

Writing Word documents for multiple formats

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Introduction

This work was carried out as part of a HESTEM Mathematics Curriculum Innovation project. We have explored methods to produce flexible and accessible learning resources for mathematics with a focus on producing a guide for staff in HEI to enable them as individuals to create flexible resources efficiently and robustly.

A significant barrier for disabled students who enroll on HE programmes of study involving any mathematical or statistical content is the suitability of the resource format for their particular situation. To date, there is no single facility to produce such resources in a flexible format which can be modified according to individual requirements. We hope to provide staff with the requisite knowledge to access and make use of a small selection of currently available software to produce a variety of accessible formats automatically from a single master document. This will enable departments to:

- design inclusive curriculum delivery;
- anticipate potential barriers and resolve these in a proactive manner;
- communicate realistic expectations to prospective entrants and support staff;
- avoid the use of inflexible learning resources which cannot be tailored to particular needs and
- avoid making costly reactive adjustments for individual students which often result in additional versions of documents which cannot be reused and which are not updated.

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Document structure

Global settings

A fontsize of 12pt on A4 paper should be specified. This is the smallest size considered to be appropriate for a clear print format by the RNIB (1). Using a clear print format will ensure your base document format can be immediately accessed by more people. The RNIB also recommends that the text layout be simple and clear hence text should be presented in one column only.

Other RNIB guidelines include:

- The font you choose should be clear, avoiding anything stylized.
- All body text should be left aligned.
- Use bold sparingly, only highlight a few words rather than a paragraph.
- Don't use blocks of capitalised letters, and try not to use any italics or underlining.
- All text should be the same orientation on the page.

The transformations

The transformations will not be covered in this document. Please see accompanying documents.

It is more important to remember that what you are writing will be transformed. Many authors will write a Word document expecting the reader to view it in the same font, fontsize and using the same software as they are. It is important to remember that the act of transforming the document can destroy or alter much of the formatting and layout (consider a version delivered only in speech, or a format in a 20pt font size for instance).

Ideally, of course, you should proofread all output formats in use — and if the format supports speech then you should in addition proofread the speech output. However, practically speaking it is admitted that this is likely to be very time-consuming.

Student feedback acknowledges this but recommends that at least a subset of the documents you produce are proofread in all formats. Authors are likely to find this a useful exercise as it can assist in the transition of mindset from using Word as a “what you see is what you get” or WYSIWYG word processor to using it primarily to encode content and describe structure.

Writing a structured document

Content must be structured to ensure that transformations which produce html, xhtml or LaTeX documents produce structured output that is useful for a screenreader / text-to-speech user and which aids navigation e.g. in large print versions. Another consideration is that very long structureless webpages are quite unnatural.

In structured Word, even in short documents, as much as the document as possible (all except paragraphed text interspersing the other elements) should be laid out using Word tools. For instance, a new page must be introduced using the Page Break button, not by adding multiple newlines. Another example is that by numbering each paragraph you can visually mimic a numbered list but structurally it is not equivalent. In longer documents Styles should always be used rather than visually breaking creating section titles using bold text and font size changes (visually mimicking the sections). This will permit a table of contents to be automatically generated and allow the outline view and navigation pane to function. In transformed formats it will permit the document to be sectioned, to be broken down into shorter pieces and navigated directly. For extensive guidance on produced structured Word documents please see the JISC TechDis guidelines on Authoring Accessible Documents (2).

In the following sections the structuring commands, symbols and graphics manipulation available in the transformations, the requirements of using these and our advice on them is given.

Structure, navigation, text

You may align text left, center text or align text right however, this information will all be lost to a screenreader user:

Centered text

Align text left

Align text right

You may style short pieces of text using font size and text style commands however, this information will be lost to a screenreader user. Text should not be made smaller in order to fit it on a page width or height — this is a WYSIWYG approach, rather than encoding of content, and will not be retained in transformations. It should be remembered that styled text may impede a partially sighted reader or a reader with a specific reading disability. In general a style should as *Emphasis* or **Strong** should be used for emphasis rather than selecting italic or bold text as this allows the user to modify the appearance of emphasized text and to understand the intend. The following text sizes will transform to different size text in each of the transformations.

Size 8. Size 12. Size 14. Size 16. Size 18. Size 20. Size 24.

Standard text. **Bold text.** *Italics text.* Underlined text.

Labels and references

When referring to another part of the document internal hyperlinks should be used to enable the reader to navigate and locate the information as required. For mathematical symbols, see the section [Maths symbols](#). These are inserted by selecting the text, right clicking and selecting Hyperlink. Select Place in this Document and then select the required section heading. This is only possible in structured documents which have headings.

Standard structures

Quotations

For quotes the quote or intense quote styles should be used to ensure that these are styled appropriately in transformed formats. However, the emphasis, colour or space is lost to the screenreader user and so double quotes must also be used.

“Microsoft Word 2010 makes it easy to use styles without having to know much about them.”

Basic use of references and an automatically generated bibliography is possible. The quotation above is from “*Style basics in Word*” one of the articles at the site “*Word 2010 Help and How-to*” (3). Footnotes cannot be used as they cause display problems in XHTML with IE9.

Lists

You should use the **default** Bullets and Numbering, no others list variants were tested in transform. All list points should be punctuated e.g. with a full stop, comma, colon or semi-colon at the end of each line to ensure appropriate pauses for the screenreader or text-to-speech user.

- A bullet list,
- using default bullets.
 - With a level 2 sub-point.
 - With a level 3 sub-point.
 - With a level 4 sub-point.
 - Punctuation is important for screenreaders and text to speech.
 - 1. A numbered list,
 - 2. using default numbering.

- a. With a level 2 sub-point.
 - i. With a level 3 sub-point.
 - 1. With a level 4 sub-point.
 - ii. Punctuation is important for screenreaders and text to speech.

Frames and rules

Frames of any kind cannot be used by several transformations. To break up text or to highlight an equation etc. it is appropriate to use a rule before and after instead. However, this is not retained in the transformation to LaTeX.

Rules are produced by typing --- and then return on an empty line.

Tables

Tables should be created using Insert Table. When in the table click on the Design tab and select whether there is a first row or column. Notice how the equations are encoded using the equation editor. All mathematics must be encoded either using this or MathType to ensure it is transformed correctly.

All tables and images must have captions or the incorrect caption will be used in the transformation to LaTeX. To insert a caption hover on the top left corner until a cross appears, right click and select Insert Caption.

Table 1: This is a test table

First	Second	Third
This is the first line		
This is the second line	1×2	
This is the third line	$1 \times 2 \times 3$	6
This is the fourth line	$1 \times 2 \times 3 \times 4$	24
This is the fifth line	$1 \times 2 \times 3 \times 4 \times 5$	120
This is the sixth line	$1 \times 2 \times 3 \times 4 \times 5 \times 6$	720
This is the seventh line	$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7$	5040
This is the eighth line	$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8$	40320
	The	End

Maths symbols

All mathematics must be encoded either using the equation editor or MathType to ensure they are transformed correctly. This test document was encoded using the standard equation editor as MathType is considered to be a transform. Not all symbols available in the Word equation editor can be transformed. Those that can are listed below.

Standard

$a, b, c, d, e, f, g, h, i, j, k, l, m,$

$n, o, p, q, r, s, t, u, v, w, x, y, z$

A, B, C, D, E, F, G, H, I, J, K, L, M,

N,O,P,Q,R,S,T,U,V,W,X,Y,Z

Greek

$\alpha, \beta, \gamma, \delta, \varepsilon, \epsilon, \zeta, \eta, \theta, \vartheta, \iota, \kappa, \lambda, \mu, \nu, \xi,$

$\sigma, \pi, \varpi, \rho, \varrho, \sigma, \varsigma, \tau, \upsilon, \varphi, \phi, \chi, \psi, \omega$

The upper case Greek letters inserted as standard are upright; they will not transform well and should be changed to italic.

A, B, Γ , Δ , E, Z, H, Θ , I, K, Λ , M,

N,Ξ,O,Π,P,Σ,T,Y,Φ,X,Ψ,Ω

Letter-like symbols

Q, R, R, R, Z, U, B, E, 3, 4, F, M, N, V, I, T

Operators

$\pm, \div, \times, \mp, \infty, a/b, ^*, \circ, \cdot, \cap, \cup, \uplus, \sqcap, \sqcup, \wedge, \vee$

$=, \neq, <, >, \leq, \geq, \not<, \not\leq, \not>, \not\geq, \equiv, \sim, \simeq, \approx, \cong, \not\equiv, \propto, \ll, \gg,$

$\in, \exists, \notin, \subset, \supset, \subseteq, \supseteq, \prec, \succ, \preceq, \succeq, \sqsubset, \sqsupset, \sqsubseteq, \sqsupseteq, \parallel, \perp, \vdash, \dashv$

Σ∫∫∫ΠΠ

$$\sum x, \int x, \iint x, \oint x,$$

$\prod x, \coprod x,$

$\subseteq, \supseteq, \triangleleft, \triangleright, \triangleleft, \triangleright, \models, \in, \ni, \sqsubset, \sqsupset, \Vdash, \Vdash, \vDash, \models, \cong, \approx, \propto, \pitchfork, \doteq$

Arrows

$\leftarrow, \rightarrow, \uparrow, \downarrow, \leftrightarrow, \updownarrow, \Leftarrow, \Rightarrow, \Uparrow, \Downarrow, \Leftrightarrow, \Updownarrow, \nearrow, \nwarrow, \searrow, \swarrow$,

Negated relations

$\neq, <, >, \leq, \geq, \sim, \not\equiv, \not\leq, \not\geq, \not\sim, \not\equiv, \not\leq, \not\geq, \not\sim, \not\equiv,$

Scripts

Not all letters in the script alphabet will be spoken as script-letter by MathPlayer.

$\mathcal{A}, \mathcal{B}, \mathcal{C}, \mathcal{D}, \mathcal{E}, \mathcal{F}, \mathcal{G}, \mathcal{H}, \mathcal{I}, \mathcal{K}, \mathcal{L}, \mathcal{M}$,

$\mathcal{N}, \mathcal{O}, \mathcal{Q}, \mathcal{R}, \mathcal{S}, \mathcal{T}, \mathcal{U}, \mathcal{V}, \mathcal{W}, \mathcal{X}, \mathcal{Y}, \mathcal{Z}$

For unknown reasons our MathType cannot transform script P correctly to MathML so you will see a transformation error at this point \mathcal{P} in all formats created from the MathType format. Presumably this will be corrected in the near future since the rest of the alphabet transforms.

Frakturs

Not all letters in the Fraktur alphabet will be spoken as fraktur-letter by MathPlayer.

a, b, c, d, e, f, g, h, i, j, k, l, m,

n, o, p, q, r, s, t, u, v, w, x, y, z

Double struck

Not all letters in the double struck alphabet will be spoken as double struck-letter by MathPlayer.

A, B, C, D, E, F, G, H, I, J, K, L, M.

N,O,P,Q,R,S,T,U,V,W,X,Y,Z

Geometry

∠, \angle , \neq , \perp , \vdash , \parallel , \vdash , \vdash , \vdash

Maths structures

Notice how the equations are encoded using the equation editor. All mathematics must be encoded either using this or MathType to ensure it is transformed correctly. This test document was encoded using the standard equation editor as MathType is considered to be a transform. Not all structures available in the Word equation editor can be transformed. Those that can are listed below.

Equations can be placed inline in the text $A_{i,j,k}^{2^n}$ like so or displayed.

Displayed math

$$\sum_{i=1}^{13} x_i^2 = x_1^2 + x_2^2 + x_3^2 + x_4^2 + x_5^2 + x_6^2 + x_7^2 + x_8^2 + x_9^2 + x_{10}^2 + x_{11}^2 + x_{12}^2 + x_{13}^2$$

$$x_1^2 = x_2^2 = x_3^2 = x_4^2 = x_5^2 = x_6^2 = x_7^2 = x_8^2 = x_9^2 = x_{10}^2 = x_{11}^2 = x_{12}^2 = x_{13}^2$$

$$\prod_{i=1}^{13} x_i^2 = x_1^2 x_2^2 x_3^2 x_4^2 x_5^2 x_6^2 x_7^2 x_8^2 x_9^2 x_{10}^2 x_{11}^2 x_{12}^2 x_{13}^2$$

$$\prod_{i=1}^{13} x_i^2 = x_1^2 \cdot x_2^2 \cdot x_3^2 \cdot x_4^2 \cdot x_5^2 \cdot x_6^2 \cdot x_7^2 \cdot x_8^2 \cdot x_9^2 \cdot x_{10}^2 \cdot x_{11}^2 \cdot x_{12}^2 \cdot x_{13}^2$$

$$\sqrt{\sum_{i=1}^{13} x_i^2} = \sqrt{x_1^2 + x_2^2 + x_3^2 + x_4^2 + x_5^2 + x_6^2 + x_7^2 + x_8^2 + x_9^2 + x_{10}^2 + x_{11}^2 + x_{12}^2 + x_{13}^2}$$

You can align equations by creating them as separate displayed items, selecting them, right clicking and clicking on Align at =.

$$a = b + c = d$$

However, the layout will not be maintained in other formats – the line breaks will be lost – and is likely to cause significant layout problems on translation to LaTeX. Keep equations separate. Don't align, keep each equation line separate, and don't select centred as a group.

$$\sum_{i=1}^{13} 2^i = 2^1 + 2^2 + 2^3 + 2^4 + 2^5 + 2^6 + 2^7 + 2^8 + 2^9 + 2^{10} + 2^{11} + 2^{12} + 2^{13}$$

$$= 2 + 4 + 8 + 16 + 32 + 64 + 128 + 256 + 1024 + 2048 + 4096 + 8192$$

$$= 16382$$
 and in equation tools is a button for placing normal text

Word structures

$$\frac{a}{b}, a/b, \frac{a}{b}$$

$$x^2, x_2, x_1^2, {}^2_1x$$

$$\sqrt{a}, \sqrt[k]{a}, \sqrt[2]{a}, \sqrt[3]{a}$$

$$\int x, \int_a^b x, \int_a^b x, \iint x, \int_a^b \iint x, \int_a^b \iint x,$$

$$\oint_a^b x, \oint_a^b x, \oint_a^b x,$$

$$\sum x, \sum_a^b x, \sum_a^b x, \sum x, \sum_a x$$

$$\prod x, \prod_a^b x, \prod_a^b x, \prod x, \prod_a x, \coprod x, \coprod_a^b x, \coprod_a^b x, \coprod x, \coprod_a x$$

$$(x), [x], \{x\}, |x|, [x[,]x],]x[,$$

$$(x, [x, \{x, |x, \dots, x|, x\}, x], x)$$

$$\begin{cases} a \\ b \end{cases}$$

$$\begin{cases} a \\ b \\ c \end{cases}$$

$$\begin{matrix} a \\ b \end{matrix}$$

$$\begin{pmatrix} a \\ b \end{pmatrix}$$

$$\sin x, \cos x, \tan x, \csc x, \sec x, \cot x$$

$$\sin^{-1} x, \cos^{-1} x, \tan^{-1} x, \csc^{-1} x, \sec^{-1} x, \cot^{-1} x$$

$$\sinh x, \cosh x, \tanh x, \operatorname{csch} x, \operatorname{sech} x, \operatorname{coth} x,$$

$\sinh^{-1} x, \cosh^{-1} x, \tanh^{-1} x, \operatorname{csch}^{-1} x, \operatorname{sech}^{-1} x, \operatorname{coth}^{-1} x$ $\log_a b, \log b, \lim_a b, \min_a b, \max_a b, \ln b$ $\begin{array}{c} x & x \\ :=, ==, + =, - =, \stackrel{\Delta}{=}, \xleftarrow[x]{x}, \xrightarrow[x]{x}, \xleftarrow[x]{x}, \xrightarrow[x]{x}, \xleftarrow[x]{x}, \xrightarrow[x]{x}, \xleftarrow[x]{x}, \xrightarrow[x]{x}, \xleftarrow[x]{x}, \xrightarrow[x]{x} \end{array}$ $\begin{matrix} 1 & 0 \\ 0 & 1 \end{matrix}$ $\begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$
$$\begin{pmatrix} 1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & 1 \end{pmatrix}$$
$$\begin{bmatrix} 1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & 1 \end{bmatrix}$$
$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}, \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix}$$

Graphics

Inserted graphics should always be given an 'alt tag' which describes the content. A screenreader will convey this information to the user. To add an alt tag first insert the picture then right click and select Format Picture.

Select Alt Text and then enter the alternative text for the image into the description box. Captions are important for other readers and to assist with navigation if an image must be referred to. These can also be added by right clicking on the image

Only PNG images are correctly transformed to all formats.

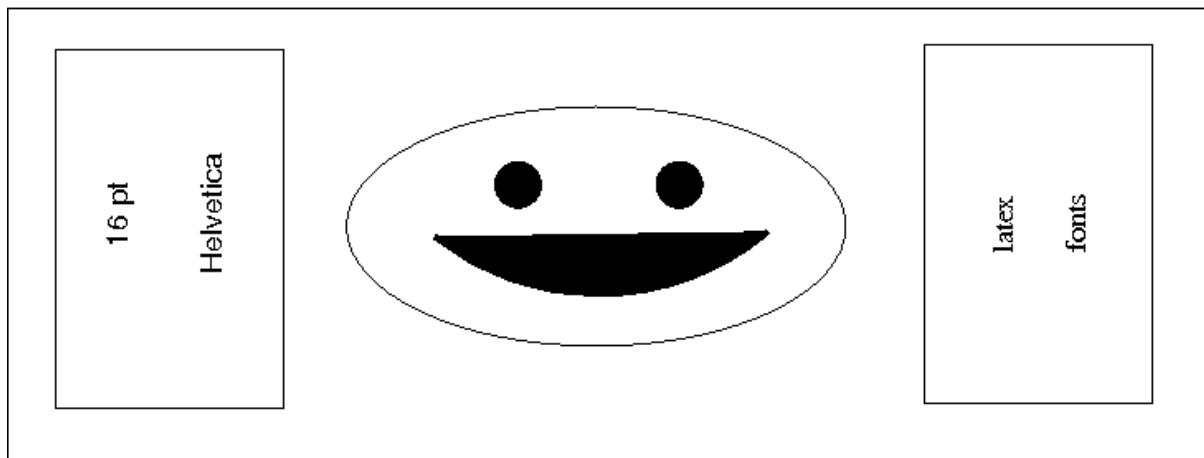


Figure 1: Inserted PNG

Bibliography

1. **RNIB.** Clear Print. [Online] 2011.
http://www.rnib.org.uk/professionals/accessibleinformation/text/pages/clear_print.aspx.
2. **JISC TechDis.** Authoring Accessible Documents. [Online]
<http://www.jisctechdis.ac.uk/AccessibilityEssentials/2007/AE2/modules/authoring%20accessible%20docs/index.html>.
3. **Microsoft.** Word 2010 Help and How-to. [Online] 2012.
<http://office.microsoft.com/en-us/word-help/CL010256357.aspx?CTT=97>.