Garamond-Math, Ver. 0.3

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1 Introduction

Garamond-Math is an open type math font matching the *EB Garamond (Octavio Pardo)*[1] and *EB Garamond (Georg Mayr-Duffner)*[2]. Many mathematical symbols are derived from other fonts, others are made from scratch. The metric is generated with a python script.

The font is best used with XeTeX, with other engine, one might end up getting very bad spacing.

This font is still under development, do not expect the font to be free of bugs. We might update any components any at any time. Issues, bug reports, forks and other contributions are welcome. Please visit GitHub (https://github.com/YuanshengZhao/Garamond-Math/) for development details.

The minimal example with `unicode-math` package is as following:

```
%Compile with XeTeX
\documentclass{article}
\usepackage[math-style=ISO, bold-style=ISO]{unicode-math}
\setmainfont{EB Garamond}%You should have installed the font
\setmathfont{Garamond-Math.otf}[StylisticSet={7,9}]%Use StylisticSet that you like
\begin{document}
    \[x^3+y^3=z^3\]
\end{document}
```

2 Alphabets & StylisticSet

The text font in this document is set to Latin Modern Roman deliberately so that the difference between text and math can be easily seen.

Latin and Greek (StylisticSet 4/5 give semi/extra bold for `\symbf`)

Each letter is regarded as variable, so the spacing is larger than usual text. I recommend typing equations like this (pay attention to `\sumup` e, i, and text cos, d): $\mathrm{e}^{\mathrm{i}kz} = \cos kz - \mathrm{i}\int_0^{kz} \cos\zeta\,\mathrm{d}\zeta$.

$ABCDEFGHIJKLMNOPQRSTUVWXYZ$

$abcdefghijklmnopqrstuvwxyz$

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

$\boldsymbol{ABCDEFGHIJKLMNOPQRSTUVWXYZ}$

$\boldsymbol{abcdefghijklmnopqrstuvwxyz}$

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

$\Gamma\Delta EZH\Theta\varTheta IK\Lambda MN\Xi O\Pi P\Sigma T\Upsilon\Phi X\Psi\Omega$

$\alpha\beta\gamma\delta\varepsilon\zeta\eta\theta\vartheta\iota\kappa\lambda\mu\nu\xi o\pi\varpi\rho\varrho\sigma\varsigma\tau\upsilon\phi\varphi\chi\psi\omega$

[1] https://ctan.org/pkg/ebgaramond/, and https://github.com/octaviopardo/EBGaramond12/

[2] https://github.com/georgd/EB-Garamond/

ΑΒΓΔΕΖΗΘΘΙΚΛΜΝΞΟΠΡΣΤΥΦΧΨΩ

αβγδεζηθϑικκλμνξοπϖρϱσςτυφφχψω

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ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

Sans and Typerwriter: From Libertinus Math[3]

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

ABCDEFGHIJKLMNOPQRSTUVWXYZ

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Blackboard (StylisticSet 1 gives rounded XITS Math[4]**)**

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𝕒𝕓𝕔𝕕𝕖𝕗𝕘𝕙𝕚𝕛𝕜𝕝𝕞𝕟𝕠𝕡𝕢𝕣𝕤𝕥𝕦𝕧𝕨𝕩𝕪𝕫

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Script: Rounded XITS Math [StylisticSet 3 gives scaled CM; 8 gives Garamond-compatible ones (experimental)]

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[3] https://github.com/khaledhosny/libertinus/

[4] https://github.com/khaledhosny/xits/

Digits: Same width between weight and serif/sans

3.14159265358979323846264338327950288419716939937510582097494459230781640628 6

3.14159265358979323846264338327950288419716939937510582097494459230781640628 6

3.14159265358979323846264338327950288419716939937510582097494459230781640628 6

\partial: (StylisticSet 2 gives curved ones)

$$\partial_\mu(\partial^\mu\phi) - \varepsilon^{\lambda\mu\nu}\partial_\mu(A_\lambda\partial_\nu f)$$

$$\partial_\mu(\partial^\mu\phi) - \varepsilon^{\lambda\mu\nu}\partial_\mu(A_\lambda\partial_\nu f)$$

\hbar: (StylisticSet 6 gives horizontal bars)

$\hbar$ $\hbar$

\tilde: (StylisticSet 9 gives "normal" ones)

$\tilde{F}$ $\tilde{F}$

\int: (StylisticSet 7 gives a variant with inversion symmetry)

$$\oint_{\partial\Sigma}\vec{E}\cdot\mathrm{d}\vec{l} = -\frac{1}{c}\frac{\mathrm{d}}{\mathrm{d}t}\iint_{\Sigma}\vec{B}\cdot\mathrm{d}\vec{S}$$

$$\oint_{\partial\Sigma}\vec{E}\cdot\mathrm{d}\vec{l} = -\frac{1}{c}\frac{\mathrm{d}}{\mathrm{d}t}\iint_{\Sigma}\vec{B}\cdot\mathrm{d}\vec{S}$$

3 Known Issue

- As mentioned before, the font should only be used with XeTeX.
- Various spacing problems. Though math fonts technically should not be kerned, some pairs looks very ugly (Ex. VA); sometimes sub/superscript may also have same problem.
- Fake optical size. EB Garamond does not contain a complete set of glyphs (normal + bold + optical size of both weights). The "optical size `ssty`" is made by interpolating different weights at the present (without this, the double script is too thin to be readable).

4 Equation Samples

$$1 + 2 - 3 \times 4 \div 5 \pm 6 \mp 7 + 8 = -a \oplus b \otimes c - \{z\}$$

$$\forall\varepsilon, \exists\delta : x \in A \cup B \subset S \cap T \nsubseteq U$$

$$R^{\mu}_{\nu\kappa\lambda} = \partial_\kappa\Gamma^{\mu}_{\lambda\nu} - \partial_\lambda\Gamma^{\mu}_{\kappa\nu} + \Gamma^{\mu}_{\kappa\sigma}\Gamma_\lambda\nu^{\sigma} - \Gamma^{\mu}_{\lambda\sigma}\Gamma^{\sigma}_{\kappa\nu}$$

$$T'^{\beta_1\cdots\beta_l}_{\alpha_1,\cdots\alpha_k} = T^{j_1\cdots j_l}_{i_1\cdots i_k}\frac{\partial x^{i_1}}{\partial x'^{\alpha_1}}\cdots\frac{\partial x^{i_k}}{\partial x'^{\alpha_k}}\frac{\partial x'^{\beta_1}}{\partial x^{j_1}}\cdots\frac{\partial x'^{\beta_l}}{\partial x^{j_l}}$$

$$\int_{\sqrt{\frac{1-mu+mJ/k^2}{2mu/k}}}^{X_p}\overbrace{1+2+3+4}+\overbrace{5+6+7+8}$$

$$x \leftarrow y \leftrightarrow w \Rightarrow b \Leftrightarrow c \uparrow y \updownarrow w \Downarrow b \Updownarrow c \searrow p \swarrow px \leftarrow x \restriction X \mapsfrom Y \mapsto Z \updownarrow f \rightleftarrows f \upuparrows fh \rightrightarrows h \lessdot p$$

$$\int_0^1\frac{\ln(x+1)}{x}\mathrm{d}x = \int_0^1\sum_{i=1}^{\infty}\frac{(-x)^{i-1}}{i}\mathrm{d}x = \sum_{i=1}^{\infty}\int_0^1\frac{(-x)^{i-1}}{i}\mathrm{d}x = \sum_{i=1}^{\infty}\frac{(-1)^{i+1}}{i^2} = \frac{\pi^2}{12}$$

$$\int_0^{\infty}\int_0^{\infty}\sum_{i=1}^{\infty}\prod_{j=i}^{\infty}\coprod_{k=i}^{\infty}\iiint\oint\oint\oint\oint$$

$$\left(\left(\left((x)\right)\right)\right)\quad\left[\left[\left[[x]\right]\right]\right]\quad\left\{\left\{\left\{\{x\}\right\}\right\}\right\}\quad\left|\left|\left||x|\right|\right|\right|\quad\left\|\left\|\left\|\|x\|\right\|\right\|\right\|\quad\left\langle\left\langle\left\langle\langle x\rangle\right\rangle\right\rangle\right\rangle$$

$$\left(\left(\left((x)\right)\right)\right)\quad\left\lfloor\left\lfloor\left\lfloor\lfloor x\rfloor\right\rfloor\right\rfloor\right\rfloor\quad\left\lceil\left\lceil\left\lceil\lceil x\rceil\right\rceil\right\rceil\right\rceil$$

$$\langle x|+|x\rangle+\langle\alpha|\beta\rangle+|\alpha\rangle\langle\beta|+\left\langle\frac{1}{2}\right|+\left|\frac{1}{2}\right\rangle+\left\langle\frac{1}{2}\middle|\frac{1}{2}\right\rangle+\left|\frac{1}{2}\right\rangle\left\langle\frac{1}{2}\right|+\left\langle\frac{a^2}{b^2}\right|+\left|\frac{\mathrm{e}^{x^2}}{\mathrm{e}^{y^2}}\right\rangle$$

$$\text{❶❷❸❹❺❻❼❽❾❿}+ABC^{⓪①②③④⑤⑥⑦⑧⑨⑩}$$

$$\begin{pmatrix}u_0\\u_1\\\vdots\\u_{N-1}\end{pmatrix}=\sum_{k>0}\left[\begin{pmatrix}1\\\cos ka\\\vdots\\\cos k\,(N-1)\,a\end{pmatrix}\underbrace{C_{k+}\cos(\omega_k t+\varphi_{k+})}_{\frac{2}{\sqrt{N}}q_{k+}}+\begin{pmatrix}0\\\sin ka\\\vdots\\\sin k\,(N-1)\,a\end{pmatrix}\underbrace{C_{k-}\cos(\omega_k t+\varphi_{k-})}_{\frac{2}{\sqrt{N}}q_{k-}}\right]$$

$$\begin{aligned}\mathscr{F}^{-1}(|j\rangle)&=\frac{1}{\sqrt{2^n}}\sum_{k=0}^{2^n-1}\exp\left(-2\pi\mathrm{i}\frac{jk}{2^n}\right)|k\rangle.\\&=\frac{1}{\sqrt{2^n}}\sum_{k_{n-1}=0}^{1}\cdots\sum_{k_0=0}^{1}\exp\left(-2\pi\mathrm{i}j\sum_{l=0}^{n-1}\frac{2^l k_l}{2^n}\right)|k_{n-1}\cdots k_0\rangle\\&=\frac{1}{\sqrt{2^n}}\sum_{k_{n-1}=0}^{1}\cdots\sum_{k_0=0}^{1}\bigotimes_{l=1}^{n}\left[\exp\left(-2\pi\mathrm{i}j\frac{k_{n-l}}{2^l}\right)|k_{n-l}\rangle\right]\\&=\frac{1}{\sqrt{2^n}}\bigotimes_{l=1}^{n}\left[\sum_{k_{n-l}=0}^{1}\exp\left(-2\pi\mathrm{i}j\frac{k_{n-l}}{2^l}\right)|k_{n-l}\rangle\right]\\&=\frac{1}{\sqrt{2^n}}\bigotimes_{l=1}^{n}\left[|0\rangle_{n-l}+\mathrm{e}^{-2\pi\mathrm{i}j/2^l}|1\rangle_{n-l}\right]\\&=\frac{1}{\sqrt{2^n}}\bigotimes_{l=1}^{n}\left[|0\rangle_{n-l}+\mathrm{e}^{-2\pi\mathrm{i}(0.j_{l-1}\cdots j_0)}|1\rangle_{n-l}\right].\end{aligned}$$

$$\begin{aligned}S&=\frac{m}{2}\int_0^{t_\mathrm{f}}\left[\left(-\omega x_\mathrm{i}\sin\omega t+\omega\frac{x_\mathrm{f}-x_\mathrm{i}\cos\omega t_\mathrm{f}}{\sin\omega t_\mathrm{f}}\cos\omega t\right)^2+\sum_{n=1}^{\infty}\left(\frac{a_n n\pi}{t_\mathrm{f}}\right)^2\cos^2\frac{n\pi t}{t_\mathrm{f}}\right]\mathrm{d}t\\&\quad-\frac{m\omega^2}{2}\int_0^{t_\mathrm{f}}\left[\left(x_\mathrm{i}\cos\omega t+\frac{x_\mathrm{f}-x_\mathrm{i}\cos\omega t_\mathrm{f}}{\sin\omega t_\mathrm{f}}\sin\omega t\right)^2+\sum_{n=1}^{\infty}{a_n}^2\sin^2\frac{n\pi t}{t_\mathrm{f}}\right]\mathrm{d}t\\&=\sum_{n=1}^{\infty}\int_0^{t_\mathrm{f}}\left[\frac{m}{2}\left(\frac{a_n n\pi}{t_\mathrm{f}}\right)^2\cos^2\frac{n\pi t}{t_\mathrm{f}}-\frac{m\omega^2}{2}{a_n}^2\sin^2\frac{n\pi t}{t_\mathrm{f}}\right]\mathrm{d}t\\&\quad+\frac{m\omega^2}{2}\int_0^{t_\mathrm{f}}\left[{x_\mathrm{i}}^2-\left(\frac{x_\mathrm{f}-x_\mathrm{i}\cos\omega t_\mathrm{f}}{\sin\omega t_\mathrm{f}}\right)^2\right]\left(\sin^2\omega t-\cos^2\omega t\right)\mathrm{d}t\\&\quad-\frac{m\omega^2}{2}\int_0^{t_\mathrm{f}}4x_\mathrm{i}\left(\frac{x_\mathrm{f}-x_\mathrm{i}\cos\omega t_\mathrm{f}}{\sin\omega t_\mathrm{f}}\right)(\sin\omega t\cos\omega t)\,\mathrm{d}t.\end{aligned}$$

$$\begin{aligned}U(x_\mathrm{f},t_\mathrm{f};x_\mathrm{i},t_\mathrm{i})=&\sqrt{\frac{m\omega}{2\pi\mathrm{i}\hbar\sin[\omega(t_\mathrm{f}-t_\mathrm{i})]}}\\&\times\exp\left\{\frac{\mathrm{i}m\omega}{2\hbar\sin[\omega(t_\mathrm{f}-t_\mathrm{i})]}\left[\left({x_\mathrm{i}}^2+{x_\mathrm{f}}^2\right)\cos[\omega(t_\mathrm{f}-t_\mathrm{i})]-2x_\mathrm{i}x_\mathrm{f}\right]\right\}.\end{aligned}$$