Meaningfull Math

in ConTEXt

Examples

```
1 PLUS 2 EQUALS 3
1 plus 2 equals 3
1 plus 2 är lika med 3
```

```
% Addition and equals
\im {1 + 2 = 3}
```

```
<math>
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  <mo>+</mo>
  <mn>2</mn>
  <mo>=</mo>
  <mn>3</mn>
 </mrow>
</math>
```

1 MINUS 2 EQUALS MINUS 1

1 minus 2 equals minus 1

1 minus 2 är lika med minus 1

```
% Subtraction and negative number
\im {1 - 2 = -1}
```

```
<math>
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  <mn>2</mn>
  <mo>=</mo>
  <mo>-</mo>
  <mn>1</mn>
 </mrow>
</math>
```

$2 \times 3 = 2 \cdot 3 = 6$

2 MULTIPLICATION 3 EQUALS 2 MULTIPLICATION 3 EQUALS 6

2 times 3 equals 2 times 3 equals 6

2 multiplicerat med 3 är lika med 2 multiplicerat med 3 är lika med 6

```
% Multiplication
\im {2 \times 3 = 2 \cdot 3 = 6}
```

```
<math>
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  <mo>=</mo>
  <mn>2</mn>
  <mo>·</mo>
  <mn>3</mn>
  <mo>=</mo>
  <mn>6</mn>
 </mrow>
</math>
```

$1.1 + 2.22 = 3.33 = 3 + (0.1 + .22) \neq -1.23{\times}10^4 \neq 10^5$

1.1 PLUS 2.22 EQUALS 3.33 EQUALS 3 PLUS BEGIN GROUP 0.1 PLUS .22 END GROUP IS NOT EQUAL TO MINUS 1.23 MULTIPLICATION 10 TO THE POWER OF 4 IS NOT EQUAL TO 10 TO THE POWER OF 5

1.1 plus 2.22 equals 3.33 equals 3 plus group 0.1 plus .22 end group is not equal to minus 1.23 times 10 to the power of 4 is not equal to 10 to the power of 5

1.1 plus 2.22 är lika med 3.33 är lika med 3 plus grupp 0.1 plus .22 slut är inte lika med minus 1.23 multiplicerat med 10 upphöjt till 4 är inte lika med 10 upphöjt till 5

```
% Decimal numbers
\im {1.1 + 2.22 = 3.33 = 3 + (0.1 + .22) \neq - \digits{1.23^4} \neq 10^5}
```

```
<math>
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  <mo>-</mo>
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  <mo>≠</mo>
  <msup>
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   <mn>5</mn>
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</math>
```

0x3BE EQUALS 13502 EQUALS 13502

0x3BE equals 13502 equals 13502

0x3BE är lika med 13502 är lika med 13502

```
% Hexadecimal with \mn
\im {\mn{0x34BE} = 13502 = \digits{13502}}
```

```
<math>
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  <mo>=</mo>
  <mn>13502</mn>
  <mo>=</mo>
  <mn>13502</mn>
 </mrow>
</math>
```

3 SQUARED PLUS 4 SQUARED EQUALS 5 SQUARED

3 squared plus 4 squared equals 5 squared

3 i kvadrat plus 4 i kvadrat är lika med 5 i kvadrat

```
% Squared
\im {3^2 + 4^2 = 5^2}
```

```
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   <mn>2</mn>
  </msup>
  <mo>+</mo>
  <msup>
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  <mo>=</mo>
  <msup>
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   <mn>2</mn>
  </msup>
 </mrow>
</math>
```

3 TO THE POWER OF 4 PLUS 4 TO THE POWER OF 4 IS NOT EQUAL TO 5 TO THE POWER OF 4

3 to the power of 4 plus 4 to the power of 4 is not equal to 5 to the power of 4

3 upphöjt till 4 plus 4 upphöjt till 4 är inte lika med 5 upphöjt till 4

```
% Higher power
\im {3^4 + 4^4 \neq 5^4}
```

```
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  </msup>
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  <msup>
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   <mn>4</mn>
  </msup>
 </mrow>
</math>
```

$$\frac{1}{2} = \frac{1}{3} + \frac{1}{6}$$

THE FRACTION OF 1 AND 2 EQUALS THE FRACTION OF 1 AND 3 PLUS THE FRACTION OF 1 AND 6

the fraction of 1 and 2 equals the fraction of 1 and 3 plus the fraction of 1 and 6

kvoten av 1 och 2 är lika med kvoten av 1 och 3 plus kvoten av 1 och 6

```
% Simple fraction
\dm {\frac{1}{2} = \frac{1}{3} + \frac{1}{6}}
```

```
<math>
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   <mn>2</mn>
  </mfrac>
  <mo>=</mo>
  <mfrac>
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  <mo>+</mo>
  <mfrac>
   <mn>1</mn>
   <mn>6</mn>
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 </mrow>
</math>
```

$$\frac{1}{x} + \frac{1}{y} = \frac{x+y}{xy}$$

THE FRACTION OF 1 AND x PLUS THE FRACTION OF 1 AND y EQUALS THE FRACTION OF BEGIN NUMERATOR x PLUS y END NUMERATOR AND BEGIN DENOMINATOR x y END DENOMINATOR

the fraction of 1 and x plus the fraction of 1 and y equals the fraction of numerator x plus y end numerator and denominator x y end denominator

kvoten av 1 och x plus kvoten av 1 och y är lika med kvoten av täljare x plus y avsluta täljare och nämnare x y avsluta nämnare

```
% Fraction with symbols
\dm {\frac{1}{x} + \frac{1}{y} = \frac{x + y}{xy}}
```

```
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  <mo>+</mo>
  <mfrac>
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```

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

THE FRACTION OF 1 AND 2 TIMES 2 EQUALS THE FRACTION OF 1 AND 2 MULTIPLICATION 2 EQUALS THE FRACTION OF 1 AND 2 MULTIPLICATION 2 EQUALS 2 TIMES THE FRACTION OF 1 AND 2 EQUALS 2 MULTIPLICATION THE FRACTION OF 1 AND 2 EQUALS 2 MULTIPLICATION THE FRACTION OF 1 AND 2

the fraction of 1 and 2 times 2 equals the fraction of 1 and 2 times 2 equals the fraction of 1 and 2 times 2 equals 2 times the fraction of 1 and 2 equals 2 times the fraction of 1 and 2 equals 2 times the fraction of 1 and 2

kvoten av 1 och 2 multiplicerat med 2 är lika med kvoten av 1 och 2 multiplicerat med 2 är lika med kvoten av 1 och 2 multiplicerat med 2 är lika med 2 multiplicerat med kvoten av 1 och 2 är lika med 2 multiplicerat med kvoten av 1 och 2 är lika med 2 multiplicerat med kvoten av 1 och 2

```
% Fraction multiplied by number
\m{\frac{1}{2}2 = \frac{1}{2} \cdot 2 = \frac{1}{2} \times 2 = 2 \frac{1}{2} = 2 \cdot \frac{1}{2} = 2 \times \frac{1}{2}}
```

```
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 </mrow>
</math>
```

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

THE FRACTION OF 1 AND 2 TIMES a EQUALS THE FRACTION OF 1 AND 2 MULTIPLICATION a EQUALS THE FRACTION OF 1 AND 2 MULTIPLICATION a EQUALS a TIMES THE FRACTION OF 1 AND 2 EQUALS a MULTIPLICATION THE FRACTION OF 1 AND 2 EQUALS a MULTIPLICATION THE FRACTION OF 1 AND 2

the fraction of 1 and 2 times a equals the fraction of 1 and 2 times a equals the fraction of 1 and 2 times a equals a times the fraction of 1 and 2 equals a times the fraction of 1 and 2 equals a times the fraction of 1 and 2

kvoten av 1 och 2 multiplicerat med a är lika med kvoten av 1 och 2 multiplicerat med a är lika med kvoten av 1 och 2 multiplicerat med a är lika med a multiplicerat med kvoten av 1 och 2 är lika med a multiplicerat med kvoten av 1 och 2 är lika med a multiplicerat med kvoten av 1 och 2

```
% Fraction multiplied by symbol
\m{\frac{1}{2}a = \frac{1}{2}\cdot a = \frac{1}{2} \times a = a \frac{1}{2} = a \cdot \frac{1}{2} = a \times \frac{1}{2}}
```

```
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   <mn>2</mn>
  </mfrac>
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  <mo>=</mo>
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   <mn>2</mn>
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  <mo>·</mo>
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  <mo>×</mo>
  <mfrac>
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   <mn>2</mn>
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 </mrow>
</math>
```

$$a\frac{1+x}{x-1}+\frac{1-x}{1+x}\frac{1-y}{1+y}+\frac{1-x}{1+x}y$$

a TIMES THE FRACTION OF BEGIN NUMERATOR 1 PLUS *x* END NUMERATOR AND BEGIN DENOMINATOR *x* MINUS 1 END DENOMINATOR PLUS THE FRACTION OF BEGIN NUMERATOR 1 MINUS *x* END NUMERATOR AND BEGIN DENOMINATOR 1 PLUS *x* END DENOMINATOR TIMES THE FRACTION OF BEGIN NUMERATOR 1 MINUS *y* END NUMERATOR AND BEGIN DENOMINATOR 1 PLUS *y* END DENOMINATOR PLUS THE FRACTION OF BEGIN NUMERATOR 1 MINUS *x* END NUMERATOR AND BEGIN DENOMINATOR 1 PLUS *x* END DENOMINATOR TIMES *y*

a times the fraction of numerator 1 plus *x* end numerator and denominator *x* minus 1 end denominator plus the fraction of numerator 1 minus *x* end numerator and denominator 1 plus *x* end denominator times the fraction of numerator 1 minus *y* end numerator and denominator 1 plus *y* end denominator plus the fraction of numerator 1 minus *x* end numerator and denominator 1 plus *x* end denominator times *y*

a multiplicerat med kvoten av täljare 1 plus *x* avsluta täljare och nämnare *x* minus 1 avsluta nämnare plus kvoten av täljare 1 minus *x* avsluta täljare och nämnare 1 plus *x* avsluta nämnare multiplicerat med kvoten av täljare 1 minus *y* avsluta täljare och nämnare 1 plus *y* avsluta nämnare plus kvoten av täljare 1 minus *x* avsluta täljare och nämnare 1 plus *x* avsluta nämnare multiplicerat med *y*

```
% With fraction times fraction
\dm {a\frac{1 + x}{x - 1} + \frac{1 - x}{1 + x}\frac{1 - y}{1 + y} + \frac{1 - x}{1 + x}y}
```

```
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    <mi>x</mi>
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    <mo>+</mo>
    <mi>x</mi>
   </mrow>
  </mfrac>
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 </mrow>
</math>
```

$2(1+x)+(1+y)3-a(1+z)-(1+u)b$

2 BEGIN GROUP 1 PLUS x END GROUP PLUS BEGIN GROUP 1 PLUS y END GROUP TIMES 3 MINUS a TIMES BEGIN GROUP 1 PLUS z END GROUP MINUS BEGIN GROUP 1 PLUS u END GROUP TIMES b

2 group 1 plus x end group plus group 1 plus y end group times 3 minus a times group 1 plus z end group minus group 1 plus u end group times b

2 grupp 1 plus x slut plus grupp 1 plus y slut multiplicerat med 3 minus a multiplicerat med grupp 1 plus z slut minus grupp 1 plus u slut multiplicerat med b

```
% Group and number/variable
\im {2(1 + x) + (1 + y)3 - a(1 + z) - (1 + u)b}
```

```
<math>
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  <mn>2</mn>
  <mo>(</mo>
  <mn>1</mn>
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  <mi>x</mi>
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  <mn>1</mn>
  <mo>+</mo>
  <mi>y</mi>
  <mo>)</mo>
  <mn>3</mn>
  <mo>-</mo>
  <mi>a</mi>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>z</mi>
  <mo>)</mo>
  <mo>-</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>u</mi>
  <mo>)</mo>
  <mi>b</mi>
 </mrow>
</math>
```

$2 \cdot (1 + x) + (1 + y) \cdot 3 - a \cdot (1 + z) - (1 + u) \cdot b$

2 MULTIPLICATION BEGIN GROUP 1 PLUS x END GROUP PLUS BEGIN GROUP 1 PLUS y END GROUP MULTIPLICATION 3 MINUS a MULTIPLICATION BEGIN GROUP 1 PLUS z END GROUP MINUS BEGIN GROUP 1 PLUS u END GROUP MULTIPLICATION b

2 times group 1 plus x end group plus group 1 plus y end group times 3 minus a times group 1 plus z end group minus group 1 plus u end group times b

2 multiplicerat med grupp 1 plus x slut plus grupp 1 plus y slut multiplicerat med 3 minus a multiplicerat med grupp 1 plus z slut minus grupp 1 plus u slut multiplicerat med b

```
% Group and number/variable with explicit multiplication
\im {2 \cdot (1 + x) + (1 + y) \cdot 3 - a \cdot (1 + z) - (1 + u) \cdot b}
```

```
<math>
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  <mo>·</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>x</mi>
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  <mo>+</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>y</mi>
  <mo>)</mo>
  <mo>·</mo>
  <mn>3</mn>
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  <mi>a</mi>
  <mo>·</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>z</mi>
  <mo>)</mo>
  <mo>−</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>u</mi>
  <mo>)</mo>
  <mo>·</mo>
  <mi>b</mi>
 </mrow>
</math>
```

$a_2b_1 - a_1b_2 = a_2b_1 - a_1b_2$

a SUB 2 TIMES b SUB 1 MINUS a SUB 1 TIMES b SUB 2 EQUALS a SUB 2 NOTIMES b SUB 1 MINUS a SUB 1 NOTIMES b SUB 2

a with lower index 2 times b with lower index 1 minus a with lower index 1 times b with lower index 2 equals a with lower index 2 , b with lower index 1 minus a with lower index 1 , b with lower index 2

a med undre index 2 multiplicerat med b med undre index 1 minus a med undre index 1 multiplicerat med b med undre index 2 är lika med a med undre index 2 , b med undre index 1 minus a med undre index 1 , b med undre index 2

```
% Multiplication of indexed/sub (use \notimes if times should be surpressed)
\dm {a__2b__1 - a_1b_2 = a__2\notimes b__1 - a_1\notimes b_2}
```

```
<math>
 <mrow>
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   <mn>2</mn>
  </msub>
  <msub>
   <mi>b</mi>
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   <mn>1</mn>
  </msub>
  <msub>
   <mi>b</mi>
   <mn>2</mn>
  </msub>
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   <mn>2</mn>
  </msub>
  <mo></mo>
  <msub>
   <mi>b</mi>
   <mn>1</mn>
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   <mn>1</mn>
  </msub>
  <mo></mo>
  <msub>
   <mi>b</mi>
   <mn>2</mn>
  </msub>
 </mrow>
</math>
```

A SUB BEGIN GROUP 1 COMMA 20 END GROUP PLUS A POSTSCRIPTS POSTSUB 1 POSTSUB 20 END SCRIPTS PLUS A SUB BEGIN GROUP 1 COMMA 20 END GROUP PLUS A POSTSCRIPTS POSTSUB 1 POSTSUB 20 END SCRIPTS

A with lower index group 1 comma 20 end group plus A postscripts sub 1 sub 20 end scripts plus A with lower index group 1 comma 20 end group plus A postscripts sub 1 sub 20 end scripts

A med undre index grupp 1 komma 20 slut plus A postskript nedsänkt 1 nedsänkt 20 slut skript plus A med undre index grupp 1 komma 20 slut plus A postskript nedsänkt 1 nedsänkt 20 slut skript

```
% A few indices, both as one and as multi
% Do we want to use invisible comma anywhere? Probably not.
\dm {A_{1,20} + A_1_{20} + A_{1,20} + A_1_{20}}
```

```
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   <mrow>
    <mn>1</mn>
    <mo>,</mo>
    <mn>20</mn>
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  </msub>
  <mo>+</mo>
  <mmultiscripts>
   <mi>A</mi>
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   <mtext/>
   <mn>20</mn>
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   <mi>A</mi>
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    <mn>1</mn>
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    <mn>20</mn>
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   <mtext/>
   <mn>20</mn>
   <mtext/>
  </mmultiscripts>
 </mrow>
</math>
```

$a_1(1 + x) + (1 + y)b_1 - a_2(1 + z) - (1 + u)b_2$

a SUB 1 TIMES BEGIN GROUP 1 PLUS x END GROUP PLUS BEGIN GROUP 1 PLUS y END GROUP TIMES b SUB 1 MINUS a SUB 2 TIMES BEGIN GROUP 1 PLUS z END GROUP MINUS BEGIN GROUP 1 PLUS u END GROUP TIMES b SUB 2

a with lower index 1 times group 1 plus x end group plus group 1 plus y end group times b with lower index 1 minus a with lower index 2 times group 1 plus z end group minus group 1 plus u end group times b with lower index 2

a med undre index 1 multiplicerat med grupp 1 plus x slut plus grupp 1 plus y slut multiplicerat med b med undre index 1 minus a med undre index 2 multiplicerat med grupp 1 plus z slut minus grupp 1 plus u slut multiplicerat med b med undre index 2

```
% Group and element with sub(index)
\im {a__1(1 + x) + (1 + y)b__1 - a_2(1 + z) - (1 + u)b_2}
```

```
<math>
 <mrow>
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   <mn>1</mn>
  </msub>
  <mo>(</mo>
  <mn>1</mn>
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  <mo>)</mo>
  <mo>+</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>y</mi>
  <mo>)</mo>
  <msub>
   <mi>b</mi>
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  <mo>+</mo>
  <mi>z</mi>
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  <mi>u</mi>
  <mo>)</mo>
  <msub>
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</math>
```

$a_1 \cdot (1 + x) + (1 + y) \cdot b_1 - a_2 \cdot (1 + z) - (1 + u) \cdot b_2$

a SUB 1 MULTIPLICATION BEGIN GROUP 1 PLUS *x* END GROUP PLUS BEGIN GROUP 1 PLUS *y* END GROUP MULTIPLICATION *b* SUB 1 MINUS *a* SUB 2 MULTIPLICATION BEGIN GROUP 1 PLUS *z* END GROUP MINUS BEGIN GROUP 1 PLUS *u* END GROUP MULTIPLICATION *b* SUB 2

a with lower index 1 times group 1 plus *x* end group plus group 1 plus *y* end group times *b* with lower index 1 minus *a* with lower index 2 times group 1 plus *z* end group minus group 1 plus *u* end group times *b* with lower index 2

a med undre index 1 multiplicerat med grupp 1 plus *x* slut plus grupp 1 plus *y* slut multiplicerat med *b* med undre index 1 minus *a* med undre index 2 multiplicerat med grupp 1 plus *z* slut minus grupp 1 plus *u* slut multiplicerat med *b* med undre index 2

```
% Group and element with sub(index) and with explicit multiplication
\im {a__1 \cdot (1 + x) + (1 + y) \cdot b__1 - a_2 \cdot (1 + z) - (1 + u) \cdot b_2}
```

```
<math>
 <mrow>
  <msub>
   <mi>a</mi>
   <mn>1</mn>
  </msub>
  <mo>·</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>x</mi>
  <mo>)</mo>
  <mo>+</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>y</mi>
  <mo>)</mo>
  <mo>·</mo>
  <msub>
   <mi>b</mi>
   <mn>1</mn>
  </msub>
  <mo>−</mo>
  <msub>
   <mi>a</mi>
   <mn>2</mn>
  </msub>
  <mo>·</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>z</mi>
  <mo>)</mo>
  <mo>−</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>u</mi>
  <mo>)</mo>
  <mo>·</mo>
  <msub>
   <mi>b</mi>
   <mn>2</mn>
  </msub>
 </mrow>
</math>
```

$(n+k)n+(n+k)(n+1)+n(n+k)$

BEGIN GROUP n PLUS k END GROUP TIMES n PLUS BEGIN GROUP n PLUS k END GROUP TIMES BEGIN GROUP n PLUS 1 END GROUP PLUS n TIMES BEGIN GROUP n PLUS k END GROUP

group n plus k end group times n plus group n plus k end group times group n plus 1 end group plus n times group n plus k end group

grupp n plus k slut multiplicerat med n plus grupp n plus k slut multiplicerat med grupp n plus 1 slut plus n multiplicerat med grupp n plus k slut

```
% Groups and times
\im {(n+k)n + (n+k)(n+1) + n(n+k)}
```

```
<math>
 <mrow>
  <mo>(</mo>
  <mi>n</mi>
  <mo>+</mo>
  <mi>k</mi>
  <mo>)</mo>
  <mi>n</mi>
  <mo>+</mo>
  <mo>(</mo>
  <mi>n</mi>
  <mo>+</mo>
  <mi>k</mi>
  <mo>)</mo>
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  <mi>n</mi>
  <mo>+</mo>
  <mn>1</mn>
  <mo>)</mo>
  <mo>+</mo>
  <mi>n</mi>
  <mo>(</mo>
  <mi>n</mi>
  <mo>+</mo>
  <mi>k</mi>
  <mo>)</mo>
 </mrow>
</math>
```

$(n+k)n+(n+k)(n+1)+n(n+k)$

OPTIONAL BEGIN BEGIN FENCED n PLUS k END FENCED n PLUS OPTIONAL BEGIN BEGIN FENCED n PLUS k END FENCED TIMES OPTIONAL BEGIN BEGIN FENCED n PLUS 1 END FENCED PLUS n TIMES OPTIONAL BEGIN BEGIN FENCED n PLUS k END FENCED

fenced n plus k end fenced n plus fenced n plus k end fenced times fenced n plus 1 end fenced plus n times fenced n plus k end fenced

grupp n plus k slut grupp n plus grupp n plus k slut grupp multiplicerat med grupp n plus 1 slut grupp plus n multiplicerat med grupp n plus k slut grupp

```
% Left right groups times
\im {\left(n+k\right)n + \left(n+k\right)\left(n+1\right) + n\left(n+k\right)}
```

```
<math>
 <mrow>
  <mrow>
   <mo>(</mo>
   <mrow>
    <mi>n</mi>
    <mo>+</mo>
    <mi>k</mi>
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  </mrow>
  <mi>n</mi>
  <mo>+</mo>
  <mrow>
   <mo>(</mo>
   <mrow>
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    <mo>+</mo>
    <mi>k</mi>
   </mrow>
   <mo>)</mo>
  </mrow>
  <mrow>
   <mo>(</mo>
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    <mo>+</mo>
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   </mrow>
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  </mrow>
  <mo>+</mo>
  <mi>n</mi>
  <mrow>
   <mo>(</mo>
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    <mo>+</mo>
    <mi>k</mi>
   </mrow>
   <mo>)</mo>
  </mrow>
 </mrow>
</math>
```

$(n+k)n+(n+k)(n+1)+n(n+k)$

OPTIONAL BEGIN PARENTHESIS n PLUS k END PARENTHESIS n PLUS OPTIONAL BEGIN PARENTHESIS n PLUS k END PARENTHESIS TIMES OPTIONAL BEGIN PARENTHESIS n PLUS 1 END PARENTHESIS PLUS n TIMES OPTIONAL BEGIN PARENTHESIS n PLUS k END PARENTHESIS

parenthesis n plus k end parenthesis n plus parenthesis n plus k end parenthesis times parenthesis n plus 1 end parenthesis plus n times parenthesis n plus k end parenthesis

parentes n plus k slut parentes n plus parentes n plus k slut parentes multiplicerat med parentes n plus 1 slut parentes plus n multiplicerat med parentes n plus k slut parentes

```
% Fenced and times
\im {\fenced[parenthesis]{n+k}n + \fenced[parenthesis]{n+k}\fenced[parenthesis]{n+1} + n\fenced[parenthesis]{n+k}}
```

```
<math>
 <mrow>
  <mrow>
   <mo>(</mo>
   <mrow>
    <mi>n</mi>
    <mo>+</mo>
    <mi>k</mi>
   </mrow>
   <mo>)</mo>
  </mrow>
  <mi>n</mi>
  <mo>+</mo>
  <mrow>
   <mo>(</mo>
   <mrow>
    <mi>n</mi>
    <mo>+</mo>
    <mi>k</mi>
   </mrow>
   <mo>)</mo>
  </mrow>
  <mrow>
   <mo>(</mo>
   <mrow>
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    <mo>+</mo>
    <mn>1</mn>
   </mrow>
   <mo>)</mo>
  </mrow>
  <mo>+</mo>
  <mi>n</mi>
  <mrow>
   <mo>(</mo>
   <mrow>
    <mi>n</mi>
    <mo>+</mo>
    <mi>k</mi>
   </mrow>
   <mo>)</mo>
  </mrow>
 </mrow>
</math>
```

$$(1+x)^n a = a(1+x)^n \neq (1+x)^n (1+y) - (1+x)(1+y)^n$$

BEGIN GROUP 1 PLUS x END GROUP TO THE POWER OF n TIMES a EQUALS a TIMES BEGIN GROUP 1 PLUS x END GROUP TO THE POWER OF n IS NOT EQUAL TO BEGIN GROUP 1 PLUS x END GROUP TO THE POWER OF n TIMES BEGIN GROUP 1 PLUS y END GROUP MINUS BEGIN GROUP 1 PLUS x END GROUP TIMES BEGIN GROUP 1 PLUS y END GROUP TO THE POWER OF n

group 1 plus x end group to the power of n times a equals a times group 1 plus x end group to the power of n is not equal to group 1 plus x end group to the power of n times group 1 plus y end group minus group 1 plus x end group times group 1 plus y end group to the power of n

grupp 1 plus x slut upphöjt till n multiplicerat med a är lika med a multiplicerat med grupp 1 plus x slut upphöjt till n är inte lika med grupp 1 plus x slut upphöjt till n multiplicerat med grupp 1 plus y slut minus grupp 1 plus x slut multiplicerat med grupp 1 plus y slut upphöjt till n

```
% Groups with powers and times
\dm {(1 + x)^n a  = a (1 + x)^n \neq (1 + x)^n (1 + y) - (1 + x)(1 + y)^n}
```

```
<math>
 <mrow>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>x</mi>
  <msup>
   <mo>)</mo>
   <mi>n</mi>
  </msup>
  <mi>a</mi>
  <mo>=</mo>
  <mi>a</mi>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>x</mi>
  <msup>
   <mo>)</mo>
   <mi>n</mi>
  </msup>
  <mo>≠</mo>
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  <mn>1</mn>
  <mo>+</mo>
  <mi>x</mi>
  <msup>
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   <mi>n</mi>
  </msup>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>y</mi>
  <mo>)</mo>
  <mo>−</mo>
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  <mi>x</mi>
  <mo>)</mo>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mi>y</mi>
  <msup>
   <mo>)</mo>
   <mi>n</mi>
  </msup>
 </mrow>
</math>
```

$$(1 + 2 + 3 + 4)^2 = 1^3 + 2^3 + 3^3 + 4^3$$

BEGIN GROUP 1 PLUS 2 PLUS 3 PLUS 4 END GROUP SQUARED EQUALS 1 CUBED PLUS 2 CUBED PLUS 3 CUBED PLUS 4 CUBED

group 1 plus 2 plus 3 plus 4 end group squared equals 1 cubed plus 2 cubed plus 3 cubed plus 4 cubed

grupp 1 plus 2 plus 3 plus 4 slut i kvadrat är lika med 1 i kubik plus 2 i kubik plus 3 i kubik plus 4 i kubik

```
% Simple parenthesis usage
% Better use structured input (see next two examples)
\im {(1 + 2 + 3 + 4)^2 = 1^3 + 2^3 + 3^3 + 4^3}
```

```
<math>
 <mrow>
  <mo>(</mo>
  <mn>1</mn>
  <mo>+</mo>
  <mn>2</mn>
  <mo>+</mo>
  <mn>3</mn>
  <mo>+</mo>
  <mn>4</mn>
  <msup>
   <mo>)</mo>
   <mn>2</mn>
  </msup>
  <mo>=</mo>
  <msup>
   <mn>1</mn>
   <mn>3</mn>
  </msup>
  <mo>+</mo>
  <msup>
   <mn>2</mn>
   <mn>3</mn>
  </msup>
  <mo>+</mo>
  <msup>
   <mn>3</mn>
   <mn>3</mn>
  </msup>
  <mo>+</mo>
  <msup>
   <mn>4</mn>
   <mn>3</mn>
  </msup>
 </mrow>
</math>
```

$(1+2+3+4)^2 = 1^3 + 2^3 + 3^3 + 4^3$

OPTIONAL BEGIN BEGIN FENCED 1 PLUS 2 PLUS 3 PLUS 4 END FENCED SQUARED EQUALS 1 CUBED PLUS 2 CUBED PLUS 3 CUBED PLUS 4 CUBED

fenced 1 plus 2 plus 3 plus 4 end fenced squared equals 1 cubed plus 2 cubed plus 3 cubed plus 4 cubed

grupp 1 plus 2 plus 3 plus 4 slut grupp i kvadrat är lika med 1 i kubik plus 2 i kubik plus 3 i kubik plus 4 i kubik

```
% Better, but next one might be even more clear
\im {\left(1 + 2 + 3 + 4 \right)^2 = 1^3 + 2^3 + 3^3 + 4^3}
```

```
<math>
 <mrow>
  <msup>
   <mrow>
    <mo>(</mo>
    <mrow>
     <mn>1</mn>
     <mo>+</mo>
     <mn>2</mn>
     <mo>+</mo>
     <mn>3</mn>
     <mo>+</mo>
     <mn>4</mn>
    </mrow>
    <mo>)</mo>
   </mrow>
   <mn>2</mn>
  </msup>
  <mo>=</mo>
  <msup>
   <mn>1</mn>
   <mn>3</mn>
  </msup>
  <mo>+</mo>
  <msup>
   <mn>2</mn>
   <mn>3</mn>
  </msup>
  <mo>+</mo>
  <msup>
   <mn>3</mn>
   <mn>3</mn>
  </msup>
  <mo>+</mo>
  <msup>
   <mn>4</mn>
   <mn>3</mn>
  </msup>
 </mrow>
</math>
```

OPTIONAL BEGIN PARENTHESIS 1 PLUS 2 PLUS 3 PLUS 4 END PARENTHESIS SQUARED EQUALS 1 CUBED PLUS 2 CUBED PLUS 3 CUBED PLUS 4 CUBED

parenthesis 1 plus 2 plus 3 plus 4 end parenthesis squared equals 1 cubed plus 2 cubed plus 3 cubed plus 4 cubed

parentes 1 plus 2 plus 3 plus 4 slut parentes i kvadrat är lika med 1 i kubik plus 2 i kubik plus 3 i kubik plus 4 i kubik

```
% Structured parenthesis usage
\im{\fenced[parenthesis]{1 + 2 + 3 + 4 }^2 = 1^3 + 2^3 + 3^3 + 4^3}
```

```
<math>
 <mrow>
  <msup>
   <mrow>
    <mo>(</mo>
    <mrow>
     <mn>1</mn>
     <mo>+</mo>
     <mn>2</mn>
     <mo>+</mo>
     <mn>3</mn>
     <mo>+</mo>
     <mn>4</mn>
    </mrow>
    <mo>)</mo>
   </mrow>
   <mn>2</mn>
  </msup>
  <mo>=</mo>
  <msup>
   <mn>1</mn>
   <mn>3</mn>
  </msup>
  <mo>+</mo>
  <msup>
   <mn>2</mn>
   <mn>3</mn>
  </msup>
  <mo>+</mo>
  <msup>
   <mn>3</mn>
   <mn>3</mn>
  </msup>
  <mo>+</mo>
  <msup>
   <mn>4</mn>
   <mn>3</mn>
  </msup>
 </mrow>
</math>
```

x IS NOT EQUAL TO x PLUS MINUS 1

x is not equal to x plus minus 1

x är inte lika med x plus minus 1

```
% Plus minus
\im {x \neq x + -1}
```

```
<math>
 <mrow>
  <mi>x</mi>
  <mo>≠</mo>
  <mi>x</mi>
  <mo>+</mo>
  <mo>-</mo>
  <mn>1</mn>
 </mrow>
</math>
```

$x = 1.$

x EQUALS 1

x equals 1

x är lika med 1

```
% Decimal period last in math goes
\im {x = 1.}
```

```
<math>
 <mrow>
  <mi>x</mi>
  <mo>=</mo>
  <mn>1</mn>
  <mi>.</mi>
 </mrow>
</math>
```

$x = 1.$

```
x EQUALS 1
x equals 1
x är lika med 1
```

```
% Also goes for mathtextpunctuation
% (Mostly for displayed formulas, otherwise, keep the punctuation outside math)
\im {x = 1\mtp{.}}
```

```
<math>
 <mrow>
  <mi>x</mi>
  <mo>=</mo>
  <mn>1</mn>
  <mtext>.</mtext>
 </mrow>
</math>
```

$x = y.$

x EQUALS y

x equals y

x är lika med y

```
% Period at end -> period goes
\im {x = y.}
```

```
<math>
 <mrow>
  <mi>x</mi>
  <mo>=</mo>
  <mi>y</mi>
  <mi>.</mi>
 </mrow>
</math>
```

$x = z.$

x EQUALS z

x equals z

x är lika med z

```
% Also goes for mathtextpunctuation
\im {x=z\mtp{.}}
```

```
<math>
 <mrow>
  <mi>x</mi>
  <mo>=</mo>
  <mi>z</mi>
  <mtext>.</mtext>
 </mrow>
</math>
```

$x = y,$

x EQUALS y COMMA

x equals y comma

x är lika med y komma

```
% Shoulf comma at the end also go? (bad input)
\im {x = y,}
```

```
<math>
 <mrow>
  <mi>x</mi>
  <mo>=</mo>
  <mi>y</mi>
  <mo>,</mo>
 </mrow>
</math>
```

$a_0.a_1a_2\ldots a_n\ldots$

a SUB 0 . a SUB 1 NOTIMES a SUB 2 AND SO ON a SUB n AND SO ON

a with lower index 0 . a with lower index 1 , a with lower index 2 , and so on, a with lower index n , and so on,

a med undre index 0 . a med undre index 1 , a med undre index 2 , och så vidare, a med undre index n , och så vidare,

```
% Variables can be used as placeholders for numbers (explaining decimals)
% We use \notimes to get rid of the explicit multiplication
\im {a__{0}.a__{1}\notimes a__{2} \ldots a__{n} \ldots}
```

```
<math>
 <mrow>
  <msub>
   <mi>a</mi>
   <mn>0</mn>
  </msub>
  <mi>.</mi>
  <msub>
   <mi>a</mi>
   <mn>1</mn>
  </msub>
  <mo></mo>
  <msub>
   <mi>a</mi>
   <mn>2</mn>
  </msub>
  <mo>…</mo>
  <msub>
   <mi>a</mi>
   <mi>n</mi>
  </msub>
  <mo>…</mo>
 </mrow>
</math>
```

$y \cdot z = y \cdot z = y \cdot z$

y MULTIPLICATION *z* EQUALS *y* MULTIPLICATION *z* EQUALS *y* SCALARPRODUCT *z*

y times *z* equals *y* times *z* equals *y* scalarproduct *z*

y multiplicerat med *z* är lika med *y* multiplicerat med *z* är lika med *y* skalärprodukt *z*

```
% Different ways to access the multiplication dot
\im {y·z = y \cdot z = y \scalarproduct z}
```

```
<math>
 <mrow>
  <mi>y</mi>
  <mo>·</mo>
  <mi>z</mi>
  <mo>=</mo>
  <mi>y</mi>
  <mo>·</mo>
  <mi>z</mi>
  <mo>=</mo>
  <mi>y</mi>
  <mo>·</mo>
  <mi>z</mi>
 </mrow>
</math>
```

a TIMES *b* TIMES *c* TIMES *d* TIMES *e* TIMES FUNCTION *f* TIMES FUNCTION *g* TIMES *h* TIMES *i* TIMES *k* TIMES *l*

a times *b* times *c* times *d* times *e* times the function *f* times the function *g* times *h* times *i* times *k* times *l*

a multiplicerat med *b* multiplicerat med *c* multiplicerat med *d* multiplicerat med *e* multiplicerat med *f* multiplicerat med *g* multiplicerat med *h* multiplicerat med *i* multiplicerat med *k* multiplicerat med *l*

```
% The f and g are in this document registered as functions
% There should be TIMES between g and h
\im {abcdefghikl}
```

```
<math>
 <mrow>
  <mi>a</mi>
  <mi>b</mi>
  <mi>c</mi>
  <mi>d</mi>
  <mi>e</mi>
  <mi>f</mi>
  <mi>g</mi>
  <mi>h</mi>
  <mi>i</mi>
  <mi>k</mi>
  <mi>l</mi>
 </mrow>
</math>
```

$$xx\sin(x)\,x\frac{x}{x}x\sqrt{x}x\int x\sin\cos x\sin(x)\cos$$

x TIMES x TIMES sin FUNCTIONOF x TIMES x TIMES THE FRACTION OF x AND x TIMES x TIMES THE SQUARE ROOT ROOTOF x TIMES x TIMES INTEGRAL x TIMES sin cos x TIMES sin FUNCTIONOF x TIMES cos

x times x times sin of x times x times the fraction of x and x times x times the square root of x times x times integral x times sin cos x times sin of x times cos

x multiplicerat med x multiplicerat med sin av x multiplicerat med x multiplicerat med kvoten av x och x multiplicerat med x multiplicerat med kvadratroten av x multiplicerat med x multiplicerat med integral x multiplicerat med sin cos x multiplicerat med sin av x multiplicerat med cos

```
% Lots of times
\im {xx \sin(x) x \frac{x}{x} x \sqrt{x} x \int x \sin \cos x \sin(x) \cos}
```

```
<math>
 <mrow>
  <mi>x</mi>
  <mi>x</mi>
  <mi>sin</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
  <mi>x</mi>
  <mfrac>
   <mi>x</mi>
   <mi>x</mi>
  </mfrac>
  <mi>x</mi>
  <msqrt>
   <mi>x</mi>
  </msqrt>
  <mi>x</mi>
  <mo>∫</mo>
  <mi>x</mi>
  <mi>sin</mi>
  <mi>cos</mi>
  <mi>x</mi>
  <mi>sin</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
  <mi>cos</mi>
 </mrow>
</math>
```

a TIMES FUNCTION f FUNCTIONOF x PLUS b TIMES h TIMES BEGIN GROUP x END GROUP PLUS FUNCTION f FUNCTIONOF BEGIN GROUP x PLUS b END GROUP

a times the function f of x plus b times h times group x end group plus the function f of group x plus b end group

a multiplicerat med f av x plus b multiplicerat med h multiplicerat med grupp x slut plus f av grupp x plus b slut

```
% f is registered as a function, h is not
\im {af(x) + bh(x) + f(x + b)}
```

```
<math>
 <mrow>
  <mi>a</mi>
  <mi>f</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
  <mo>+</mo>
  <mi>b</mi>
  <mi>h</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
  <mo>+</mo>
  <mi>f</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>+</mo>
  <mi>b</mi>
  <mo>)</mo>
 </mrow>
</math>
```

A TIMES BEGIN GROUP X END GROUP IS NOT EQUAL TO A NOTIMES BEGIN GROUP X END GROUP IS NOT EQUAL TO A APPLY-FUNCTION BEGIN GROUP X END GROUP IS NOT EQUAL TO A APPLYFUNCTIONOF BEGIN GROUP X END GROUP

A times group X end group is not equal to A , group X end group is not equal to A group X end group is not equal to A of group X end group

A multiplicerat med grupp X slut är inte lika med A , grupp X slut är inte lika med A grupp X slut är inte lika med A av grupp X slut

```
% Apply function or whatever
\dm { A(X) \neq A\notimes(X) \neq A\applyfunction(X) \neq A\of(X)}
```

```
<math>
 <mrow>
  <mi>A</mi>
  <mo>(</mo>
  <mi>X</mi>
  <mo>)</mo>
  <mo>≠</mo>
  <mi>A</mi>
  <mo></mo>
  <mo>(</mo>
  <mi>X</mi>
  <mo>)</mo>
  <mo>≠</mo>
  <mi>A</mi>
  <mo></mo>
  <mo>(</mo>
  <mi>X</mi>
  <mo>)</mo>
  <mo>≠</mo>
  <mi>A</mi>
  <mo></mo>
  <mo>(</mo>
  <mi>X</mi>
  <mo>)</mo>
 </mrow>
</math>
```

Σ APPLYFUNCTIONOF BEGIN GROUP X WEDGE SUM Y END GROUP EQUALS Σ APPLYFUNCTIONOF X WEDGE SUM Σ APPLYFUNCTIONOF Y

Σ of group X wedge sum Y end group equals Σ of X wedge sum Σ of Y

Σ av grupp X haksumma Y slut är lika med Σ av X haksumma Σ av Y

```
% Just an example where \of makes sense
\dm {\Sigma \of (X \vee Y) = \Sigma \of X \vee \Sigma \of Y}
```

```
<math>
 <mrow>
  <mi>Σ</mi>
  <mo></mo>
  <mo>(</mo>
  <mi>X</mi>
  <mo>∨</mo>
  <mi>Y</mi>
  <mo>)</mo>
  <mo>=</mo>
  <mi>Σ</mi>
  <mo></mo>
  <mi>X</mi>
  <mo>∨</mo>
  <mi>Σ</mi>
  <mo></mo>
  <mi>Y</mi>
 </mrow>
</math>
```

$$F(x,t) = f_t(x) = \mathrm{f}_t(x)$$

F APPLYFUNCTIONOF BEGIN GROUP x COMMA t END GROUP EQUALS FUNCTION f SUB t FUNCTIONOF x EQUALS f SUB t APPLY-FUNCTIONOF BEGIN GROUP x END GROUP

F of group x comma t end group equals the function f with lower index t of x equals f with lower index t of group x end group

F av grupp x komma t slut är lika med f med undre index t av x är lika med f med undre index t av grupp x slut

```
% An example with something of two variables
\dm { F\of(x,t) = f__t(x) = \mathrm{f}__t\of(x)}
```

```
<math>
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  <mo>(</mo>
  <mi>x</mi>
  <mo>,</mo>
  <mi>t</mi>
  <mo>)</mo>
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  <msub>
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   <mi>t</mi>
  </msub>
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   <mi>t</mi>
  </msub>
  <mo></mo>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
 </mrow>
</math>
```

$h'(x) \neq h'(x)$

h PRIME APPLYFUNCTIONOF BEGIN GROUP x END GROUP IS NOT EQUAL TO h PRIME PRIMEOF BEGIN GROUP x END GROUP

h prime of group x end group is not equal to h prime of group x end group

h prim av grupp x slut är inte lika med h prim av grupp x slut

```
% Prime with and without \of
\dm { h'\of(x) \neq h'(x)}
```

```
<math>
 <mrow>
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   <mo>′</mo>
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   <mo>′</mo>
  </msup>
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  <mi>x</mi>
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 </mrow>
</math>
```

$C((a,b)) \neq C^2([a,b]) \neq C^2[0,1] \neq C(\Omega) \neq \mathcal{C}(\Omega)$

C APPLYFUNCTIONOF BEGIN GROUP OPTIONAL BEGIN OPENINTERVAL a COMMA b END OPENINTERVAL END GROUP IS NOT EQUAL TO C SUPINDEX 2 APPLYFUNCTIONOF BEGIN GROUP OPTIONAL BEGIN interval a COMMA b END interval END GROUP IS NOT EQUAL TO C SUPINDEX 2 APPLYFUNCTIONOF OPTIONAL BEGIN interval 0 COMMA 1 END interval IS NOT EQUAL TO C APPLYFUNCTIONOF BEGIN GROUP Ω END GROUP IS NOT EQUAL TO $\mathcal{C}$ APPLYFUNCTIONOF BEGIN GROUP Ω END GROUP

C of group the open interval a comma b end the open interval end group is not equal to C with upper index 2 of group interval a comma b end interval end group is not equal to C with upper index 2 of interval 0 comma 1 end interval is not equal to C of group Ω end group is not equal to $\mathcal{C}$ of group Ω end group

C av grupp det öppna intervallet a komma b slut det öppna intervallet slut är inte lika med C med övre index 2 av grupp interval a komma b slut interval slut är inte lika med C med övre index 2 av interval 0 komma 1 slut interval är inte lika med C av grupp Ω slut är inte lika med $\mathcal{C}$ av grupp Ω slut

```
% C \of examples
% We shall not get rid of the grouping since it gives structure
% One could think of a \nogroup (just as \notimes)
\im { C \of (\openinterval{a,b}) \neq C^^2 \of (\interval{a,b}) \neq C^^2 \of \interval{0,1} \neq C\of(\Omega) \neq C \of (\Omega)}
```

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<math>
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  <mi>C</mi>
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  <mo>(</mo>
  <mi>Ω</mi>
  <mo>)</mo>
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```

BEGIN GROUP BEGIN GROUP BEGIN GROUP x END GROUP END GROUP END GROUP IS NOT EQUAL TO BEGIN GROUP BEGIN GROUP x END GROUP END GROUP IS NOT EQUAL TO BEGIN GROUP OPTIONAL BEGIN PARENTHESIS x END PARENTHESIS END GROUP

group group group x end group end group end group is not equal to group group x end group end group is not equal to group parenthesis x end parenthesis end group

grupp grupp grupp x slut slut slut är inte lika med grupp grupp x slut slut är inte lika med grupp parentes x slut parentes slut

```
% Nesting groups. Could it have meaning? Or should we only get one group.
\im { (((x))) \neq ((x)) \neq (\parenthesis{x})}
```

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<math>
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  <mo>(</mo>
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  <mo>(</mo>
  <mi>x</mi>
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  <mrow>
   <mo>(</mo>
   <mi>x</mi>
   <mo>)</mo>
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  <mo>)</mo>
 </mrow>
</math>
```

$s(1) = s(\{0\}) = \{0\} \cup \{\{0\}\}$

s APPLYFUNCTIONOF BEGIN GROUP 1 END GROUP EQUALS *s* APPLYFUNCTIONOF BEGIN GROUP OPTIONAL BEGIN SET 0 END SET END GROUP EQUALS OPTIONAL BEGIN SET 0 END SET UNION OPTIONAL BEGIN SET OPTIONAL BEGIN SET 0 END SET END SET

s of group 1 end group equals *s* of group the set 0 end the set end group equals the set 0 end the set union the set the set 0 end the set end the set

s av grupp 1 slut är lika med *s* av grupp mängden 0 slut mängden slut är lika med mängden 0 slut mängden union mängden mängden 0 slut mängden slut mängden

```
% Nesting groups/parentheses need to be there
\im { s\of(1) = s\of(\set{0}) = \set{0} \cup \set{\set{0}}}
```

```
<math>
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  <mi>s</mi>
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  <mn>1</mn>
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  <mi>s</mi>
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    <mo>{</mo>
    <mn>0</mn>
    <mo>}</mo>
   </mrow>
   <mo>}</mo>
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 </mrow>
</math>
```

THE REAL NUMBERS APPLYFUNCTIONOF OPTIONAL BEGIN bracket x PLUS 1 END bracket EQUALS THE REAL NUMBERS OPTIONAL BEGIN bracket x END bracket IS NOT EQUAL TO THE REAL NUMBERS APPLYFUNCTIONOF BEGIN GROUP x END GROUP

the real numbers of bracket x plus 1 end bracket equals the real numbers bracket x end bracket is not equal to the real numbers of group x end group

de rella talen av bracket x plus 1 slut bracket är lika med de rella talen bracket x slut bracket är inte lika med de rella talen av grupp x slut

```
% Algebra (ring) examples
\dm {\reals \of \bracket{x + 1} = \reals\fenced[bracket]{x} \neq \reals\of[x]}
```

```
<math>
 <mrow>
  <mi>ℝ</mi>
  <mo></mo>
  <mrow>
   <mo>[</mo>
   <mrow>
    <mi>x</mi>
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</math>
```

the matrix A SUB the vector **u** TIMES the vector **v** IS DEFINED BY the vector **u** CROSSPRODUCT the vector **v**

the matrix A with lower index the vector **u** times the vector **v** is defined by the vector **u** crossproduct the vector **v**

matrisen A med undre index vektorn **u** multiplicerat med vektorn **v** definieras av vektorn **u** kryssprodukt vektorn **v**

```
% This is a result of
% \registermathsymbol[default][en][lowercasebold][the vector]
% \registermathsymbol[default][en][uppercasesansserifnormal][the matrix]
\im {\mathss{A}__{\mathbf{u}}\mathbf{v} \colonequals \mathbf{u} \crossproduct \mathbf{v}}
```

```
<math>
 <mrow>
  <msub>
   <mi>A</mi>
   <mi>u</mi>
  </msub>
  <mi>v</mi>
  <mo>≔</mo>
  <mi>u</mi>
  <mo>×</mo>
  <mi>v</mi>
 </mrow>
</math>
```

$\binom{3}{2} = \frac{3!}{(3-2)!2!}$

BINOM 3 OVER 2 END BINOM EQUALS THE FRACTION OF BEGIN NUMERATOR 3 FACTORIAL END NUMERATOR AND BEGIN DENOMINATOR BEGIN GROUP 3 MINUS 2 END GROUP FACTORIAL 2 FACTORIAL END DENOMINATOR

begin the binomial coefficient 3 over 2 end equals the fraction of numerator 3 factorial end numerator and denominator group 3 minus 2 end group factorial 2 factorial end denominator

start binomialkoefficienten 3 över 2 slut är lika med kvoten av täljare 3 fakultet avsluta täljare och nämnare grupp 3 minus 2 slut fakultet 2 fakultet avsluta nämnare

```
% Binomials are fractions
\im {\binom{3}{2} = \frac{3!}{(3-2)!2!}}
```

```
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    <mn>2</mn>
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    <mo>!</mo>
    <mn>2</mn>
    <mo>!</mo>
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  </mfrac>
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</math>
```

$$\binom{2n}{n+1} = \frac{(2n)!}{(n-1)!(n+1)!}$$

BINOM 2 n OVER n PLUS 1 END BINOM EQUALS THE FRACTION OF BEGIN NUMERATOR BEGIN GROUP 2 n END GROUP FACTORIAL END NUMERATOR AND BEGIN DENOMINATOR BEGIN GROUP n MINUS 1 END GROUP FACTORIAL BEGIN GROUP n PLUS 1 END GROUP FACTORIAL END DENOMINATOR

begin the binomial coefficient 2 n over n plus 1 end equals the fraction of numerator group 2 n end group factorial end numerator and denominator group n minus 1 end group factorial group n plus 1 end group factorial end denominator

start binomialkoefficienten 2 n över n plus 1 slut är lika med kvoten av täljare grupp 2 n slut fakultet avsluta täljare och nämnare grupp n minus 1 slut fakultet grupp n plus 1 slut fakultet avsluta nämnare

```
% With symbols it gets a bit long
\im {\binom{2n}{n + 1} = \frac{(2n)!}{(n - 1)!(n + 1)!}}
```

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   <mfrac>
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     <mn>2</mn>
     <mi>n</mi>
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    <mn>1</mn>
    <mo>)</mo>
    <mo>!</mo>
   </mrow>
  </mfrac>
 </mrow>
</math>
```

$$a\binom{n}{k} + \binom{n}{k}\binom{n}{a} + \binom{n}{k}x^k + \binom{n}{k}x$$

a TIMES BINOM n OVER k END BINOM PLUS BINOM n OVER k END BINOM TIMES BINOM n OVER a END BINOM PLUS BINOM n OVER k END BINOM TIMES x TO THE POWER OF k PLUS BINOM n OVER k END BINOM TIMES x

a times begin the binomial coefficient n over k end plus begin the binomial coefficient n over k end times begin the binomial coefficient n over a end plus begin the binomial coefficient n over k end times x to the power of k plus begin the binomial coefficient n over k end times x

a multiplicerat med start binomialkoefficienten n över k slut plus start binomialkoefficienten n över k slut multiplicerat med start binomialkoefficienten n över a slut plus start binomialkoefficienten n över k slut multiplicerat med x upphöjt till k plus start binomialkoefficienten n över k slut multiplicerat med x

```
% Binomials, multiplied
\im {a\binom{n}{k} + \binom{n}{k}\binom{n}{a} + \binom{n}{k}x^k + \binom{n}{k}x}
```

```
<math>
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    <mi>k</mi>
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    <mi>k</mi>
   </mfrac>
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 </mrow>
</math>
```

$$(1+x)^n = \sum_{k=0}^{n} \binom{n}{k} x^k$$

OPTIONAL BEGIN PARENTHESIS 1 PLUS x END PARENTHESIS TO THE POWER OF n EQUALS SUM OPERATORSUBSUPFROM BEGIN GROUP k EQUALS 0 END GROUP OPERATORSUBSUPTO n PAUSE OPERATOROF BINOM n OVER k END BINOM TIMES x TO THE POWER OF k

parenthesis 1 plus x end parenthesis to the power of n equals the sum from group k equals 0 end group to n , of begin the binomial coefficient n over k end times x to the power of k

parentes 1 plus x slut parentes upphöjt till n är lika med summan från grupp k är lika med 0 slut till n , av start binomialkoefficienten n över k slut multiplicerat med x upphöjt till k

```
% Binomial theorem
\dm {\parenthesis{1 + x}^n = \sum_{k = 0}^{n} \binom{n}{k}x^k}
```

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     <mo>+</mo>
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```

x PLUS x SQUARED PLUS x CUBED PLUS AND SO ON EQUALS x DIVIDED BY BEGIN GROUP 1 MINUS x END GROUP

x plus x squared plus x cubed plus , and so on, equals x divided by group 1 minus x end group

x plus x i kvadrat plus x i kubik plus , och så vidare, är lika med x delat med grupp 1 minus x slut

```
% \ldots = , and so on
\im {x + x^2 + x^3 + \ldots = x/(1 - x)}
```

```
<math>
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   <mn>2</mn>
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  <mo>(</mo>
  <mn>1</mn>
  <mo>−</mo>
  <mi>x</mi>
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</math>
```

3 *i* IS NOT EQUAL TO 3 *i* IS NOT EQUAL TO 1 PLUS *i* IS NOT EQUAL TO 2 PLUS *i* IS NOT EQUAL TO 3 PLUS *a* TIMES *i* IS NOT EQUAL TO 3 PLUS *a* *i*

3 *i* is not equal to 3 *i* is not equal to 1 plus *i* is not equal to 2 plus *i* is not equal to 3 plus *a* times *i* is not equal to 3 plus *a* *i*

3 *i* är inte lika med 3 *i* är inte lika med 1 plus *i* är inte lika med 2 plus *i* är inte lika med 3 plus *a* multiplicerat med *i* är inte lika med 3 plus *a* *i*

```
% Well-known complex formula
\im {3i \neq 3\ii \neq 1 + i \neq 2 + \ii \neq 3 + a i \neq 3 + a \ii }
```

```
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  <mn>3</mn>
  <mi>i</mi>
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  <mn>3</mn>
  <mo>+</mo>
  <mi>a</mi>
  <mi>i</mi>
 </mrow>
</math>
```

e TO THE POWER OF BEGIN GROUP π i END GROUP EQUALS MINUS 1

e to the power of group π i end group equals minus 1

e upphöjt till grupp π i slut är lika med minus 1

```
% Well-known complex formula
\im {\ee^{\pi \ii } = -1}
```

```
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   <mrow>
    <mi>π</mi>
    <mi>i</mi>
   </mrow>
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  <mo>-</mo>
  <mn>1</mn>
 </mrow>
</math>
```

$$a + bi = \sqrt{a^2 + b^2}e^{i\arg(a+ib)}$$

a PLUS *b* *i* EQUALS THE SQUARE ROOT ROOTOF BEGIN GROUP *a* SQUARED PLUS *b* SQUARED END GROUP TIMES *e* TO THE POWER OF BEGIN GROUP *i* ARG FUNCTIONOF BEGIN GROUP *a* PLUS *i* *b* END GROUP END GROUP

a plus *b* *i* equals the square root of group *a* squared plus *b* squared end group times *e* to the power of group *i* the argument of group *a* plus *i* *b* end group end group

a plus *b* *i* är lika med kvadratroten av grupp *a* i kvadrat plus *b* i kvadrat slut multiplicerat med *e* upphöjt till grupp *i* argumentet av grupp *a* plus *i* *b* slut slut

```
% Do we need "times" before the \ee?
\im {a + b \ii = \sqrt{a^2 + b^2}\ee^{\ii\arg(a + \ii b)}}
```

```
<math>
 <mrow>
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  <mo>+</mo>
  <mi>b</mi>
  <mi>i</mi>
  <mo>=</mo>
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    <mi>i</mi>
    <mi>b</mi>
    <mo>)</mo>
   </mrow>
  </msup>
 </mrow>
</math>
```

CONJUGATE a PLUS b i EQUALS a MINUS b i

the conjugate of a plus b i equals a minus b i

konjugatet av a plus b i är lika med a minus b i

```
% Simple conjugate
\im {\conjugate{a + b \ii} = a - b \ii}
```

```
<math>
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    <mo>+</mo>
    <mi>b</mi>
    <mi>i</mi>
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  <mo>=</mo>
  <mi>a</mi>
  <mo>−</mo>
  <mi>b</mi>
  <mi>i</mi>
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</math>
```

$x^2 = -1 \implies x = \pm i$

x SQUARED EQUALS MINUS 1 IMPLIES x EQUALS PLUS MINUS i

x squared equals minus 1 implies x equals plus or minus i

x i kvadrat är lika med minus 1 implicerar x är lika med plus eller minus i

```
% Implication
\im {x^2 = -1 \implies x = \pm \ii}
```

```
<math>
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   <mn>2</mn>
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  <mo>-</mo>
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  <mo>⟹</mo>
  <mi>x</mi>
  <mo>=</mo>
  <mo>±</mo>
  <mi>i</mi>
 </mrow>
</math>
```

$\sqrt{x} = x^{1/2} \neq x^{1/3} = \sqrt[3]{x}$

THE SQUARE ROOT ROOTOF x EQUALS x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 2 END GROUP IS NOT EQUAL TO x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 3 END GROUP EQUALS THE ROOT WITH DEGREE 3 ROOTOF x

the square root of x equals x to the power of group 1 divided by 2 end group is not equal to x to the power of group 1 divided by 3 end group equals the root with degree 3 of x

kvadratroten av x är lika med x upphöjt till grupp 1 delat med 2 slut är inte lika med x upphöjt till grupp 1 delat med 3 slut är lika med roten ur med grad 3 av x

```
% Some radicals
\im {\sqrt{x} = x^{1/2} \neq x^{1/3} = \root[3]{x}}
```

```
<math>
 <mrow>
  <msqrt>
   <mi>x</mi>
  </msqrt>
  <mo>=</mo>
  <msup>
   <mi>x</mi>
   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>2</mn>
   </mrow>
  </msup>
  <mo>≠</mo>
  <msup>
   <mi>x</mi>
   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>3</mn>
   </mrow>
  </msup>
  <mo>=</mo>
  <mroot>
   <mi>x</mi>
   <mn>3</mn>
  </mroot>
 </mrow>
</math>
```

$$2\sqrt{x} = 2x^{1/2} \neq 2x^{1/3} = 2\sqrt[3]{x}$$

2 TIMES THE SQUARE ROOT ROOTOF x EQUALS 2 x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 2 END GROUP IS NOT EQUAL TO 2 x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 3 END GROUP EQUALS 2 TIMES THE ROOT WITH DEGREE 3 ROOTOF x

2 times the square root of x equals 2 x to the power of group 1 divided by 2 end group is not equal to 2 x to the power of group 1 divided by 3 end group equals 2 times the root with degree 3 of x

2 multiplicerat med kvadratroten av x är lika med 2 x upphöjt till grupp 1 delat med 2 slut är inte lika med 2 x upphöjt till grupp 1 delat med 3 slut är lika med 2 multiplicerat med roten ur med grad 3 av x

```
% Some radicals with multiplication
\im {2\sqrt{x} = 2x^{1/2} \neq 2x^{1/3} = 2\root[3]{x}}
```

```
<math>
 <mrow>
  <mn>2</mn>
  <msqrt>
   <mi>x</mi>
  </msqrt>
  <mo>=</mo>
  <mn>2</mn>
  <msup>
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   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>2</mn>
   </mrow>
  </msup>
  <mo>≠</mo>
  <mn>2</mn>
  <msup>
   <mi>x</mi>
   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>3</mn>
   </mrow>
  </msup>
  <mo>=</mo>
  <mn>2</mn>
  <mroot>
   <mi>x</mi>
   <mn>3</mn>
  </mroot>
 </mrow>
</math>
```

$a\sqrt{x} = ax^{1/2} \neq ax^{1/3} = a\sqrt[3]{x}$

a TIMES THE SQUARE ROOT ROOTOF x EQUALS a TIMES x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 2 END GROUP IS NOT EQUAL TO a TIMES x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 3 END GROUP EQUALS a TIMES THE ROOT WITH DEGREE 3 ROOTOF x

a times the square root of x equals a times x to the power of group 1 divided by 2 end group is not equal to a times x to the power of group 1 divided by 3 end group equals a times the root with degree 3 of x

a multiplicerat med kvadratroten av x är lika med a multiplicerat med x upphöjt till grupp 1 delat med 2 slut är inte lika med a multiplicerat med x upphöjt till grupp 1 delat med 3 slut är lika med a multiplicerat med roten ur med grad 3 av x

```
% Some radicals with multiplication
\im {a\sqrt{x} = ax^{1/2} \neq ax^{1/3} = a\root[3]{x}}
```

```
<math>
 <mrow>
  <mi>a</mi>
  <msqrt>
   <mi>x</mi>
  </msqrt>
  <mo>=</mo>
  <mi>a</mi>
  <msup>
   <mi>x</mi>
   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>2</mn>
   </mrow>
  </msup>
  <mo>≠</mo>
  <mi>a</mi>
  <msup>
   <mi>x</mi>
   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>3</mn>
   </mrow>
  </msup>
  <mo>=</mo>
  <mi>a</mi>
  <mroot>
   <mi>x</mi>
   <mn>3</mn>
  </mroot>
 </mrow>
</math>
```

$\sqrt{x}2 = x^{1/2}2 \neq x^{1/3}2 = \sqrt[3]{x}2$

THE SQUARE ROOT ROOTOF x TIMES 2 EQUALS x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 2 END GROUP TIMES 2 IS NOT EQUAL TO x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 3 END GROUP TIMES 2 EQUALS THE ROOT WITH DEGREE 3 ROOTOF x TIMES 2

the square root of x times 2 equals x to the power of group 1 divided by 2 end group times 2 is not equal to x to the power of group 1 divided by 3 end group times 2 equals the root with degree 3 of x times 2

kvadratroten av x multiplicerat med 2 är lika med x upphöjt till grupp 1 delat med 2 slut multiplicerat med 2 är inte lika med x upphöjt till grupp 1 delat med 3 slut multiplicerat med 2 är lika med roten ur med grad 3 av x multiplicerat med 2

```
% Some radicals with multiplication
% This is bad input!
\im {\sqrt{x}2 = x^{1/2}2 \neq x^{1/3}2 = \root[3]{x}2}
```

```
<math>
 <mrow>
  <msqrt>
   <mi>x</mi>
  </msqrt>
  <mn>2</mn>
  <mo>=</mo>
  <msup>
   <mi>x</mi>
   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>2</mn>
   </mrow>
  </msup>
  <mn>2</mn>
  <mo>≠</mo>
  <msup>
   <mi>x</mi>
   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>3</mn>
   </mrow>
  </msup>
  <mn>2</mn>
  <mo>=</mo>
  <mroot>
   <mi>x</mi>
   <mn>3</mn>
  </mroot>
  <mn>2</mn>
 </mrow>
</math>
```

$$\sqrt{x}\,\sqrt{y} = \sqrt{xy}$$

THE SQUARE ROOT ROOTOF x TIMES THE SQUARE ROOT ROOTOF y EQUALS THE SQUARE ROOT ROOTOF BEGIN GROUP x TIMES y END GROUP

the square root of x times the square root of y equals the square root of group x times y end group

kvadratroten av x multiplicerat med kvadratroten av y är lika med kvadratroten av grupp x multiplicerat med y slut

```
% Product of radicals
\im {\sqrt{x} \sqrt{y} = \sqrt{xy}}
```

```
<math>
 <mrow>
  <msqrt>
   <mi>x</mi>
  </msqrt>
  <msqrt>
   <mi>y</mi>
  </msqrt>
  <mo>=</mo>
  <msqrt>
   <mrow>
    <mi>x</mi>
    <mi>y</mi>
   </mrow>
  </msqrt>
 </mrow>
</math>
```

$\sqrt{x}a = x^{1/2}a \neq x^{1/3}a = \sqrt[3]{x}a$

THE SQUARE ROOT ROOTOF x TIMES a EQUALS x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 2 END GROUP TIMES a IS NOT EQUAL TO x TO THE POWER OF BEGIN GROUP 1 DIVIDED BY 3 END GROUP TIMES a EQUALS THE ROOT WITH DEGREE 3 ROOTOF x TIMES a

the square root of x times a equals x to the power of group 1 divided by 2 end group times a is not equal to x to the power of group 1 divided by 3 end group times a equals the root with degree 3 of x times a

kvadratroten av x multiplicerat med a är lika med x upphöjt till grupp 1 delat med 2 slut multiplicerat med a är inte lika med x upphöjt till grupp 1 delat med 3 slut multiplicerat med a är lika med roten ur med grad 3 av x multiplicerat med a

```
% Some radicals with multiplication
\im {\sqrt{x}a = x^{1/2}a \neq x^{1/3}a = \root[3]{x}a}
```

```
<math>
 <mrow>
  <msqrt>
   <mi>x</mi>
  </msqrt>
  <mi>a</mi>
  <mo>=</mo>
  <msup>
   <mi>x</mi>
   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>2</mn>
   </mrow>
  </msup>
  <mi>a</mi>
  <mo>≠</mo>
  <msup>
   <mi>x</mi>
   <mrow>
    <mn>1</mn>
    <mo>/</mo>
    <mn>3</mn>
   </mrow>
  </msup>
  <mi>a</mi>
  <mo>=</mo>
  <mroot>
   <mi>x</mi>
   <mn>3</mn>
  </mroot>
  <mi>a</mi>
 </mrow>
</math>
```

THE NATURAL NUMBERS IS A SUBSET OF THE INTEGERS IS A SUBSET OF THE RATIONAL NUMBERS IS A SUBSET OF THE REAL NUMBERS IS A SUBSET OF THE COMPLEX NUMBERS

the natural numbers is a subset of the integers is a subset of the rational numbers is a subset of the real numbers is a subset of the complex numbers

de naturliga talen är en delmängd av heltalen är en delmängd av de rationella talen är en delmängd av de rella talen är en delmängd av de komplexa talen

```
% Just a few numbersets with subsets
\im {\naturalnumbers \subset \integers \subset \rationals \subset \reals \subset \complexes}
```

```
<math>
 <mrow>
  <mi>ℕ</mi>
  <mo>⊂</mo>
  <mi>ℤ</mi>
  <mo>⊂</mo>
  <mi>ℚ</mi>
  <mo>⊂</mo>
  <mi>ℝ</mi>
  <mo>⊂</mo>
  <mi>ℂ</mi>
 </mrow>
</math>
```

THE NATURAL NUMBERS INTERSECTION THE REAL NUMBERS EQUALS THE NATURAL NUMBERS

the natural numbers intersection the real numbers equals the natural numbers

de naturliga talen snitt de rella talen är lika med de naturliga talen

```
% Just a few numbersets with intersection
\im {\naturalnumbers \cap \reals = \naturalnumbers}
```

```
<math>
 <mrow>
  <mi>ℕ</mi>
  <mo>∩</mo>
  <mi>ℝ</mi>
  <mo>=</mo>
  <mi>ℕ</mi>
 </mrow>
</math>
```

OPTIONAL BEGIN SET a BELONGS TO THE NATURAL NUMBERS SET:FENCE a is even END SET

the set a belongs to the natural numbers such that a is even end the set

mängden a tillhör de naturliga talen sådana att a is even slut mängden

```
% A set with a \fence. Notice that no group should be started after the fence
\im {\set{a \in \naturalnumbers \fence \mtext{\im{a} is even}}}
```

```
<math>
 <mrow>
  <mo>{</mo>
  <mrow>
   <mi>a</mi>
   <mo>∈</mo>
   <mi>ℕ</mi>
  </mrow>
  <mo>|</mo>
  <mrow><mi>a</mi><mtext> is even</mtext></mrow>
  <mo>}</mo>
 </mrow>
</math>
```

$$\mathbb{Q} = \left\{ \frac{p}{q} \middle| p, q \in \mathbb{Z} \land q \neq 0 \right\}$$

THE RATIONAL NUMBERS EQUALS OPTIONAL BEGIN SET THE FRACTION OF p AND q SET:FENCE p COMMA q BELONGS TO THE INTEGERS AND q IS NOT EQUAL TO 0 END SET

the rational numbers equals the set the fraction of p and q such that p comma q belongs to the integers and q is not equal to 0 end the set

de rationella talen är lika med mängden kvoten av p och q sådana att p komma q tillhör heltalen och q är inte lika med 0 slut mängden

```
% A set with a \fence. More conditions
\dm {\rationals = \set{\frac{p}{q} \fence p,q \in \integers \land q \neq 0}}
```

```
<math>
 <mrow>
  <mi>ℚ</mi>
  <mo>=</mo>
  <mrow>
   <mo>{</mo>
   <mfrac>
    <mi>p</mi>
    <mi>q</mi>
   </mfrac>
   <mo>|</mo>
   <mrow>
    <mi>p</mi>
    <mo>,</mo>
    <mi>q</mi>
    <mo>∈</mo>
    <mi>ℤ</mi>
    <mo>∧</mo>
    <mi>q</mi>
    <mo>≠</mo>
    <mn>0</mn>
   </mrow>
   <mo>}</mo>
  </mrow>
 </mrow>
</math>
```

FUNCTION f MAPS THE REAL NUMBERS TO THE REAL NUMBERS

the function f maps the real numbers to the real numbers

f avbildar de rella talen till de rella talen

```
% Maps colon is given by \maps (defined function)
\im {f \maps \reals \to \reals}
```

```
<math>
 <mrow>
  <mi>f</mi>
  <mo>:</mo>
  <mi>ℝ</mi>
  <mo>→</mo>
  <mi>ℝ</mi>
 </mrow>
</math>
```

sin MAPS THE REAL NUMBERS TO THE REAL NUMBERS

sin maps the real numbers to the real numbers

sin avbildar de rella talen till de rella talen

```
% Maps colon is given by \maps (named function)
\im {\sin \maps \reals \to \reals}
```

```
<math>
 <mrow>
  <mi>sin</mi>
  <mo>:</mo>
  <mi>ℝ</mi>
  <mo>→</mo>
  <mi>ℝ</mi>
 </mrow>
</math>
```

FUNCTION f MAPS AS x MAPS TO x PLUS exp FUNCTIONOF x

the function f is defined so that x maps to x plus exp of x

f är definierad så att x avbildas på x plus exp av x

```
% Maps as colon by \mapsas
\im {f \mapsas x \mapsto x + \exp(x)}
```

```
<math>
 <mrow>
  <mi>f</mi>
  <mo>:</mo>
  <mi>x</mi>
  <mo>↦</mo>
  <mi>x</mi>
  <mo>+</mo>
  <mi>exp</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
 </mrow>
</math>
```

$\sin\colon x \mapsto \sin(x)$

sin MAPS AS x MAPS TO sin FUNCTIONOF x

sin is defined so that x maps to sin of x

sin är definierad så att x avbildas på sin av x

```
% Maps as colon by \mapsas
\im {\sin \mapsas x \mapsto \sin(x)}
```

```
<math>
 <mrow>
  <mi>sin</mi>
  <mo>:</mo>
  <mi>𝑥</mi>
  <mo>↦</mo>
  <mi>sin</mi>
  <mo>(</mo>
  <mi>𝑥</mi>
  <mo>)</mo>
 </mrow>
</math>
```

x MAPS TO LN FUNCTIONOF x

x maps to the natural logarithm of x

x avbildas på den naturliga logaritmen av x

```
% Logarithms, spelled out
% Todo, add for other or remove for ln
\im {x \mapsto \ln(x)}
```

```
<math>
 <mrow>
  <mi>x</mi>
  <mo>↦</mo>
  <mi>ln</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
 </mrow>
</math>
```

sin x EQUALS sin FUNCTIONOF x IS NOT EQUAL TO sin FUNCTIONOF x PLUS 1 IS NOT EQUAL TO sin FUNCTIONOF BEGIN GROUP x PLUS 1 END GROUP

sin x equals sin of x is not equal to sin of x plus 1 is not equal to sin of group x plus 1 end group

sin x är lika med sin av x är inte lika med sin av x plus 1 är inte lika med sin av grupp x plus 1 slut

```
% The grouping is sometimes needed
\im {\sin x = \sin(x) \neq \sin(x) + 1 \neq \sin(x + 1)}
```

```
<math>
 <mrow>
  <mi>sin</mi>
  <mi>x</mi>
  <mo>=</mo>
  <mi>sin</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
  <mo>≠</mo>
  <mi>sin</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
  <mo>+</mo>
  <mn>1</mn>
  <mo>≠</mo>
  <mi>sin</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>+</mo>
  <mn>1</mn>
  <mo>)</mo>
 </mrow>
</math>
```

FUNCTION f EQUALS sin

the function f equals sin

f är lika med sin

```
% Just a function
\im {f = \sin}
```

```
<math>
 <mrow>
  <mi>f</mi>
  <mo>=</mo>
  <mi>sin</mi>
 </mrow>
</math>
```

$\lim a_k = -\infty$

LIM a SUB k EQUALS MINUS INFINITY

the limit a with lower index k equals minus infinity

gränsvärdet a med undre index k är lika med minus oändligheten

```
% Just a limit
\im {\lim a_{k} = -\infty}
```

```
<math>
 <mrow>
  <mi>lim</mi>
  <msub>
   <mi>a</mi>
   <mi>k</mi>
  </msub>
  <mo>=</mo>
  <mo>-</mo>
  <mi>∞</mi>
 </mrow>
</math>
```

LIM LIMITSUB BEGIN GROUP k TENDS TO PLUS INFINITY END GROUP PAUSE OPERATOROF a SUB k

the limit as group k tends to plus infinity end group , of a with lower index k

gränsvärdet då grupp k går mot plus oändligheten slut , av a med undre index k

```
% A limit with sub on lim
\im {\lim_{k \tendsto +\infty} a_{k}}
```

```
<math>
 <mrow>
  <msub>
   <mi>lim</mi>
   <mrow>
    <mi>k</mi>
    <mo>→</mo>
    <mo>+</mo>
    <mi>∞</mi>
   </mrow>
  </msub>
  <msub>
   <mi>a</mi>
   <mi>k</mi>
  </msub>
 </mrow>
</math>
```

LIM LIMITSUB BEGIN GROUP k TENDS TO PLUS INFINITY END GROUP PAUSE OPERATOROF a SUB k EQUALS MINUS INFINITY

the limit as group k tends to plus infinity end group , of a with lower index k equals minus infinity

gränsvärdet då grupp k går mot plus oändligheten slut , av a med undre index k är lika med minus oändligheten

```
% Using index (__)
\im {\lim__{k \tendsto +\infty} a__{k} = -\infty}
```

```
<math>
 <mrow>
  <msub>
   <mi>lim</mi>
   <mrow>
    <mi>k</mi>
    <mo>→</mo>
    <mo>+</mo>
    <mi>∞</mi>
   </mrow>
  </msub>
  <msub>
   <mi>a</mi>
   <mi>k</mi>
  </msub>
  <mo>=</mo>
  <mo>−</mo>
  <mi>∞</mi>
 </mrow>
</math>
```

$$\lim \frac{a_k}{b_k}$$

LIM THE FRACTION OF BEGIN NUMERATOR a SUB k END NUMERATOR AND BEGIN DENOMINATOR b SUB k END DENOMINATOR

the limit the fraction of numerator a with lower index k end numerator and denominator b with lower index k end denominator

gränsvärdet kvoten av täljare a med undre index k avsluta täljare och nämnare b med undre index k avsluta nämnare

```
% Limit and fractin (no times inbetween)
\dm {\lim \frac{a__{k}}{b__{k}}}
```

```
<math>
 <mrow>
  <mi>lim</mi>
  <mfrac>
   <mrow>
    <msub>
     <mi>a</mi>
     <mi>k</mi>
    </msub>
   </mrow>
   <mrow>
    <msub>
     <mi>b</mi>
     <mi>k</mi>
    </msub>
   </mrow>
  </mfrac>
 </mrow>
</math>
```

$$\lim_{k \to +\infty} \frac{A_k}{B_k}$$

LIM LIMITSUB BEGIN GROUP k TENDS TO PLUS INFINITY END GROUP PAUSE OPERATOROF THE FRACTION OF BEGIN NUMERATOR A SUB k END NUMERATOR AND BEGIN DENOMINATOR B SUB k END DENOMINATOR

the limit as group k tends to plus infinity end group , of the fraction of numerator A with lower index k end numerator and denominator B with lower index k end denominator

gränsvärdet då grupp k går mot plus oändligheten slut , av kvoten av täljare A med undre index k avsluta täljare och nämnare B med undre index k avsluta nämnare

```
% Limit and fraction with sub on lim
\dm {\lim_{k \tendsto +\infty} \frac{A__k}{B__k}}
```

```
<math>
 <mrow>
  <msub>
   <mi>lim</mi>
   <mrow>
    <mi>k</mi>
    <mo>→</mo>
    <mo>+</mo>
    <mi>∞</mi>
   </mrow>
  </msub>
  <mfrac>
   <mrow>
    <msub>
     <mi>A</mi>
     <mi>k</mi>
    </msub>
   </mrow>
   <mrow>
    <msub>
     <mi>B</mi>
     <mi>k</mi>
    </msub>
   </mrow>
  </mfrac>
 </mrow>
</math>
```

$f(x) \to A$ as $x \to a$

FUNCTION f FUNCTIONOF x TENDS TO A as x TENDS TO a

the function f of x tends to A as x tends to a

f av x går mot A as x går mot a

```
% Should be two formulas, but in this document we only show the last one
\im {f(x) \tendsto A \mtext{ as } x \tendsto a}
```

```
<math>
 <mrow>
  <mi>f</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
  <mo>→</mo>
  <mi>A</mi>
  <mtext> as </mtext>
  <mi>x</mi>
  <mo>→</mo>
  <mi>a</mi>
 </mrow>
</math>
```

$$\lim_{x \to 0} \frac{\sin(x)}{x} = 1$$

LIM LIMITSUB BEGIN GROUP x TENDS TO 0 END GROUP PAUSE OPERATOROF THE FRACTION OF BEGIN NUMERATOR sin FUNCTIONOF BEGIN GROUP x END GROUP END NUMERATOR AND x EQUALS 1

the limit as group x tends to 0 end group , of the fraction of numerator sin of group x end group end numerator and x equals 1

gränsvärdet då grupp x går mot 0 slut , av kvoten av täljare sin av grupp x slut avsluta täljare och x är lika med 1

```
% Just a standard limit
\dm {\lim_{x \tendsto 0} \frac{\sin (x)}{x} = 1}
```

```
<math>
 <mrow>
  <msub>
   <mi>lim</mi>
   <mrow>
    <mi>x</mi>
    <mo>→</mo>
    <mn>0</mn>
   </mrow>
  </msub>
  <mfrac>
   <mrow>
    <mi>sin</mi>
    <mo>(</mo>
    <mi>x</mi>
    <mo>)</mo>
   </mrow>
   <mi>x</mi>
  </mfrac>
  <mo>=</mo>
  <mn>1</mn>
 </mrow>
</math>
```

$$\lim_{f(x)\to 0} g(x)$$

LIM LIMITSUB BEGIN GROUP FUNCTION f FUNCTIONOF x TENDS TO 0 END GROUP PAUSE OPERATOROF FUNCTION g FUNCTIONOF x

the limit as group the function f of x tends to 0 end group , of the function g of x

gränsvärdet då grupp f av x går mot 0 slut , av g av x

```
% More complicated in the sub.
\dm {\lim_{f(x) \tendsto 0} g(x)}
```

```
<math>
 <mrow>
  <msub>
   <mi>lim</mi>
   <mrow>
    <mi>f</mi>
    <mo>(</mo>
    <mi>x</mi>
    <mo>)</mo>
    <mo>→</mo>
    <mn>0</mn>
   </mrow>
  </msub>
  <mi>g</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
 </mrow>
</math>
```

$f'(x) + f''(x) + f'''(x) + f''''(x)$

FUNCTION f PRIME PRIMEOF x PLUS FUNCTION f DOUBLE PRIME PRIMEOF x PLUS FUNCTION f TRIPLE PRIME PRIMEOF x PLUS FUNCTION f QUADRUPLE PRIME PRIMEOF x

the function f prime of x plus the function f double prime of x plus the function f triple prime of x plus the function f quadruple prime of x

f prim av x plus f bis av x plus f trippelprim av x plus f kvadrupelprim av x

```
% Some derivatives
% Do we want "The function" here? (That is a more general question)
\im {f'(x) + f''(x) + f'''(x) + f''''(x)}
```

```
<math>
 <mrow>
  <msup>
   <mi>f</mi>
   <mo>′</mo>
  </msup>
  <mo>(</mo>
  <mi>x</mi>
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  <msup>
   <mi>f</mi>
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  <mi>x</mi>
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   <mi>f</mi>
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   <mo>⁗</mo>
  </msup>
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  <mi>x</mi>
  <mo>)</mo>
 </mrow>
</math>
```

$f' + h' + h'' + h''' + h''''$

FUNCTION f PRIME PLUS h PRIME PLUS h DOUBLE PRIME PLUS h TRIPLE PRIME PLUS h QUADRUPLE PRIME

the function f prime plus h prime plus h double prime plus h triple prime plus h quadruple prime

f prim plus h prim plus h bis plus h trippelprim plus h kvadrupelprim

```
% Variable primed
\im {f' + h' + h'' + h''' + h''''}
```

```
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  <msup>
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   <mi>h</mi>
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  </msup>
 </mrow>
</math>
```

secondderivative OPERATOROF FUNCTION f EQUALS FUNCTION f DOUBLE PRIME

secondderivative of the function f equals the function f double prime

secondderivative av f är lika med f bis

```
% More derivatives
\im { \secondderivative{f} = f'' }
```

```
<math>
 <mrow>
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    <mi>f</mi>
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   </msup>
  </mrow>
  <mo>=</mo>
  <msup>
   <mi>f</mi>
   <mo>″</mo>
  </msup>
 </mrow>
</math>
```

sin DOUBLE PRIME PRIMEOF x EQUALS MINUS sin FUNCTIONOF x EQUALS sin FUNCTIONOF BEGIN GROUP x PLUS π END GROUP

sin double prime of x equals minus sin of x equals sin of group x plus π end group

sin bis av x är lika med minus sin av x är lika med sin av grupp x plus π slut

```
% An example with derivative
\im {\sin''(x) = -\sin(x) = \sin(x + \pi)}
```

```
<math>
 <mrow>
  <msup>
   <mi>sin</mi>
   <mo>″</mo>
  </msup>
  <mo>(</mo>
  <mi>x</mi>
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  <mo>=</mo>
  <mo>-</mo>
  <mi>sin</mi>
  <mo>(</mo>
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  <mo>=</mo>
  <mi>sin</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>+</mo>
  <mi>π</mi>
  <mo>)</mo>
 </mrow>
</math>
```

$f_1'(x) + f_1^{2\prime}(x)$

FUNCTION f SUB 1 PRIME PRIMEOF BEGIN GROUP x END GROUP PLUS BEGIN GROUP FUNCTION f SUB 1 SQUARED END GROUP PRIME PRIMEOF BEGIN GROUP x END GROUP

the function f with lower index 1 prime of group x end group plus group the function f with lower index 1 squared end group prime of group x end group

f med undre index 1 prim av grupp x slut plus grupp f med undre index 1 i kvadrat slut prim av grupp x slut

```
% Even more derivatives, also with indices
\im {f__1'(x) + f__1^^2'(x) }
```

```
<math>
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  <msup>
   <mrow>
    <msub>
     <mi>𝑓</mi>
     <mn>1</mn>
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  <mo>+</mo>
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     <mn>2</mn>
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   <mo>′</mo>
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  <mo>(</mo>
  <mi>𝑥</mi>
  <mo>)</mo>
 </mrow>
</math>
```

$$(f)'(x) + (f)'(x) + (f)'(x) + (f)'(x)$$

BEGIN GROUP FUNCTION f END GROUP PRIME TIMES BEGIN GROUP x END GROUP PLUS BEGIN GROUP FUNCTION f END GROUP PRIME NOTIMES BEGIN GROUP x END GROUP PLUS DERIVATIVE BEGIN GROUP FUNCTION f END GROUP OPERATOROF TIMES x PLUS DERIVATIVE BEGIN GROUP FUNCTION f END GROUP OPERATOROF NOTIMES BEGIN GROUP x END GROUP

group the function f end group prime times group x end group plus group the function f end group prime , group x end group plus the derivative group the function f end group of times x plus the derivative group the function f end group of , group x end group

grupp f slut prim multiplicerat med grupp x slut plus grupp f slut prim , grupp x slut plus derivatan grupp f slut av multiplicerat med x plus derivatan grupp f slut av , grupp x slut

```
% Without \notimes we get a times. See also next example
\im {(f)'(x) + (f)'\notimes(x) + \derivative{(f)}(x) + \derivative{(f)}\notimes(x)}
```

```
<math>
 <mrow>
  <mo>(</mo>
  <mi>𝑓</mi>
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  </mrow>
  <mo></mo>
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  <mo>)</mo>
 </mrow>
</math>
```

BEGIN GROUP FUNCTION f PLUS FUNCTION g END GROUP PRIME TIMES BEGIN GROUP FUNCTION f PLUS FUNCTION g END GROUP

group the function f plus the function g end group prime times group the function f plus the function g end group

grupp f plus g slut prim multiplicerat med grupp f plus g slut

```
% Here we want times, so we cannot block it in previous example
\im {(f+g)'(f+g) }
```

```
<math>
 <mrow>
  <mo>(</mo>
  <mi>f</mi>
  <mo>+</mo>
  <mi>g</mi>
  <msup>
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  <mi>f</mi>
  <mo>+</mo>
  <mi>g</mi>
  <mo>)</mo>
 </mrow>
</math>
```

$(f_1)^2 = (f_1)^2 \neq f_1^2$

BEGIN GROUP FUNCTION f SUB 1 END GROUP SQUARED EQUALS BEGIN GROUP FUNCTION f SUB 1 END GROUP SQUARED IS NOT EQUAL TO FUNCTION f SUB 1 SQUARED

group the function f with lower index 1 end group squared equals group the function f with lower index 1 end group squared is not equal to the function f with lower index 1 squared

grupp f med undre index 1 slut i kvadrat är lika med grupp f med undre index 1 slut i kvadrat är inte lika med f med undre index 1 i kvadrat

```
% More indices
\im {(f__1)^2 = (f_1)^2 \neq f_1^2 }
```

```
<math>
 <mrow>
  <mo>(</mo>
  <msub>
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   <mn>1</mn>
  </msub>
  <msup>
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  <msup>
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  <mo>≠</mo>
  <msubsup>
   <mi>f</mi>
   <mn>1</mn>
   <mn>2</mn>
  </msubsup>
 </mrow>
</math>
```

BEGIN GROUP x SUB 1 END GROUP SQUARED IS NOT EQUAL TO x SUB 1 SQUARED

group x with lower index 1 end group squared is not equal to x with lower index 1 squared

grupp x med undre index 1 slut i kvadrat är inte lika med x med undre index 1 i kvadrat

```
% A few more
\im {(x_1)^2 \neq x_1^2 }
```

```
<math>
 <mrow>
  <mo>(</mo>
  <msub>
   <mi>x</mi>
   <mn>1</mn>
  </msub>
  <msup>
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  </msup>
  <mo>≠</mo>
  <msubsup>
   <mi>x</mi>
   <mn>1</mn>
   <mn>2</mn>
  </msubsup>
 </mrow>
</math>
```

$h_1 + h_1 + h^1 + h^1$

h SUB 1 PLUS *h* SUB 1 PLUS *h* TO THE POWER OF 1 PLUS *h* SUPINDEX 1

h with lower index 1 plus *h* with lower index 1 plus *h* to the power of 1 plus *h* with upper index 1

h med undre index 1 plus *h* med undre index 1 plus *h* upphöjt till 1 plus *h* med övre index 1

```
% More indiced, we probably can remove some
\im {h_1 + h__1 + h^1 + h^^1}
```

```
<math>
 <mrow>
  <msub>
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   <mn>1</mn>
  </msub>
  <mo>+</mo>
  <msub>
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  </msup>
  <mo>+</mo>
  <msup>
   <mi>h</mi>
   <mn>1</mn>
  </msup>
 </mrow>
</math>
```

$${}_{t}{}_{s}h^{\lambda}{}_{\kappa}{}_{\mu}{}^{\nu}{}_{\phi}$$

h PRESCRIPTS PRESUB t PRESUB s POSTSCRIPTS POSTSUPER λ POSTSUB κ POSTSUB μ POSTSUPER ν POSTSUB ϕ END SCRIPTS

h prescripts sub t sub s postscripts super λ sub κ sub μ super ν sub ϕ end scripts

h preskript nedsänkt t nedsänkt s postskript upphöjd λ nedsänkt κ nedsänkt μ upphöjd ν nedsänkt ϕ slut skript

```
% Amazing multiscript example
\im{
    h_{}      ^{\lambda} ___{s}
     _{\kappa}^{} % \noscript  %
     _{\mu}   ^{} % \noscript  %
     _{}      ^{\nu}     ___{t}
     _{\phi}  ^{} % \noscript
    }
```

```
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   <mi>λ</mi>
   <mi>κ</mi>
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   <mi>ν</mi>
   <mi>ϕ</mi>
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   <mi>t</mi>
   <mtext/>
   <mi>s</mi>
   <mtext/>
  </mmultiscripts>
 </mrow>
</math>
```

Γ POSTSCRIPTS POSTSUB 1 POSTSUPER 2 POSTSUB 3 POSTSUPER 4 END SCRIPTS IS NOT EQUAL TO Γ POSTSCRIPTS POSTSUB 1 POSTSUPER 2 POSTSUB 3 POSTSUPER 4 END SCRIPTS

Γ postscripts sub 1 super 2 sub 3 super 4 end scripts is not equal to Γ postscripts sub 1 super 2 sub 3 super 4 end scripts

Γ postskript nedsänkt 1 upphöjd 2 nedsänkt 3 upphöjd 4 slut skript är inte lika med Γ postskript nedsänkt 1 upphöjd 2 nedsänkt 3 upphöjd 4 slut skript

```
% Multiscripts
\im {\Gamma_1^2_3^4 \neq \Gamma__1^^2__3^^4}
```

```
<math>
 <mrow>
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   <mi>Γ</mi>
   <mn>1</mn>
   <mn>2</mn>
   <mn>3</mn>
   <mn>4</mn>
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  <mo>≠</mo>
  <mmultiscripts>
   <mi>Γ</mi>
   <mn>1</mn>
   <mn>2</mn>
   <mn>3</mn>
   <mn>4</mn>
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 </mrow>
</math>
```

Γ POSTSCRIPTS POSTSUB 1 POSTSUPER 2 POSTSUB 3 POSTSUPER 4 END SCRIPTS IS NOT EQUAL TO Γ POSTSCRIPTS POSTSUB 1 POSTSUPER 2 POSTSUB 3 POSTSUPER 4 END SCRIPTS

Γ postscripts sub 1 super 2 sub 3 super 4 end scripts is not equal to Γ postscripts sub 1 super 2 sub 3 super 4 end scripts

Γ postskript nedsänkt 1 upphöjd 2 nedsänkt 3 upphöjd 4 slut skript är inte lika med Γ postskript nedsänkt 1 upphöjd 2 nedsänkt 3 upphöjd 4 slut skript

```
% Even more multiscripts
\im {\Gamma__1^^2__3^^4 \neq \Gamma__1^^2^^{}__3^^4}
```

```
<math>
 <mrow>
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   <mi>Γ</mi>
   <mn>1</mn>
   <mn>2</mn>
   <mn>3</mn>
   <mn>4</mn>
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  <mmultiscripts>
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   <mn>3</mn>
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   <mtext/>
   <mn>4</mn>
  </mmultiscripts>
 </mrow>
</math>
```

F PRESCRIPTS PRESUB 2 POSTSCRIPTS POSTSUB 1 END SCRIPTS

F prescripts sub 2 postscripts sub 1 end scripts

F preskript nedsänkt 2 postskript nedsänkt 1 slut skript

```
% One example with prescript
The hypergeometric function \im {F____2__1}
```

```
<math>
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</math>
```

$$\sum_{n=1}^{+\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$$

SUM OPERATORSUBSUPFROM BEGIN GROUP n EQUALS 1 END GROUP OPERATORSUBSUPTO BEGIN GROUP PLUS INFINITY END GROUP PAUSE OPERATOROF THE FRACTION OF 1 AND BEGIN DENOMINATOR n SQUARED END DENOMINATOR EQUALS THE FRACTION OF BEGIN NUMERATOR π SQUARED END NUMERATOR AND 6

the sum from group n equals 1 end group to group plus infinity end group , of the fraction of 1 and denominator n squared end denominator equals the fraction of numerator π squared end numerator and 6

summan från grupp n är lika med 1 slut till grupp plus oändligheten slut , av kvoten av 1 och nämnare n i kvadrat avsluta nämnare är lika med kvoten av täljare π i kvadrat avsluta täljare och 6

```
% A sum and a fraction
\dm {\sum_{n = 1}^{+\infty} \frac{1}{n^2} = \frac{\pi^2}{6}}
```

```
<math>
 <mrow>
  <msubsup>
   <mo>∑</mo>
   <mrow>
    <mi>n</mi>
    <mo>=</mo>
    <mn>1</mn>
   </mrow>
   <mrow>
    <mo>+</mo>
    <mi>∞</mi>
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  </msubsup>
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     <mn>2</mn>
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   </mrow>
  </mfrac>
  <mo>=</mo>
  <mfrac>
   <mrow>
    <msup>
     <mi>π</mi>
     <mn>2</mn>
    </msup>
   </mrow>
   <mn>6</mn>
  </mfrac>
 </mrow>
</math>
```

$$\sum_{n\in\mathbb{N}} \frac{1}{n^2} = \frac{\pi^2}{6}$$

SUM INTEGRALSUB BEGIN GROUP n BELONGS TO THE NATURAL NUMBERS END GROUP PAUSE OPERATOROF THE FRACTION OF 1 AND BEGIN DENOMINATOR n SQUARED END DENOMINATOR EQUALS THE FRACTION OF BEGIN NUMERATOR π SQUARED END NUMERATOR AND 6

the sum over group n belongs to the natural numbers end group , of the fraction of 1 and denominator n squared end denominator equals the fraction of numerator π squared end numerator and 6

summan över grupp n tillhör de naturliga talen slut , av kvoten av 1 och nämnare n i kvadrat avsluta nämnare är lika med kvoten av täljare π i kvadrat avsluta täljare och 6

```
% A sum with only sub index, and a fraction
\dm {\sum_{n \in \naturalnumbers} \frac{1}{n^2} = \frac{\pi^2}{6}}
```

```
<math>
 <mrow>
  <msub>
   <mo>∑</mo>
   <mrow>
    <mi>n</mi>
    <mo>∈</mo>
    <mi>ℕ</mi>
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     <mn>2</mn>
    </msup>
   </mrow>
   <mn>6</mn>
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</math>
```

$$\sin x = \prod_{n=1}^{+\infty}\left(1 - \frac{x^2}{\pi^2 n^2}\right)$$

sin x EQUALS PRODUCT OPERATORSUBSUPFROM BEGIN GROUP n EQUALS 1 END GROUP OPERATORSUBSUPTO BEGIN GROUP PLUS INFINITY END GROUP PAUSE OPERATOROF OPTIONAL BEGIN BEGIN FENCED 1 MINUS THE FRACTION OF BEGIN NUMERATOR x SQUARED END NUMERATOR AND BEGIN DENOMINATOR π SQUARED n SQUARED END DENOMINATOR END FENCED

sin x equals the product from group n equals 1 end group to group plus infinity end group , of fenced 1 minus the fraction of numerator x squared end numerator and denominator π squared n squared end denominator end fenced

sin x är lika med produkten från grupp n är lika med 1 slut till grupp plus oändligheten slut , av grupp 1 minus kvoten av täljare x i kvadrat avsluta täljare och nämnare π i kvadrat n i kvadrat avsluta nämnare slut grupp

```
% A product followed by a delimitered parenthesis
\dm {\sin x = \prod_{n = 1}^{+\infty} \left(1 - \frac{x^2}{\pi^2n^2}\right)}
```

```
<math>
 <mrow>
  <mi>sin</mi>
  <mi>x</mi>
  <mo>=</mo>
  <msubsup>
   <mo>∏</mo>
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  </mrow>
 </mrow>
</math>
```

$$\sin x = \prod_{n=1}^{+\infty}\left(1 - \frac{x^2}{\pi^2 n^2}\right)$$

sin x EQUALS PRODUCT OPERATORSUBSUPFROM BEGIN GROUP n EQUALS 1 END GROUP OPERATORSUBSUPTO BEGIN GROUP PLUS INFINITY END GROUP PAUSE OPERATOROF OPTIONAL BEGIN PARENTHESIS 1 MINUS THE FRACTION OF BEGIN NUMERATOR x SQUARED END NUMERATOR AND BEGIN DENOMINATOR π SQUARED n SQUARED END DENOMINATOR END PARENTHESIS

sin x equals the product from group n equals 1 end group to group plus infinity end group , of parenthesis 1 minus the fraction of numerator x squared end numerator and denominator π squared n squared end denominator end parenthesis

sin x är lika med produkten från grupp n är lika med 1 slut till grupp plus oändligheten slut , av parentes 1 minus kvoten av täljare x i kvadrat avsluta täljare och nämnare π i kvadrat n i kvadrat avsluta nämnare slut parentes

```
% A product followed by a fence
\dm {\sin x = \prod_{n = 1}^{+\infty} \parenthesis{1 - \frac{x^2}{\pi^2n^2}}}
```

```
<math>
 <mrow>
  <mi>sin</mi>
  <mi>x</mi>
  <mo>=</mo>
  <msubsup>
   <mo>∏</mo>
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       <mn>2</mn>
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     </mrow>
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       <mn>2</mn>
      </msup>
     </mrow>
    </mfrac>
   </mrow>
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  </mrow>
 </mrow>
</math>
```

$$\int_a^b f'(x)\,dx = f(b) - f(a)$$

INTEGRAL OPERATORSUBSUPFROM a OPERATORSUBSUPTO b PAUSE OPERATOROF FUNCTION f PRIME PRIMEOF x DIFFERENTIAL x EQUALS FUNCTION f FUNCTIONOF b MINUS FUNCTION f FUNCTIONOF a

integral from a to b , of the function f prime of x d x equals the function f of b minus the function f of a

integral från a till b , av f prim av x d x är lika med f av b minus f av a

```
% A simple integral with limits
\dm {\int_{a}^{b} f'(x) \dd x = f(b) - f(a)}
```

```
<math>
 <mrow>
  <msubsup>
   <mo>∫</mo>
   <mi>a</mi>
   <mi>b</mi>
  </msubsup>
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  <mi>f</mi>
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  <mi>b</mi>
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  <mo>−</mo>
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  <mo>(</mo>
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</math>
```

$$\int_{x=a}^{b} f'(x)\,dx = f(b) - f(a)$$

INTEGRAL OPERATORSUBSUPFROM BEGIN GROUP x EQUALS a END GROUP OPERATORSUBSUPTO b PAUSE OPERATOROF FUNCTION f PRIME PRIMEOF x DIFFERENTIAL x EQUALS FUNCTION f FUNCTIONOF b MINUS FUNCTION f FUNCTIONOF a

integral from group x equals a end group to b , of the function f prime of x d x equals the function f of b minus the function f of a

integral från grupp x är lika med a slut till b , av f prim av x d x är lika med f av b minus f av a

```
% A bit more complex lower limit
\dm {\int_{x=a}^{b} f'(x) \dd x = f(b) - f(a)}
```

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    <mi>a</mi>
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  <mo>−</mo>
  <mi>f</mi>
  <mo>(</mo>
  <mi>a</mi>
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 </mrow>
</math>
```

$$\int_{\Omega} f \, d\mu = 0$$

INTEGRAL INTEGRALSUB Ω PAUSE OPERATOROF FUNCTION f DIFFERENTIAL μ EQUALS 0

integral over Ω , of the function f d μ equals 0

integral över Ω , av f d μ är lika med 0

```
% An integral over the domain
\dm {\int_{\Omega} f \dd \mu = 0}
```

```
<math>
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   <mo>∫</mo>
   <mi>Ω</mi>
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  <mi>f</mi>
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  <mi>μ</mi>
  <mo>=</mo>
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</math>
```

$$\int \frac{1}{1+x^2}\, dx$$

INTEGRAL THE FRACTION OF 1 AND BEGIN DENOMINATOR 1 PLUS x SQUARED END DENOMINATOR DIFFERENTIAL x

integral the fraction of 1 and denominator 1 plus x squared end denominator d x

integral kvoten av 1 och nämnare 1 plus x i kvadrat avsluta nämnare d x

```
% An integral followed by a fraction
\dm {\int \frac{1}{1 + x^2} \dd x}
```

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<math>
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   <mn>1</mn>
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    <mo>+</mo>
    <msup>
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     <mn>2</mn>
    </msup>
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  </mfrac>
  <mi>d</mi>
  <mi>x</mi>
 </mrow>
</math>
```

$$\int_0^1 \frac{1}{1+x^2}\,dx$$

INTEGRAL OPERATORSUBSUPFROM 0 OPERATORSUBSUPTO 1 PAUSE OPERATOROF THE FRACTION OF 1 AND BEGIN DENOMINATOR 1 PLUS x SQUARED END DENOMINATOR DIFFERENTIAL x

integral from 0 to 1 , of the fraction of 1 and denominator 1 plus x squared end denominator d x

integral från 0 till 1 , av kvoten av 1 och nämnare 1 plus x i kvadrat avsluta nämnare d x

```
% An integral with limits, followed by a fraction
\dm {\int_0^1 \frac{1}{1 + x^2} \dd x}
```

```
<math>
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   <mo>∫</mo>
   <mn>0</mn>
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 </mrow>
</math>
```

$\left(x^1, x^2, x^3\right) \neq \left(x^1, x^2, x^3\right) = (x_1, x_2, x_3)$

OPTIONAL BEGIN TUPLE x TO THE POWER OF 1 COMMA x SQUARED COMMA x CUBED END TUPLE IS NOT EQUAL TO OPTIONAL BEGIN TUPLE x SUPINDEX 1 COMMA x SUPINDEX 2 COMMA x SUPINDEX 3 END TUPLE EQUALS OPTIONAL BEGIN TUPLE x SUB 1 COMMA x SUB 2 COMMA x SUB 3 END TUPLE

the tuple x to the power of 1 comma x squared comma x cubed end the tuple is not equal to the tuple x with upper index 1 comma x with upper index 2 comma x with upper index 3 end the tuple equals the tuple x with lower index 1 comma x with lower index 2 comma x with lower index 3 end the tuple

tupeln x upphöjt till 1 komma x i kvadrat komma x i kubik slut tupeln är inte lika med tupeln x med övre index 1 komma x med övre index 2 komma x med övre index 3 slut tupeln är lika med tupeln x med undre index 1 komma x med undre index 2 komma x med undre index 3 slut tupeln

```
% Some tuples
\im {\tuple{x^1, x^2, x^3} \neq \tuple{x^^1, x^^2, x^^3} = \tuple{x__1, x__2, x__3}}
```

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     <mi>x</mi>
     <mn>3</mn>
    </msub>
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   <mo>)</mo>
  </mrow>
 </mrow>
</math>
```

A UNION THE COMPLEMENT OF A

A union the complement of A

A union komplementet av A

```
% Complement shall not give times
\im {A \cup \complement A}
```

```
<math>
 <mrow>
  <mi>A</mi>
  <mo>∪</mo>
  <mi>∁</mi>
  <mi>A</mi>
 </mrow>
</math>
```

$\forall x \in A \exists y \in B : |x - y| > 1$

FOR ALL x BELONGS TO A THERE EXISTS y BELONGS TO B : OPTIONAL BEGIN ABS x MINUS y END ABS IS GREATER THAN 1

for all x belongs to A there exists y belongs to B : the absolute value x minus y end the absolute value is greater than 1

för alla x tillhör A det existerar y tillhör B : absolutbeloppet x minus y slut absolutbeloppet är större än 1

```
% Quantifiers
% We need to think about unary operators (class) in a broader sense
\im {\forall x \in A \exists y \in B: \abs{x - y} > 1}
```

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<math>
 <mrow>
  <mi>∀</mi>
  <mi>x</mi>
  <mo>∈</mo>
  <mi>A</mi>
  <mi>∃</mi>
  <mi>y</mi>
  <mo>∈</mo>
  <mi>B</mi>
  <mo>:</mo>
  <mrow>
   <mo>|</mo>
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    <mi>x</mi>
    <mo>−</mo>
    <mi>y</mi>
   </mrow>
   <mo>|</mo>
  </mrow>
  <mo>&gt;</mo>
  <mn>1</mn>
 </mrow>
</math>
```

ADJOINT OPERATOROF T TIMES T EQUALS T TIMES ADJOINT OPERATOROF T IS NOT EQUAL TO ADJOINT OPERATOROF T

the adjoint of T times T equals T times the adjoint of T is not equal to the adjoint of T

adjunkten av T multiplicerat med T är lika med T multiplicerat med adjunkten av T är inte lika med adjunkten av T

```
% Right function adjoint
\im {\adjoint{T}T = T\adjoint{T} \neq \adjoint{T}}
```

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    <mi>T</mi>
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</math>
```

A TIMES ADJ FUNCTIONOF A EQUALS DET FUNCTIONOF A TIMES I

A times the adjugate of A equals the determinant of A times I

A multiplicerat med adjungerade av A är lika med determinanten av A multiplicerat med I

```
% Same comment as for adjoint
\im {A \adj(A) = \det(A) I}
```

```
<math>
 <mrow>
  <mi>A</mi>
  <mi>adj</mi>
  <mo>(</mo>
  <mi>A</mi>
  <mo>)</mo>
  <mo>=</mo>
  <mi>det</mi>
  <mo>(</mo>
  <mi>A</mi>
  <mo>)</mo>
  <mi>I</mi>
 </mrow>
</math>
```

$$(u * v)(x) := \int_{\mathbb{R}} u(\xi)\, v(x - \xi)\, d\xi$$

BEGIN GROUP u CONVOLVED WITH v END GROUP TIMES BEGIN GROUP x END GROUP IS DEFINED BY INTEGRAL INTEGRALSUB THE REAL NUMBERS PAUSE OPERATOROF u APPLYFUNCTIONOF BEGIN GROUP ξ END GROUP TIMES v APPLYFUNCTIONOF BEGIN GROUP x MINUS ξ END GROUP DIFFERENTIAL ξ

group u convolved with v end group times group x end group is defined by integral over the real numbers , of u of group ξ end group times v of group x minus ξ end group d ξ

grupp u faltad med v slut multiplicerat med grupp x slut definieras av integral över de rella talen , av u av grupp ξ slut multiplicerat med v av grupp x minus ξ slut d ξ

```
% Convolution with non-regiestered functions, note the \of
\im {(u \convolve v) (x) \colonequals \int_{\reals} u\of(\xi) v\of(x - \xi) \dd \xi}
```

```
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  <mo>(</mo>
  <mi>u</mi>
  <mo>*</mo>
  <mi>v</mi>
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  <mo>-</mo>
  <mi>ξ</mi>
  <mo>)</mo>
  <mi>d</mi>
  <mi>ξ</mi>
 </mrow>
```

$$(f * g)(x) := \int_{\mathbb{R}} f(\xi)\, g(x - \xi)\, d\xi$$

BEGIN GROUP FUNCTION f CONVOLVED WITH FUNCTION g END GROUP TIMES BEGIN GROUP x END GROUP IS DEFINED BY INTEGRAL INTEGRALSUB THE REAL NUMBERS PAUSE OPERATOROF FUNCTION f FUNCTIONOF ξ TIMES FUNCTION g FUNCTIONOF BEGIN GROUP x MINUS ξ END GROUP DIFFERENTIAL ξ

group the function f convolved with the function g end group times group x end group is defined by integral over the real numbers , of the function f of ξ times the function g of group x minus ξ end group d ξ

grupp f faltad med g slut multiplicerat med grupp x slut definieras av integral över de rella talen , av f av ξ multiplicerat med g av grupp x minus ξ slut d ξ

```
% Convolution with registered functions
\im {(f \convolve g) (x) \colonequals \int_{\reals} f(\xi) g(x - \xi) \dd \xi}
```

```
<math>
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  <mo>(</mo>
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  <mo>:=</mo>
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 </mrow>
</math>
```

$A^T + (A + B^2)^T + \left(A^2 + B\right)^T$

TRANSPOSE OPERATOROF A PLUS TRANSPOSE BEGIN GROUP A PLUS B SQUARED END GROUP OPERATOROF PLUS TRANSPOSE OPERATOROF OPTIONAL BEGIN BEGIN FENCED A SQUARED PLUS B END FENCED

the transpose of A plus the transpose group A plus B squared end group of plus the transpose of fenced A squared plus B end fenced

transponatet av A plus transponatet grupp A plus B i kvadrat slut av plus transponatet av grupp A i kvadrat plus B slut grupp

```
% Right transpose function
\im {\transpose{A} + \transpose{(A + B^2)} + \transpose{\left(A^2 + B\right)}}
```

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</math>
```

$f''_{xy} = f''_{yx} = f''_{xy} \neq f''{}_{yx}$

secondderivative OPERATOROF BEGIN GROUP FUNCTION f SUB secondderivative x TIMES y END GROUP EQUALS secondderivative OPERATOROF BEGIN GROUP FUNCTION f SUB secondderivative y TIMES x END GROUP EQUALS BEGIN GROUP FUNCTION f SUB BEGIN GROUP x TIMES y END GROUP END GROUP DOUBLE PRIME IS NOT EQUAL TO secondderivative OPERATOROF FUNCTION f SUB BEGIN GROUP y TIMES x END GROUP

secondderivative of group the function f with lower index secondderivative x times y end group equals secondderivative of group the function f with lower index secondderivative y times x end group equals group the function f with lower index group x times y end group end group double prime is not equal to secondderivative of the function f with lower index group y times x end group

secondderivative av grupp f med undre index secondderivative x multiplicerat med y slut är lika med secondderivative av grupp f med undre index secondderivative y multiplicerat med x slut är lika med grupp f med undre index grupp x multiplicerat med y slut slut bis är inte lika med secondderivative av f med undre index grupp y multiplicerat med x slut

```
% Partial derivatives with lower indices. Beware of order.
\im {\secondderivative{f__{xy}} = \secondderivative{f__{yx}} = f__{xy}'' \neq \secondderivative{f}__{yx}}
```

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```

$f(x) = y \iff x = f^{-1}(y)$

FUNCTION f FUNCTIONOF x EQUALS y IF, AND ONLY IF x EQUALS INVERSE OPERATOROF FUNCTION f APPLYFUNCTIONOF BEGIN GROUP y END GROUP

the function f of x equals y if, and only if x equals the inverse of the function f of group y end group

f av x är lika med y om, och endast om x är lika med inversen av f av grupp y slut

```
% Inverse of function f
% It is the preimage that is the issue
\im {f(x) = y \iff x = \inverse{f}\of(y)}
```

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  <mi>y</mi>
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</math>
```

$h(x) = y \iff x = h^{-1}(y)$

h APPLYFUNCTIONOF BEGIN GROUP x END GROUP EQUALS y IF, AND ONLY IF x EQUALS INVERSE OPERATOROF h APPLYFUNCTIONOF BEGIN GROUP y END GROUP

h of group x end group equals y if, and only if x equals the inverse of h of group y end group

h av grupp x slut är lika med y om, och endast om x är lika med inversen av h av grupp y slut

```
% Inverse of variable h
\im {h\of(x) = y \iff x = \inverse{h}\of(y)}
```

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<math>
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</math>
```

$f^{-1}(Y) = \{x \in X \mid f(x) = y\}$

PREIMAGE OPERATOROF FUNCTION f APPLYFUNCTIONOF BEGIN GROUP Y END GROUP EQUALS OPTIONAL BEGIN SET x BELONGS TO X SET:FENCE FUNCTION f FUNCTIONOF x EQUALS y END SET

the preimage of the function f of group Y end group equals the set x belongs to X such that the function f of x equals y end the set

urbilden av f av grupp Y slut är lika med mängden x tillhör X sådana att f av x är lika med y slut mängden

```
% Preimage of function f
\im {\preimage{f}\of(Y) = \set{x \in X \fence f(x) = y}}
```

```
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</math>
```

$h^{-1}(Y) = \{x \in X \mid h(x) = y\}$

PREIMAGE OPERATOROF h APPLYFUNCTIONOF BEGIN GROUP Y END GROUP EQUALS OPTIONAL BEGIN SET x BELONGS TO X SET:FENCE h APPLYFUNCTIONOF BEGIN GROUP x END GROUP EQUALS y END SET

the preimage of h of group Y end group equals the set x belongs to X such that h of group x end group equals y end the set

urbilden av h av grupp Y slut är lika med mängden x tillhör X sådana att h av grupp x slut är lika med y slut mängden

```
% Preimage of variable h
\im {\preimage{h}\of(Y) = \set{x \in X \fence h\of(x) = y}}
```

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<math>
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    <mi>X</mi>
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    <mo>)</mo>
    <mo>=</mo>
    <mi>y</mi>
   </mrow>
   <mo>}</mo>
  </mrow>
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</math>
```

$$\frac{du}{dt} = u' = \dot{u}$$

THE DERIVATIVE DIFFERENTIAL u OVER DIFFERENTIAL t END DERIVATIVE EQUALS u PRIME EQUALS dot u

the derivative d u over d t end derivative equals u prime equals dot u

derivatan d u över d t slut derivatan är lika med u prim är lika med dot u

```
% Leibniz derivatives
\dm {\frac{\dd u}{\dd t} = u' = \dot{u}}
```

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<math>
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</math>
```

$$\frac{\partial u}{\partial t} = c^2 \Delta u$$

THE PARTIAL DERIVATIVE PARTIAL D u OVER PARTIAL D t END DERIVATIVE EQUALS c SQUARED LAPLACIAN u

the partial derivative partial d u over partial d t end derivative equals c squared the laplace operator u

den partiella derivatan partiellt d u över partiellt d t slut derivatan är lika med c i kvadrat laplaceoperatorn u

```
% More derivatives, Laplace operator
% Maybe we need operatorof here?
\dm {\frac{\partial u}{\partial t} = c^2 \laplace u}
```

```
<math>
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    <mi>t</mi>
   </mrow>
  </mfrac>
  <mo>=</mo>
  <msup>
   <mi>c</mi>
   <mn>2</mn>
  </msup>
  <mi>Δ</mi>
  <mi>u</mi>
 </mrow>
</math>
```

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$$

THE PARTIAL DERIVATIVE PARTIAL D u OVER PARTIAL D t END DERIVATIVE EQUALS c SQUARED TIMES THE PARTIAL DERIVATIVE PARTIAL D SQUARED u OVER PARTIAL D x SQUARED END DERIVATIVE

the partial derivative partial d u over partial d t end derivative equals c squared times the partial derivative partial d squared u over partial d x squared end derivative

den partiella derivatan partiellt d u över partiellt d t slut derivatan är lika med c i kvadrat multiplicerat med den partiella derivatan partiellt d i kvadrat u över partiellt d x i kvadrat slut derivatan

```
\dm {\frac{\partial u}{\partial t} = c^2 \frac{\partial^2u}{\partial x^2}}
```

```
<math>
 <mrow>
  <mfrac>
   <mrow>
    <mi>∂</mi>
    <mi>u</mi>
   </mrow>
   <mrow>
    <mi>∂</mi>
    <mi>t</mi>
   </mrow>
  </mfrac>
  <mo>=</mo>
  <msup>
   <mi>c</mi>
   <mn>2</mn>
  </msup>
  <mfrac>
   <mrow>
    <msup>
     <mi>∂</mi>
     <mn>2</mn>
    </msup>
    <mi>u</mi>
   </mrow>
   <mrow>
    <mi>∂</mi>
    <msup>
     <mi>x</mi>
     <mn>2</mn>
    </msup>
   </mrow>
  </mfrac>
 </mrow>
</math>
```

$$d+\frac{d^3u}{dx^3}+\frac{df}{dx}$$

DIFFERENTIAL PLUS THE DERIVATIVE DIFFERENTIAL CUBED u OVER DIFFERENTIAL x CUBED END DERIVATIVE PLUS THE DERIVATIVE DIFFERENTIAL FUNCTION f OVER DIFFERENTIAL x END DERIVATIVE

d plus the derivative d cubed u over d x cubed end derivative plus the derivative d the function f over d x end derivative

d plus derivatan d i kubik u över d x i kubik slut derivatan plus derivatan d f över d x slut derivatan

```
% More derivatives
% Here we see that "the function" from the registered
% function is not always wanted
\dm {\dd + \frac{\dd^3 u}{\dd x^3} + \frac{\dd f}{\dd x}}
```

```
<math>
 <mrow>
  <mi>d</mi>
  <mo>+</mo>
  <mfrac>
   <mrow>
    <msup>
     <mi>d</mi>
     <mn>3</mn>
    </msup>
    <mi>u</mi>
   </mrow>
   <mrow>
    <mi>d</mi>
    <msup>
     <mi>x</mi>
     <mn>3</mn>
    </msup>
   </mrow>
  </mfrac>
  <mo>+</mo>
  <mfrac>
   <mrow>
    <mi>d</mi>
    <mi>f</mi>
   </mrow>
   <mrow>
    <mi>d</mi>
    <mi>x</mi>
   </mrow>
  </mfrac>
 </mrow>
</math>
```

$$\mathrm{d} + \frac{\mathrm{d}^3 u}{\mathrm{d}x^3} + \frac{\mathrm{d}f}{\mathrm{d}x}$$

DIFFERENTIAL PLUS THE DERIVATIVE DIFFERENTIAL CUBED u OVER DIFFERENTIAL x CUBED END DERIVATIVE PLUS THE DERIVATIVE DIFFERENTIAL FUNCTION f OVER DIFFERENTIAL x END DERIVATIVE

d plus the derivative d cubed u over d x cubed end derivative plus the derivative d the function f over d x end derivative

d plus derivatan d i kubik u över d x i kubik slut derivatan plus derivatan d f över d x slut derivatan

```
% Upright d
\setupmathematics[differentiald=upright]
\dm {\dd + \frac{\dd^3 u}{\dd x^3} + \frac{\dd f}{\dd x}}
```

```
<math>
 <mrow>
  <mi>d</mi>
  <mo>+</mo>
  <mfrac>
   <mrow>
    <msup>
     <mi>d</mi>
     <mn>3</mn>
    </msup>
    <mi>𝑢</mi>
   </mrow>
   <mrow>
    <mi>d</mi>
    <msup>
     <mi>𝑥</mi>
     <mn>3</mn>
    </msup>
   </mrow>
  </mfrac>
  <mo>+</mo>
  <mfrac>
   <mrow>
    <mi>d</mi>
    <mi>𝑓</mi>
   </mrow>
   <mrow>
    <mi>d</mi>
    <mi>𝑥</mi>
   </mrow>
  </mfrac>
 </mrow>
</math>
```

THE PARTIAL DERIVATIVE PARTIAL D CUBED u OVER PARTIAL D x SQUARED PARTIAL D y END DERIVATIVE

the partial derivative partial d cubed u over partial d x squared partial d y end derivative

den partiella derivatan partiellt d i kubik u över partiellt d x i kvadrat partiellt d y slut derivatan

```
% A mixed partial derivative
\dm {\frac{\partial^3 u}{\partial x^2 \partial y}}
```

```
<math>
 <mfrac>
  <mrow>
   <msup>
    <mi>∂</mi>
    <mn>3</mn>
   </msup>
   <mi>u</mi>
  </mrow>
  <mrow>
   <mi>∂</mi>
   <msup>
    <mi>x</mi>
    <mn>2</mn>
   </msup>
   <mi>∂</mi>
   <mi>y</mi>
  </mrow>
 </mfrac>
</math>
```

$\bar{\partial} u = \bar{\partial} u = f$

CONJUGATE PARTIAL D u EQUALS bar PARTIAL D u EQUALS FUNCTION f

the conjugate of partial d u equals bar partial d u equals the function f

konjugatet av partiellt d u är lika med bar partiellt d u är lika med f

```
% A complex analysis way of writing it.
% To be thought of
\im {\conjugate{\partial} u = \bar{\partial} u = f}
```

```
<math>
 <mrow>
  <mover>
   <mi>∂</mi>
   <mo>¯</mo>
  </mover>
  <mi>u</mi>
  <mo>=</mo>
  <mover>
   <mi>∂</mi>
   <mo>¯</mo>
  </mover>
  <mi>u</mi>
  <mo>=</mo>
  <mi>f</mi>
 </mrow>
</math>
```

$$\frac{\partial}{\partial x}(u+v) = \frac{\partial u}{\partial x} + \frac{\partial v}{\partial x}$$

THE PARTIAL DERIVATIVE PARTIAL D OVER PARTIAL D x END DERIVATIVE APPLYFUNCTIONOF BEGIN GROUP u PLUS v END GROUP EQUALS THE PARTIAL DERIVATIVE PARTIAL D u OVER PARTIAL D x END DERIVATIVE PLUS THE PARTIAL DERIVATIVE PARTIAL D v OVER PARTIAL D x END DERIVATIVE

the partial derivative partial d over partial d x end derivative of group u plus v end group equals the partial derivative partial d u over partial d x end derivative plus the partial derivative partial d v over partial d x end derivative

den partiella derivatan partiellt d över partiellt d x slut derivatan av grupp u plus v slut är lika med den partiella derivatan partiellt d u över partiellt d x slut derivatan plus den partiella derivatan partiellt d v över partiellt d x slut derivatan

```
% Experimented with partial derivative d d x group u plus v end group...
% but for accessibility reasons it is better to keep the partial
% We need \of here because one can have products as well
% Without \of one could consider \notimes, but if none is there we should get a TIMES
\dm {\frac{\partial}{\partial x}\of(u + v) = \frac{\partial u}{\partial x} + \frac{\partial v}{\partial x}}
```

```
<math>
 <mrow>
  <mfrac>
   <mi>∂</mi>
   <mrow>
    <mi>∂</mi>
    <mi>x</mi>
   </mrow>
  </mfrac>
  <mo></mo>
  <mo>(</mo>
  <mi>u</mi>
  <mo>+</mo>
  <mi>v</mi>
  <mo>)</mo>
  <mo>=</mo>
  <mfrac>
   <mrow>
    <mi>∂</mi>
    <mi>u</mi>
   </mrow>
   <mrow>
    <mi>∂</mi>
    <mi>x</mi>
   </mrow>
  </mfrac>
  <mo>+</mo>
  <mfrac>
   <mrow>
    <mi>∂</mi>
    <mi>v</mi>
   </mrow>
   <mrow>
    <mi>∂</mi>
    <mi>x</mi>
   </mrow>
  </mfrac>
 </mrow>
</math>
```

BEGIN GROUP 1 MINUS LAPLACIAN END GROUP TIMES u EQUALS FUNCTION f

group 1 minus the laplace operator end group times u equals the function f

grupp 1 minus laplaceoperatorn slut multiplicerat med u är lika med f

```
% One example with Laplace followed by a close parenthesis
\im {(1 - \laplace)u = f}
```

```
<math>
 <mrow>
  <mo>(</mo>
  <mn>1</mn>
  <mo>-</mo>
  <mi>Δ</mi>
  <mo>)</mo>
  <mi>u</mi>
  <mo>=</mo>
  <mi>f</mi>
 </mrow>
</math>
```

LAPLACIAN EQUALS GRADIENT SCALARPRODUCT GRADIENT EQUALS ∇ SQUARED EQUALS NABLA SCALARPRODUCT NABLA

the laplace operator equals the gradient scalarproduct the gradient equals ∇ squared equals the nabla scalarproduct the nabla

laplaceoperatorn är lika med gradienten skalärprodukt gradienten är lika med ∇ i kvadrat är lika med nablan skalärprodukt nablan

```
% Just a few operators
\im {\laplace = \gradient \scalarproduct \gradient = \gradient^2 = \nabla \scalarproduct \nabla}
```

```
<math>
 <mrow>
  <mi>Δ</mi>
  <mo>=</mo>
  <mi>∇</mi>
  <mo>·</mo>
  <mi>∇</mi>
  <mo>=</mo>
  <msup>
   <mi>∇</mi>
   <mn>2</mn>
  </msup>
  <mo>=</mo>
  <mi>∇</mi>
  <mo>·</mo>
  <mi>∇</mi>
 </mrow>
</math>
```

GRADIENT CROSSPRODUCT GRADIENT

the gradient crossproduct the gradient

gradienten kryssprodukt gradienten

```
% Operator and crossproduct
\im {\gradient \crossproduct \gradient}
```

```
<math>
 <mrow>
  <mi>∇</mi>
  <mo>×</mo>
  <mi>∇</mi>
 </mrow>
</math>
```

OPTIONAL BEGIN FLOOR 3.6 END FLOOR EQUALS OPTIONAL BEGIN CEILING 2.7 END CEILING EQUALS OPTIONAL BEGIN INTEGERPART 3.2 END INTEGERPART

the floor 3.6 end the floor equals the ceiling 2.7 end the ceiling equals the integer part 3.2 end the integer part

golvfunktionen 3.6 slut golvfunktionen är lika med takfunktionen 2.7 slut takfunktionen är lika med heltalsdelen 3.2 slut heltalsdelen

```
% Maybe shorter end
% Made an issue to enable discussion
\im {\floor{3.6} = \ceiling{2.7} = \integerpart{3.2}}
```

```
<math>
 <mrow>
  <mrow>
   <mo>⌊</mo>
   <mn>3.6</mn>
   <mo>⌋</mo>
  </mrow>
  <mo>=</mo>
  <mrow>
   <mo>⌈</mo>
   <mn>2.7</mn>
   <mo>⌉</mo>
  </mrow>
  <mo>=</mo>
  <mrow>
   <mo>[</mo>
   <mn>3.2</mn>
   <mo>]</mo>
  </mrow>
 </mrow>
</math>
```

$A = \{1, 2, 3\}$

A EQUALS OPTIONAL BEGIN SET 1 COMMA 2 COMMA 3 END SET

A equals the set 1 comma 2 comma 3 end the set

A är lika med mängden 1 komma 2 komma 3 slut mängden

```
% Just a set
\im {A = \set[size=1]{1, 2, 3}}
```

```
<math>
 <mrow>
  <mi>A</mi>
  <mo>=</mo>
  <mrow>
   <mo>{</mo>
   <mrow>
    <mn>1</mn>
    <mo>,</mo>
    <mn>2</mn>
    <mo>,</mo>
    <mn>3</mn>
   </mrow>
   <mo>}</mo>
  </mrow>
 </mrow>
</math>
```

$A = (1, 2, 3)$

A EQUALS OPTIONAL BEGIN TUPLE 1 COMMA 2 COMMA 3 END TUPLE

A equals the tuple 1 comma 2 comma 3 end the tuple

A är lika med tupeln 1 komma 2 komma 3 slut tupeln

```
% Just a tuple
\im {A = \tuple{1, 2, 3}}
```

```
<math>
 <mrow>
  <mi>A</mi>
  <mo>=</mo>
  <mrow>
   <mo>(</mo>
   <mrow>
    <mn>1</mn>
    <mo>,</mo>
    <mn>2</mn>
    <mo>,</mo>
    <mn>3</mn>
   </mrow>
   <mo>)</mo>
  </mrow>
 </mrow>
</math>
```

$||a_{n_k} - A| < \epsilon$

| OPTIONAL BEGIN ABS a SUB BEGIN GROUP n SUB k END GROUP MINUS A END ABS IS LESS THAN ϵ

| the absolute value a with lower index group n with lower index k end group minus A end the absolute value is less than ϵ

| absolutbeloppet a med undre index grupp n med undre index k slut minus A slut absolutbeloppet är mindre än ϵ

```
% Just an absolute value
\im {|\abs[size=0]{a__{n__k} - A} < \epsilon}
```

```
<math>
 <mrow>
  <mi>|</mi>
  <mrow>
   <mo>|</mo>
   <mrow>
    <msub>
     <mi>a</mi>
     <mrow>
      <msub>
       <mi>n</mi>
       <mi>k</mi>
      </msub>
     </mrow>
    </msub>
    <mo>-</mo>
    <mi>A</mi>
   </mrow>
   <mo>|</mo>
  </mrow>
  <mo>&lt;</mo>
  <mi>ϵ</mi>
 </mrow>
</math>
```

OPTIONAL BEGIN INNERPRODUCT u INNERPRODUCT:FENCE v END INNERPRODUCT EQUALS CONJUGATE OPTIONAL BEGIN INNERPRODUCT v INNERPRODUCT:FENCE u END INNERPRODUCT

the inner product u and v end the inner product equals the conjugate of the inner product v and u end the inner product

inre produkten u och v slut inre produkten är lika med konjugatet av inre produkten v och u slut inre produkten

```
% Inner product
\im {\innerproduct{u \fence v} = \conjugate{\innerproduct{v \fence u}}}
```

```
<math>
 <mrow>
  <mrow>
   <mo>⟨</mo>
   <mi>u</mi>
   <mo>|</mo>
   <mi>v</mi>
   <mo>⟩</mo>
  </mrow>
  <mo>=</mo>
  <mover>
   <mrow>
    <mo>⟨</mo>
    <mi>v</mi>
    <mo>|</mo>
    <mi>u</mi>
    <mo>⟩</mo>
   </mrow>
   <mo>¯</mo>
  </mover>
 </mrow>
</math>
```

$\mathbb{R}_+ := \{x \mid x \in \mathbb{R} \land x > 0\}$

THE REAL NUMBERS SUB PLUS IS DEFINED BY OPTIONAL BEGIN SET x SET:FENCE x BELONGS TO THE REAL NUMBERS AND x IS GREATER THAN 0 END SET

the real numbers with lower index plus is defined by the set x such that x belongs to the real numbers and x is greater than 0 end the set

de rella talen med undre index plus definieras av mängden x sådana att x tillhör de rella talen och x är större än 0 slut mängden

```
% A set with a fence
\im {\reals__{+} \colonequals \set{x \fence x \in \reals \land x > 0}}
```

```
<math>
 <mrow>
  <msub>
   <mi>ℝ</mi>
   <mo>+</mo>
  </msub>
  <mo>≔</mo>
  <mrow>
   <mo>{</mo>
   <mi>x</mi>
   <mo>|</mo>
   <mrow>
    <mi>x</mi>
    <mo>∈</mo>
    <mi>ℝ</mi>
    <mo>∧</mo>
    <mi>x</mi>
    <mo>&gt;</mo>
    <mn>0</mn>
   </mrow>
   <mo>}</mo>
  </mrow>
 </mrow>
</math>
```

$[a,b[\neq]a,b] \neq]a,b[\neq [a,b]$

BEGIN GROUP a COMMA b END GROUP IS NOT EQUAL TO BEGIN GROUP a COMMA b END GROUP IS NOT EQUAL TO BEGIN GROUP a COMMA b END GROUP IS NOT EQUAL TO BEGIN GROUP a COMMA b END GROUP

group a comma b end group is not equal to group a comma b end group is not equal to group a comma b end group is not equal to group a comma b end group

grupp a komma b slut är inte lika med grupp a komma b slut är inte lika med grupp a komma b slut är inte lika med grupp a komma b slut

```
% Simple unstructured input works, but do not use!
% \setupmathematics[autointervals=no]
\im {[a,b[ \neq ]a,b] \neq ]a,b[ \neq [a,b]}
```

```
<math>
 <mrow>
  <mo>[</mo>
  <mi>a</mi>
  <mo>,</mo>
  <mi>b</mi>
  <mo>[</mo>
  <mo>≠</mo>
  <mo>]</mo>
  <mi>a</mi>
  <mo>,</mo>
  <mi>b</mi>
  <mo>]</mo>
  <mo>≠</mo>
  <mo>]</mo>
  <mi>a</mi>
  <mo>,</mo>
  <mi>b</mi>
  <mo>[</mo>
  <mo>≠</mo>
  <mo>[</mo>
  <mi>a</mi>
  <mo>,</mo>
  <mi>b</mi>
  <mo>]</mo>
 </mrow>
</math>
```

$X =]a,(b+1)] \neq]a,(b+1)]$

X EQUALS OPTIONAL BEGIN VARLEFTOPENINTERVAL a COMMA BEGIN GROUP b PLUS 1 END GROUP END VARLEFTOPENINTERVAL IS NOT EQUAL TO END GROUP TIMES a COMMA BEGIN GROUP b PLUS 1 END GROUP END GROUP

X equals the left open interval a comma group b plus 1 end group end the left open interval is not equal to end group times a comma group b plus 1 end group end group

X är lika med det vänsteröppna intervallet a komma grupp b plus 1 slut slut det vänsteröppna intervallet är inte lika med slut multiplicerat med a komma grupp b plus 1 slut slut

```
% Warning: Nesting with weird parenthesis is not supported
\im {X = \varleftopeninterval{a,(b + 1)} \neq ]a,(b + 1)]}
```

```
<math>
 <mrow>
  <mi>X</mi>
  <mo>=</mo>
  <mrow>
   <mo>]</mo>
   <mrow>
    <mi>a</mi>
    <mo>,</mo>
    <mo>(</mo>
    <mi>b</mi>
    <mo>+</mo>
    <mn>1</mn>
    <mo>)</mo>
   </mrow>
   <mo>]</mo>
  </mrow>
  <mo>≠</mo>
  <mo>]</mo>
  <mi>a</mi>
  <mo>,</mo>
  <mo>(</mo>
  <mi>b</mi>
  <mo>+</mo>
  <mn>1</mn>
  <mo>)</mo>
  <mo>]</mo>
 </mrow>
</math>
```

$\overline{(a, b)} = [a, b]$

CLOSURE OPTIONAL BEGIN OPENINTERVAL *a* COMMA *b* END OPENINTERVAL EQUALS OPTIONAL BEGIN CLOSEDINTERVAL *a* COMMA *b* END CLOSEDINTERVAL

the closure of the open interval *a* comma *b* end the open interval equals the closed interval *a* comma *b* end the closed interval

det slutna höljet av det öppna intervallet *a* komma *b* slut det öppna intervallet är lika med det slutna intervallet *a* komma *b* slut det slutna intervallet

```
% Closure of interval
\im {\closure{\openinterval{a,b}} = \closedinterval{a,b}}
```

```
<math>
 <mrow>
  <mover>
   <mrow>
    <mo>(</mo>
    <mrow>
     <mi>a</mi>
     <mo>,</mo>
     <mi>b</mi>
    </mrow>
    <mo>)</mo>
   </mrow>
   <mo>¯</mo>
  </mover>
  <mo>=</mo>
  <mrow>
   <mo>[</mo>
   <mrow>
    <mi>a</mi>
    <mo>,</mo>
    <mi>b</mi>
   </mrow>
   <mo>]</mo>
  </mrow>
 </mrow>
</math>
```

CLOSURE OPTIONAL BEGIN VAROPENINTERVAL 0 COMMA 1 END VAROPENINTERVAL EQUALS OPTIONAL BEGIN CLOSEDINTERVAL 0 COMMA 1 END CLOSEDINTERVAL

the closure of the open interval 0 comma 1 end the open interval equals the closed interval 0 comma 1 end the closed interval

det slutna höljet av det öppna intervallet 0 komma 1 slut det öppna intervallet är lika med det slutna intervallet 0 komma 1 slut det slutna intervallet

```
% Closure of interval
\im {\closure{\varopeninterval{0,1}} = \closedinterval{0,1}}
```

```
<math>
 <mrow>
  <mover>
   <mrow>
    <mo>]</mo>
    <mrow>
     <mn>0</mn>
     <mo>,</mo>
     <mn>1</mn>
    </mrow>
    <mo>[</mo>
   </mrow>
   <mo>¯</mo>
  </mover>
  <mo>=</mo>
  <mrow>
   <mo>[</mo>
   <mrow>
    <mn>0</mn>
    <mo>,</mo>
    <mn>1</mn>
   </mrow>
   <mo>]</mo>
  </mrow>
 </mrow>
</math>
```

$$u(b) - u(a) = \lim_{n\to+\infty}(f(x_1)\Delta x_1 + f(x_2)\Delta x_2 + \ldots + f(x_n)\Delta x_n)$$

u APPLYFUNCTIONOF BEGIN GROUP *b* END GROUP MINUS *u* APPLYFUNCTIONOF BEGIN GROUP *a* END GROUP EQUALS LIM LIMIT-SUB BEGIN GROUP *n* TO PLUS INFINITY END GROUP PAUSE OPERATOROF OPTIONAL BEGIN PARENTHESIS FUNCTION *f* FUNCTIONOF BEGIN GROUP *x* SUB 1 END GROUP TIMES Δ TIMES *x* SUB 1 PLUS FUNCTION *f* FUNCTIONOF BEGIN GROUP *x* SUB 2 END GROUP TIMES Δ TIMES *x* SUB 2 PLUS AND SO ON PLUS FUNCTION *f* FUNCTIONOF BEGIN GROUP *x* SUB *n* END GROUP TIMES Δ TIMES *x* SUB *n* END PARENTHESIS

u of group *b* end group minus *u* of group *a* end group equals the limit as group *n* to plus infinity end group , of parenthesis the function *f* of group *x* with lower index 1 end group times Δ times *x* with lower index 1 plus the function *f* of group *x* with lower index 2 end group times Δ times *x* with lower index 2 plus , and so on, plus the function *f* of group *x* with lower index *n* end group times Δ times *x* with lower index *n* end parenthesis

u av grupp *b* slut minus *u* av grupp *a* slut är lika med gränsvärdet då grupp *n* till plus oändligheten slut , av parentes *f* av grupp *x* med undre index 1 slut multiplicerat med Δ multiplicerat med *x* med undre index 1 plus *f* av grupp *x* med undre index 2 slut multiplicerat med Δ multiplicerat med *x* med undre index 2 plus , och så vidare, plus *f* av grupp *x* med undre index *n* slut multiplicerat med Δ multiplicerat med *x* med undre index *n* slut parentes

```
% Random formula
% Mikael: Think about the Delta
\dm {u\of(b)-u\of(a)=\lim_{n\to+\infty} \parenthesis{f(x__1)\Delta x__1+f(x__2)\Delta x__2+\ldots+f(x__n)\Delta x__n}}
```

```
<math>
 <mrow>
  <mi>u</mi>
  <mo></mo>
  <mo>(</mo>
  <mi>b</mi>
  <mo>)</mo>
  <mo>−</mo>
  <mi>u</mi>
  <mo></mo>
  <mo>(</mo>
  <mi>a</mi>
  <mo>)</mo>
  <mo>=</mo>
  <msub>
   <mi>lim</mi>
   <mrow>
    <mi>n</mi>
    <mo>→</mo>
    <mo>+</mo>
    <mi>∞</mi>
   </mrow>
  </msub>
  <mrow>
   <mo>(</mo>
   <mrow>
    <mi>f</mi>
    <mo>(</mo>
    <msub>
     <mi>x</mi>
     <mn>1</mn>
    </msub>
    <mo>)</mo>
    <mi>Δ</mi>
    <msub>
     <mi>x</mi>
     <mn>1</mn>
    </msub>
    <mo>+</mo>
    <mi>f</mi>
    <mo>(</mo>
    <msub>
     <mi>x</mi>
     <mn>2</mn>
    </msub>
    <mo>)</mo>
    <mi>Δ</mi>
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    <mo>+</mo>
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    <msub>
     <mi>x</mi>
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     <mi>x</mi>
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    </msub>
   </mrow>
   <mo>)</mo>
  </mrow>
 </mrow>
</math>
```

$|x + y| \leq |x| + |y|$

OPTIONAL BEGIN ABS x PLUS y END ABS IS LESS THAN, OR EQUAL TO OPTIONAL BEGIN ABS x END ABS PLUS OPTIONAL BEGIN ABS y END ABS

the absolute value x plus y end the absolute value is less than, or equal to the absolute value x end the absolute value plus the absolute value y end the absolute value

absolutbeloppet x plus y slut absolutbeloppet är mindre än, eller lika med absolutbeloppet x slut absolutbeloppet plus absolutbeloppet y slut absolutbeloppet

```
% Absolute value, triangle inequality
\im {\abs{x + y} \leq \abs{x} + \abs{y}}
```

```
<math>
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   <mo>|</mo>
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    <mi>x</mi>
    <mo>+</mo>
    <mi>y</mi>
   </mrow>
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   <mo>|</mo>
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  <mo>+</mo>
  <mrow>
   <mo>|</mo>
   <mi>y</mi>
   <mo>|</mo>
  </mrow>
 </mrow>
</math>
```

$$\|x + y\| \leq \|x\| + \|y\|$$

OPTIONAL BEGIN NORM x PLUS y END NORM IS LESS THAN, OR EQUAL TO OPTIONAL BEGIN NORM x END NORM PLUS OPTIONAL BEGIN NORM y END NORM

the norm x plus y end the norm is less than, or equal to the norm x end the norm plus the norm y end the norm

normen x plus y slut normen är mindre än, eller lika med normen x slut normen plus normen y slut normen

```
% Norm, triangle inequality
\im {\norm{x + y} \leq \norm{x} + \norm{y}}
```

```
<math>
 <mrow>
  <mrow>
   <mo>‖</mo>
   <mrow>
    <mi>x</mi>
    <mo>+</mo>
    <mi>y</mi>
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   <mo>‖</mo>
   <mi>y</mi>
   <mo>‖</mo>
  </mrow>
 </mrow>
</math>
```

$\|\alpha x\| = |\alpha| \|x\|$

OPTIONAL BEGIN NORM α TIMES x END NORM EQUALS OPTIONAL BEGIN ABS α END ABS TIMES OPTIONAL BEGIN NORM x END NORM

the norm α times x end the norm equals the absolute value α end the absolute value times the norm x end the norm

normen α multiplicerat med x slut normen är lika med absolutbeloppet α slut absolutbeloppet multiplicerat med normen x slut normen

```
% Both norm and absolute value
\im {\norm{\alpha x} = \abs{\alpha} \norm{x}}
```

```
<math>
 <mrow>
  <mrow>
   <mo>‖</mo>
   <mrow>
    <mi>α</mi>
    <mi>x</mi>
   </mrow>
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  </mrow>
  <mo>=</mo>
  <mrow>
   <mo>|</mo>
   <mi>α</mi>
   <mo>|</mo>
  </mrow>
  <mrow>
   <mo>‖</mo>
   <mi>x</mi>
   <mo>‖</mo>
  </mrow>
 </mrow>
</math>
```

FUNCTION f FUNCTIONOF x EQUALS x SQUARED , x BELONGS TO THE REAL NUMBERS

the function f of x equals x squared , x belongs to the real numbers

f av x är lika med x i kvadrat , x tillhör de rella talen

```
% Example with \mtp
\im {f(x) = x^2 \mtp{,} x \in \reals}
```

```
<math>
 <mrow>
  <mi>f</mi>
  <mo>(</mo>
  <mi>x</mi>
  <mo>)</mo>
  <mo>=</mo>
  <msup>
   <mi>x</mi>
   <mn>2</mn>
  </msup>
  <mtext>,</mtext>
  <mi>x</mi>
  <mo>∈</mo>
  <mi>ℝ</mi>
 </mrow>
</math>
```

NOT BEGIN GROUP P or Q END GROUP EQUALS BEGIN GROUP NOT P END GROUP AND BEGIN GROUP NOT Q END GROUP
not group P or Q end group equals group not P end group and group not Q end group
icke grupp P or Q slut är lika med grupp icke P slut och grupp icke Q slut

```
% Logic example
\im {\lnot(P \lor Q) = (\lnot P) \land (\lnot Q)}
```

```
<math>
 <mrow>
  <mi>¬</mi>
  <mo>(</mo>
  <mi>P</mi>
  <mo>∨</mo>
  <mi>Q</mi>
  <mo>)</mo>
  <mo>=</mo>
  <mo>(</mo>
  <mi>¬</mi>
  <mi>P</mi>
  <mo>)</mo>
  <mo>∧</mo>
  <mo>(</mo>
  <mi>¬</mi>
  <mi>Q</mi>
  <mo>)</mo>
 </mrow>
</math>
```

NEG FUNCTIONOF BEGIN GROUP P AND Q END GROUP IF, AND ONLY IF BEGIN GROUP NOT P END GROUP or BEGIN GROUP NOT Q END GROUP

NEGation of group P and Q end group if, and only if group not P end group or group not Q end group

negationen av grupp P och Q slut om, och endast om grupp icke P slut or grupp icke Q slut

```
% \neg is now defined as a function. Maybe char-def
% TODO Fix \neg?
\im {\neg(P \land Q) \iff (\lnot P) \lor (\lnot Q)}
```

```
<math>
 <mrow>
  <mi>neg</mi>
  <mo>(</mo>
  <mi>P</mi>
  <mo>∧</mo>
  <mi>Q</mi>
  <mo>)</mo>
  <mo>⟺</mo>
  <mo>(</mo>
  <mi>¬</mi>
  <mi>P</mi>
  <mo>)</mo>
  <mo>∨</mo>
  <mo>(</mo>
  <mi>¬</mi>
  <mi>Q</mi>
  <mo>)</mo>
 </mrow>
</math>
```

BEGIN GROUP FOR ALL x BELONGS TO THE REAL NUMBERS END GROUP NOTIMES BEGIN GROUP x IS GREATER THAN 0 or x EQUALS 0 or x IS LESS THAN 0 END GROUP

group for all x belongs to the real numbers end group , group x is greater than 0 or x equals 0 or x is less than 0 end group

grupp för alla x tillhör de rella talen slut , grupp x är större än 0 or x är lika med 0 or x är mindre än 0 slut

```
% Yet another example with quantifier
% Observe the usage of \notimes
\im {(\forall x \in \reals)\notimes (x > 0 \lor x = 0 \lor x < 0)}
```

```
<math>
 <mrow>
  <mo>(</mo>
  <mi>∀</mi>
  <mi>x</mi>
  <mo>∈</mo>
  <mi>ℝ</mi>
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  <mo></mo>
  <mo>(</mo>
  <mi>x</mi>
  <mo>&gt;</mo>
  <mn>0</mn>
  <mo>∨</mo>
  <mi>x</mi>
  <mo>=</mo>
  <mn>0</mn>
  <mo>∨</mo>
  <mi>x</mi>
  <mo>&lt;</mo>
  <mn>0</mn>
  <mo>)</mo>
 </mrow>
</math>
```

$$f(x) = \begin{cases} x & x > 0 \\ -x & x < 0 \end{cases}$$

FUNCTION f FUNCTIONOF x EQUALS OPTIONAL BEGIN BEGIN FENCED begin cases case 1 x BEGIN GROUP x IS GREATER THAN 0 END GROUP case 2 BEGIN GROUP MINUS x END GROUP BEGIN GROUP x IS LESS THAN 0 END GROUP end cases END FENCED

the function f of x equals fenced begin cases case 1 x group x is greater than 0 end group case 2 group minus x end group group x is less than 0 end group end cases end fenced

f av x är lika med grupp begin cases case 1 x grupp x är större än 0 slut case 2 grupp minus x slut grupp x är mindre än 0 slut end cases slut grupp

```
% Cases example
\dm {f(x) =
    \startcases
        \NC x  \NC x > 0 \NR
        \NC -x \NC x < 0 \NR
    \stopcases}
```

$$f(x) = \begin{cases} x, & x > 0 \\ -x, & x < 0 \end{cases}$$

FUNCTION f FUNCTIONOF x EQUALS OPTIONAL BEGIN BEGIN FENCED END FENCED begin cases case 1 BEGIN GROUP x , END GROUP BEGIN GROUP x IS GREATER THAN 0 END GROUP case 2 BEGIN GROUP MINUS x , END GROUP BEGIN GROUP x IS LESS THAN 0 END GROUP end cases

the function f of x equals fenced end fenced begin cases case 1 group x , end group group x is greater than 0 end group case 2 group minus x , end group group x is less than 0 end group end cases

f av x är lika med grupp slut grupp begin cases case 1 grupp x , slut grupp x är större än 0 slut case 2 grupp minus x , slut grupp x är mindre än 0 slut end cases

```
% Cases with lefttext
\dm{f(x) =
    \startcases[lefttext=\mtp{,}]
        \NC x  \NC x > 0 \NR
        \NC -x \NC x < 0 \NR
    \stopcases}
```

$$f(x) = \begin{cases} x & \text{if } x > 0 \\ -x & \text{if } x < 0 \end{cases}$$

FUNCTION f FUNCTIONOF x EQUALS OPTIONAL BEGIN BEGIN FENCED END FENCED begin cases case 1 x BEGIN GROUP if x IS GREATER THAN 0 END GROUP case 2 BEGIN GROUP MINUS x END GROUP BEGIN GROUP if x IS LESS THAN 0 END GROUP end cases

the function f of x equals fenced end fenced begin cases case 1 x group if x is greater than 0 end group case 2 group minus x end group group if x is less than 0 end group end cases

f av x är lika med grupp slut grupp begin cases case 1 x grupp if x är större än 0 slut case 2 grupp minus x slut grupp if x är mindre än 0 slut end cases

```
% Cases with righttext
\dm{f(x) =
    \startcases[righttext=\mtext{if }]
        \NC x  \NC x > 0 \NR
        \NC -x \NC x < 0 \NR
    \stopcases}
```

$$ {}^{123}\mathrm{X}_{12}^{+4} \approx {}^{123}X_{12}^{+4} $$

X PRESCRIPTS PRESUPER 123 POSTSCRIPTS POSTSUB 12 POSTSUPER BEGIN GROUP PLUS 4 END GROUP END SCRIPTS APPROXIMATELY EQUALS *X* PRESCRIPTS PRESUPER 123 POSTSCRIPTS POSTSUB 12 POSTSUPER BEGIN GROUP PLUS 4 END GROUP END SCRIPTS

X prescripts super 123 postscripts sub 12 super group plus 4 end group end scripts approximately equals *X* prescripts super 123 postscripts sub 12 super group plus 4 end group end scripts

X preskript upphöjd 123 postskript nedsänkt 12 upphöjd grupp plus 4 slut slut skript är ungefär lika med *X* preskript upphöjd 123 postskript nedsänkt 12 upphöjd grupp plus 4 slut slut skript

```
% Chemistry example
% Todo: maybe defaultstyle to \tf
\setupmathematics[domain=chemistry]
\dm{
    {\tf X}^^^{123}__{12}^{+4} \approx X^^^{123}__{12}^{+4}
}
```

```
<math><mrow><mmultiscripts><mi>X</mi><mn>12</mn><mrow><mo>+</mo><mn>4</mn></mrow>
<mprescripts/>
<mtext/><mn>123</mn></mmultiscripts><mo>≈</mo><mmultiscripts><mi>X</mi><mn>12</mn><mrow><mo>+</mo><mn>4</mn></mrow>
<mprescripts/>
<mtext/><mn>123</mn></mmultiscripts></mrow></math>
```

$\left(1 + x + x^2\right)^2$

OPTIONAL BEGIN BEGIN FENCED 1 PLUS x PLUS x SQUARED END FENCED SQUARED

fenced 1 plus x plus x squared end fenced squared

grupp 1 plus x plus x i kvadrat slut grupp i kvadrat

```
\dm{
    \left(1 + x + x^2\right)^2
}
```

$$\left(1 + x + x^2\right)^2$$

OPTIONAL BEGIN BEGIN FENCED 1 PLUS x PLUS x SQUARED END FENCED SQUARED

fenced 1 plus x plus x squared end fenced squared

grupp 1 plus x plus x i kvadrat slut grupp i kvadrat

```
\setupmathematics[domain=simplified]
\dm{
    \left(1 + x + x^2\right)^2
}
```

$$\chi^{2} = \sum_{i = 1}^{r}{\sum_{j = 1}^{c}\frac{\left(O_{ij} - E_{ij} \right)^{2}}{E_{ij}}}$$

```
% User formula
% Maybe add something inbetween nedsted sums (and integrals)?
\startformula \chi^{2} = \sum_{i = 1}^{r}{\sum_{j = 1}^{c}\frac{\left( O_{ij} - E_{ij} \right)^{2}}{E_{ij}}} \stopformula
```

About this document

This document is used by Mikael Sundqvist and Hans Hagen to check out how well a formula translates to a verbose meaning. It's an experiment with accessibility on the one hand but also a way to get documents validated and even annotated. Eventually there will be support for many languages but we started with English, Swedish and Dutch.

This feature is only available in ConTEXt MkXL, aka LMTX. You can enable tracking in your document by for instance:

```
\setuptagging
  [state=start]

\definemathgroupset
  [mydemogroup]
  [every]

\setmathgroupset
  [mydemogroup]

\setupnote
  [mathnote]
  [location=page]

\enabletrackers
  [math.textblobs]
```

By default a `mathnote` is set up to be an endnote in which case you need to place them with:

```
\placenote[mathnode]
```