|      | small letter sign                     | —       | —                   |
|      | capital letter sign                   | —       | —                   |

*Table of Braille Mathematical Signs*

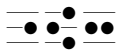
| Sign | Meaning             | Unicode | Unicode Description |
|------|---------------------|---------|---------------------|
|      | small letter sign   | —       | —                   |
|      | capital letter sign | —       | —                   |
|      | crossed symbol sign | —       | —                   |

### Some Common Struck Out Signs

The braille code includes a general method by which a normal sign in the above list is modified by inserting a dot 5 to become the struck out sign. This is explained in paragraph (b) of “Modification of Signs” in *Braille Mathematics Notation*. The following lists some common cases with specific unicode equivalents.

| Sign | Meaning                             | Unicode | Unicode Description          |
|------|-------------------------------------|---------|------------------------------|
|      | $\neq$ (not equal to)               | U+2260  | Not equal to                 |
|      | $\neq$ (not equivalent to)          | U+2262  | Not identical to             |
|      | $\not>$ (not greater than)          | U+226F  | Not greater than             |
|      | $\not<$ (not less than)             | U+226E  | Not less than                |
|      | $\nmid$ (does not divide)           | U+2224  | Does not divide              |
|      | $\not\subset$ (is not contained in) | U+2284  | Not a subset of              |
|      | $\not\supset$ (does not contain)    | U+2285  | Not a superset of            |
|      | $\notin$ (is not an element of)     | U+2209  | Not an element of            |
|      | $\nexists$ (there does not exist)   | U+2204  | There does not exist         |
|      | $\nparallel$ (is not parallel to)   | U+2226  | Not parallel to              |
|      | $\rightarrow$                       | U+219B  | Rightwards arrow with stroke |

*Table of Braille Mathematical Signs*

| <b>Sign</b>   | <b>Meaning</b> | <b>Unicode</b> | <b>Unicode Description</b>  |
|---|----------------|----------------|-----------------------------|
|  | $\leftarrow$   | U+219A         | Leftwards arrow with stroke |

[20/9/2012]