

CREATING GRAPHICS for use in books and journals

QUICK START (See following pages for detailed instructions.)

GENERAL GUIDELINES

- **Create graphics at 100% of the size at which they will be printed.**
- **Do not use a line/rule weight less than .5 point at 100%.**
If you must scale your figure, be sure that you compensate by making line weights thicker. A .5 point line scaled at 50% becomes a .25 point line. Line weights below .5 point MAY disappear during the printing process.
- **Shades of gray (screens) should not be lower than 10% or higher than 85%.**
Screens outside this range are either too light or too dark to print correctly.
- **Type point size should be no less than 10 points at 100%.**
If you must scale your figure, be sure that you compensate by making the type point size larger: 10 point type scaled at 50% becomes 5 point type, which would not be readable.
- **Color graphics to be printed in black and white or grayscale should be converted to black and white or grayscale before being submitted to the AMS.**
When color graphics are printed in black and white or grayscale, sometimes lighter colors, such as yellow, disappear, or colors, such as red and blue, appear to be the same tone. It is preferable that you convert your color graphics to grayscale and check to be sure that all the elements in your graphics print as desired.

FONT USAGE

- **Whenever possible, fonts used in graphics should match those used in text.**
- **Fonts should be fully embedded in your graphic when saving the file.**
If the fonts are not embedded in your graphic, it is possible that the font will be replaced with a default font such as Courier and the characters will not print properly. If you are unable to embed the fonts in your graphic, convert the fonts to paths (or outlines) prior to exporting the file to EPS. This can be done in the application in which they were created (consult the documentation for your graphics program for assistance).

FILE FORMAT

- **Most AMS Books: The preferred file format for graphics is EPS (Encapsulated PostScript)**
- **AMS/MAA Press Books, the AMS *Student Mathematical Library* series (STML), and AMS *Pure and Applied Undergraduate Texts* series (AMSTEXT): The preferred file format for graphics is PDF (Portable Document Format).**

RESOLUTION REQUIREMENTS

- **Line art (black and white (no grays))—600 pixels per inch (PPI) @ 100%.**
- **Halftone (grayscale figure (photographic with no text or lines))—300 PPI @ 100%.**
- **Combination halftone and line art—600 PPI @ 100%.**
- **PLEASE NOTE:** If you must scale your graphic, be sure to compensate by making the resolution higher. A 300 PPI graphic scaled at 200% becomes a 150 PPI graphic. Resolutions below 300 PPI will look jagged.

FILE NAMING

- **File name should be no longer than 20 characters in length, including an extension.**
- **Use only lowercase letters, numbers, a dash, or an underscore in the file names.**
- **File names should be specific and descriptive, not generic: smith-fig-3.eps is better than fig3.eps.**

PLACING FIGURES IN YOUR PAPER

- **Use a standard TeX graphics inclusion macro package.**
The recommended graphics inclusion package for LaTeX2e is graphicx. Be sure that commands used to include graphics in TeX are compatible with Radical Eye Software's dvips.
- **Do not place graphics for use in TeX files in subdirectories.**
- **Set figure captions in TeX, not in the graphics program.**

CREATING GRAPHICS

for use in books and journals

General guidelines

- Create graphics at 100% of the size at which they will be printed.

Lines and rules

- Do not use a line/rule weight less than .5 point at 100%.

If you must scale your figure, be sure that you compensate by making line weights thicker. A .5 point line scaled at 50% becomes a .25 point line. Line weights below .5 point MAY disappear during the printing process.

- Graded lines should increase in increments of .5 point (i.e., .5 point, 1 point, 1.5 point).

Increments less than .5 point do not read as distinctly different lines.

- Lines that are a shade of gray (screened) or color (CMYK/RGB) need a line weight of at least 1 point at 100%.

Gray and color lines thinner than 1 point look broken and jagged because of the small dot pattern used to simulate a shade of gray or color tone.

Shades of gray (screens)

- Screens defined.

A screen is a pattern of small black and white dots used to simulate shades of gray.

- Shades of gray (screens) should not be lower than 10% or higher than 85%.

Screens outside this range are either too light or too dark to print correctly.

- Screens should increase in increments of no less than 10%.

Screen variations of less than 10% are not distinguishable.

- Do not put type on a screen darker than 35%.

Type on a screen that is above 35% is not legible.

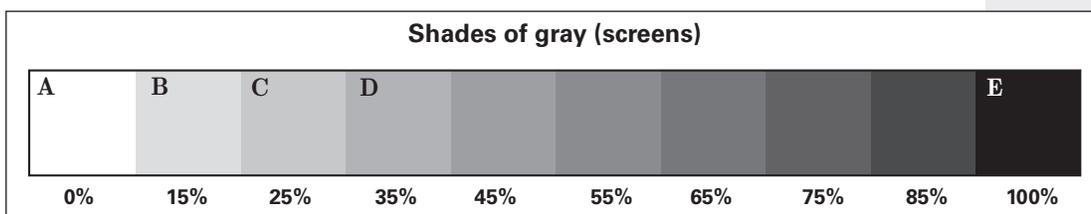
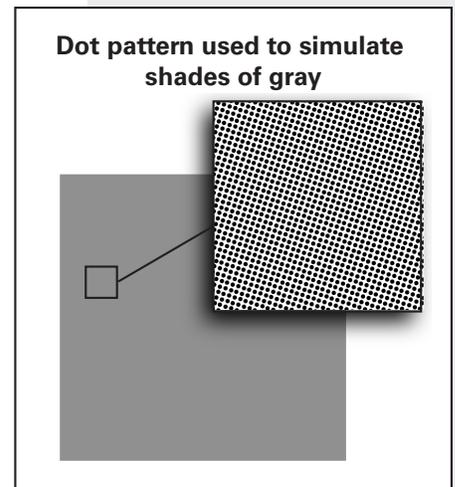
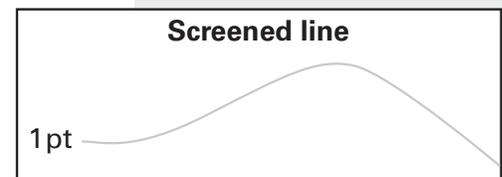
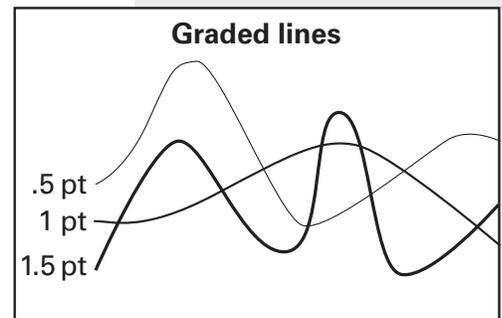
- White type can be used only on 100% black.

White type on a gray background looks broken and jagged because a small dot pattern is used to simulate shades of gray.

Multiple-part figures

- Multiple-part figures should be configured to one figure in a graphics program, not in TeX.

Aligning multiple-part figures is very difficult in TeX. It is easier and more cost-effective to do so in a graphics program.



Clipping and bounding boxes

- **When using a smaller area of a larger graphic, clip or crop within the graphics application to delete all but the desired portion.**

Do not clip or crop by pasting areas of white over portions of the graphic. Doing this will make the bounding box larger than it should be, resulting in problems when including the graphic in TeX.

- **If possible, verify that bounding box information is correct.**

Problems arise when the bounding box is not correct. Graphics might be clipped off in unexpected ways.

Type size

- **Type point size should be no less than 10 points at 100%.**

If you must scale your figure, be sure that you compensate by making the type point size larger: 10 point type scaled at 50% becomes 5 point type, which would not be readable.

Font usage

- **Whenever possible, fonts used in graphics should match those used in text.**

- **Use Type 1 outline fonts instead of bitmap fonts.**

Type 1 outline fonts are vector based. These fonts do not lose quality when output to high-resolution printers.

- **Fonts should be fully embedded in your graphic when saving the file.**

If the fonts are not embedded in your graphic, it is possible that the font will be replaced with a default font such as Courier and the characters will not print properly. If you are unable to embed the fonts in your graphic, convert the fonts to paths (or outlines) prior to exporting the file to EPS. This can be done in the application in which they were created (consult the documentation for your graphics program for assistance).

- **Do not subset fonts included in your graphic.**

It is imperative that the full font set be included in your graphic. If only a subset of a font is included, a font error can occur, causing characters to possibly disappear in both the graphic and the DVI file.

- **Avoid fonts with city names such as Chicago, Monaco, Geneva, etc.**

SAVING GRAPHICS – NEED-TO-KNOW FACTS

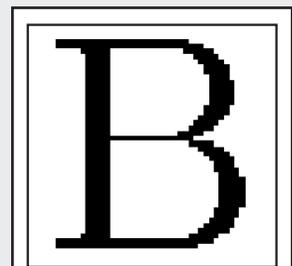
Vector vs. Raster

- **Vector art**

Vector images are created in “Drawing” programs. A vector-based graphics program uses points connected with curved or straight lines, like connect-the-dots. The spaces defined by the lines can be empty or filled with color. These points, curves, and lines are defined with code. The code is basically a set of x, y coordinates and draw commands. The advantage to using vector art is that it is resolution independent (it can be enlarged and will never lose quality).

- **Raster art**

Raster or bitmapped images are created in “Paint” programs which use pixels to define images. A pixel (short for picture element) is a square of color arranged on a grid. Resolution refers to the amount of pixel information per inch. If the resolution or pixels per inch (PPI) is too low, the image will appear “jagged”. For this reason it is extremely important that resolution be set according to the following guidelines.



**Low resolution
“Raster Art” will
appear “jagged”**

- **Resolution defined.**

In digital images, resolution refers to the amount of pixel information per inch. If the resolution or pixels per inch (PPI) is too low, the image will appear “jagged”.

- **Resolution requirements for bitmap graphics.**

Line art—1200 PPI @ 100%

Halftone—600 PPI @ 100%

Combination halftone—600 PPI @ 100%

- If you must scale your graphic, be sure to compensate by making the resolution higher. A 300 PPI graphic scaled at 200% becomes a 150 PPI graphic. Resolutions below 300 PPI will look jagged.

Figure types

- **Line art — 1200 PPI @ 100%.**

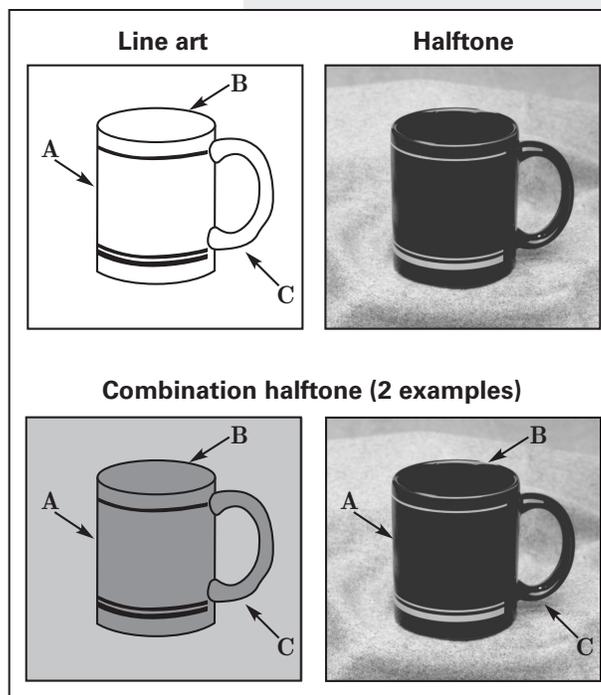
Purely black and white figures with no shades of gray. Best if created and saved as a vector graphic. If not, the resolution must be 1200 PPI.

- **Halftone — 600 PPI @ 100%.**

Figures or photographs with shades of gray. Also referred to as grayscale.

- **Combination halftone — 600 PPI @ 100%.**

Halftones that contain line art, such as labeling or outlines. Can be photographic or lines filled with shades of gray.



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COLOR GRAPHICS

- **Color graphics should be used in the print product only if color is mathematically essential to the paper. Authors of journal or proceedings articles may be requested to pay for the cost of color in the print product.**
- **Requirements for graphics to be published in color.**

Color graphics should be saved in the following format:

Electronic-only journals: **RGB format**

Electronic and/or print journals: **CMYK format**

(Note that if you submit RGB files, they will be turned into CMYK and we cannot guarantee that color reproduction in the print product will match the RGB file.)

Books: **CMYK format**

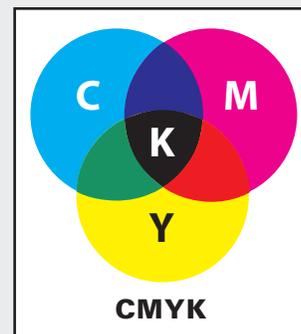
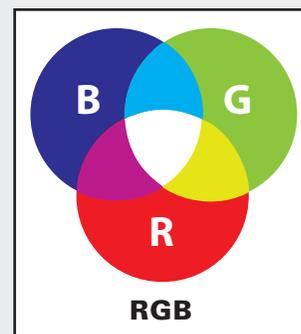
(Note that if you submit RGB files, they will be turned into CMYK and we cannot guarantee that color reproduction in the print product will match the RGB file.)

- **CMYK and RGB defined.**

CMYK is an acronym for cyan, magenta, yellow, and black—the standard ink colors used in four-color process (full-color) printing.

RGB is an acronym for red, green, and blue—the color model used for computer monitors and video output systems.

- **Color graphics to be printed in black and white or grayscale should be converted to black and white or grayscale before being submitted to the AMS.**



SCANNING PHOTOGRAPHS

General guidelines

- Photographs must be scanned at a minimum resolution of 300 dpi at the actual size the photograph will be used in the publication. Please do not scale photographs in TeX.
- **Color photographs** must be saved in CMYK mode (see Color Graphics above).
- **Black and white photographs** must be adjusted for proper reproduction on the type of stock/paper on which they will be printed, particularly if the paper is uncoated. The tones must be adjusted or they will reproduce much darker than desired. Be sure to confirm the paper stock before making any adjustments. See instructions below.
- **Uncoated stock** is absorbent and ink spreads slightly on this stock, creating darker tones than actually desired. The next section has instructions for using Adobe PhotoShop to adjust the tones in a photograph for printing on uncoated stock.
- **Coated stock** has a clay coating that does not allow the ink to be absorbed into the paper. Coated stock gives more accurate reproduction of tones than uncoated stock will. In general, the tonal value indicated in the file will reproduce accurately. Most color photographs are printed on coated stock.

Instructions for using Adobe PhotoShop to adjust black and white photographs to be printed on uncoated stock

- When printing black and white photographs on uncoated stock, gray tones of 89% and greater will print as black, and gray tones of 5% or less will print as white. The photograph must be adjusted to compensate for this. In Adobe PhotoShop you can use the “Curves” palette to adjust these tones. The black point (100% black) should be brought down to 89%, and the white point (0% black) should be brought up to 5%. After the black and white points have been adjusted, the midtones should be adjusted: 50% gray should be brought down to 40%. This adjustment will cause the darker grays to fade, so you should watch how this affects the 75% gray point and bring this point back up to the original 75% grid point.

Cleanup stray marks

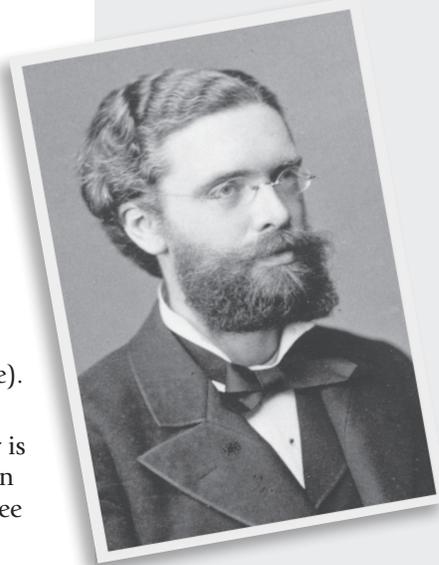
- Any undesirable specs or scratches should be masked. In Adobe PhotoShop you can use the “cloning” tool to mask these imperfections.

Descreen photographs scanned from books or magazines

- If you do not have the original photograph and are scanning from a book or magazine, you will get a moire pattern because of the small dots (screens) used in conventional printing to create tones. This pattern must be minimized. Some scanning software has a descreening option. The “Gaussian Blur” option in PhotoShop can also be used to minimize the screen pattern. This filter works by slightly blurring the dots to make them undetectable to the naked eye.

DUAL PRODUCT GRAPHICS (PRINT AND ONLINE GRAPHICS)

- **For dual product (print and online) books and journals, color graphics should be saved in either RGB or CMYK format.**
- **Do not use a line/rule weight less than 1 point (1 pixel @ 72 PPI) at 100%.** Although a .5 point line is acceptable for print, screen resolution is 72 PPI and a .5 point line will disappear online.



- **Type point size should be no less than 12 point at 100%.**
Although a 10 point type is acceptable for print, screen resolution is 72 PPI and 10 point type will be difficult to read online.
- **Do not put type on a dark background.**
Type on dark colors is not legible.
- **Check your figure on a black and white printer.**
Many people do not have color printers. Be sure that a black and white printout of your figure is legible.

ONLINE/WEB-ONLY GRAPHICS

- **Use the same visual consideration as for dual-product graphics.**
- **Web-only graphics should be saved in RGB format and at a resolution of 72 PPI (pixels per inch) at 100%.**
- **Graphics should be “optimized”.**
Optimizing means that you make the file size as small as possible without drastically affecting the quality of the image. This is important so that the web page will load quickly on all systems and browsers.

NONELECTRONIC GRAPHICS

Hand-drawn graphics

- Hand-drawn graphics should be drawn in black ink with clean, unbroken lines on nonabsorbent paper and at the size they will be printed in the published product. The appropriate amount of white space should be left in the TeX file for the graphics to be inserted into the paper.

Photographs and computer-generated images supplied only on paper (these are also considered nonelectronic graphics)

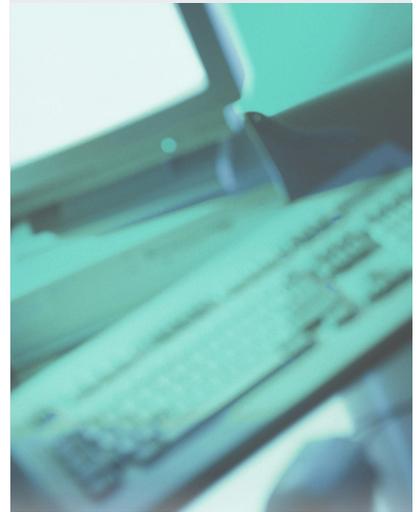
- When possible, please submit originals rather than scanning them on your own. The tonal values are adjusted by the publisher to comply with the specific stock and press on which the photograph or computer-generated image will be printed.

General guidelines for all nonelectronic graphics

- Follow the applicable “general guidelines” at the beginning of this guide.
- Whenever possible, fonts used in these graphics should match those used in text.
- The original and a labeled photocopy should be supplied with the final manuscript of accepted papers.
- Do not fold nonelectronic graphics.
- Package nonelectronic graphics in cardboard so that they will not be bent or damaged in the mail.

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- **Use only lowercase letters, numbers, a dash, or an underscore in the file names.**
- **File names should be specific and descriptive, not generic: smith-fig-3.eps is better than fig3.eps.**



PLACING FIGURES IN YOUR PAPER

- **Use a standard TeX graphics inclusion macro package.**
The recommended graphics inclusion package for LaTeX2e is `graphicx`. Be sure that commands used to include graphics in TeX are compatible with Radical Eye Software's `dvips`.
- **Do not place graphics for use in TeX files in subdirectories.**
- **Number figures consistently throughout the paper.**
- **Place the figure at the top or the bottom of the page.**
- **Use an in-text reference.**
- **Set figure captions in TeX.**
- **Set figure captions below the figure.**
- **Make sure figures are sized correctly and do not extend into the margins of the paper.**
If the figure is too large, resize the figure in a graphics program, not in TeX.
- **Leave 1.5 picas (1/4") from figure caption to text below.**
This is an automatic feature in the AMS author packages.
- **Leave 1.5 picas (1/4") from text above to graphic below.**
This is an automatic feature in the AMS author packages.

To access this PDF file, go to: <http://www.ams.org/publications/authors/creating-graphics.pdf>.

