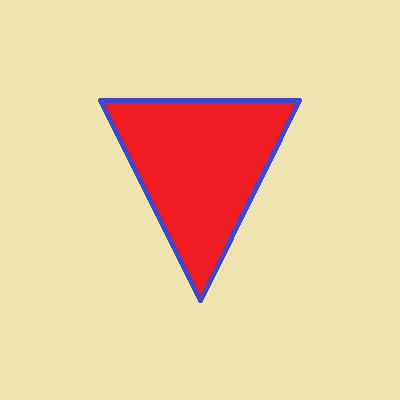
# Bitmap vs Vector images:

## This 50-pixel bitmap image is on a background which is 100x100 pixels. Its file size is 30 KB:



## This 200-pixel bitmap image is on a background which is 400x400 pixels. Its file size is 469 KB (and is the same size whether the background is white or yellow):

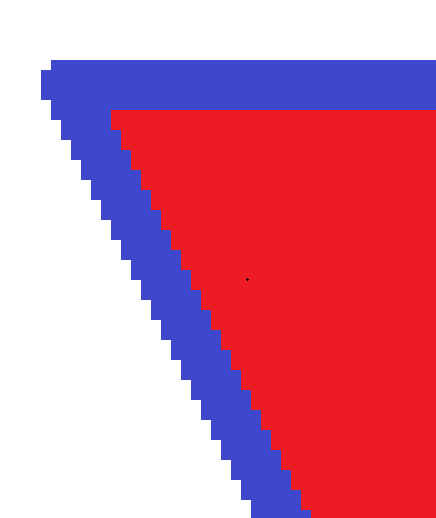


## Note that if this 50-pixel bitmap image is enlarged in Word, the borders blur due to “antialiasing”:



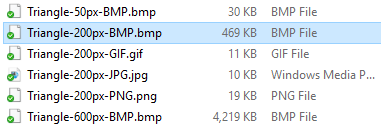
Bitmap Image – drawn “Paint”, enlarged in Word showing “antialiasing.

## If the 50-pixel bitmap image is enlarged in paint, there is no antialiasing and the image will have sharp steps:



**The BMP files are much bigger than the other formats because EVERY PIXEL has a 3 BYTE colour:**

* 1. **The 50-pixel image has a border size of 100 x 100 = 10,000 pixels**
  2. **The 200-pixel image has a border size of 400 x 400 = 160,000 pixels**
  3. **The 600-pixel image has a border size of 1200 x 1200 = 1,440,000 pixels**



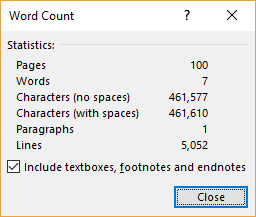
**To see what’s in the 200 pixel BMP file, right click and "Open with" > "Notepad":**

Scan with Windows Defender... 
Open with 
Give access to 
Restore previous versions 
Send to 
Copy 
Create shortcut 
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L] 
Notepad 
Paint 
Paint 3D 
Photos 
Sketch800k 
Search the Store 
Choose another app 
Triangle-2DOpx-GIF.gif 
Triangle-2DOpx-JPG.jpg 
Triangle-2DOpx- PNG.png 
25/07/2019 11:32 AM 
25/07/2019 11:31 AM 
25/07/2019 11:32 AM 
GIF File 
GIF File 
GIF File 
GIF File 
GIF File 
GIF File 
GIF File 
GIF File 
GIF File 
PNG File 
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BMP File 
GIF File 
Windows Mt 
PNG File 

**The file will take a while to open and should look like this:**

Triangle-2DOpx-8MP.bmp Notepad 
Eile Edit Fermat View Help 
8M6SO 
6 
so 

**If you paste all this into Word, it’s about 65 pages with 465,610 characters which is close to the 469 Bytes!!!**



To do the calculations, we have:

Total pixels = 400 x 400

= 160,000

Total bytes ≈ 3 bytes per pixel

≈ 3 x 160,000

≈ 480,000 Bytes

≈ 480 kilobytes

Vector Image – using Word “Shapes”

## A vector image can be expanded without distortion because it is a few lines of code such as those shown below:

Example triangle01 specifies a path in the shape of a triangle. (The **M** indicates a *moveto*, the **L**s indicate *lineto*s, and the **z** indicates a *closepath*).

<?xml version="1.0" standalone="no"?>

<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"

"<http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd>">

<svg width="4cm" height="4cm" viewBox="0 0 400 400"

xmlns="http://www.w3.org/2000/svg" version="1.1">

<title>Example triangle01- simple example of a 'path'</title>

<desc>A path that draws a triangle</desc>

<rect x="1" y="1" width="398" height="398"

fill="none" stroke="blue" />

<path d="M 100 100 L 300 100 L 200 300 z"

fill="red" stroke="blue" stroke-width="3" />

</svg>

|  |
| --- |
| Example triangle01 — simple example of a 'path |
| Example triangle01 |

[View this example as SVG (SVG-enabled browsers only)](http://www.w3.org/TR/SVG/images/paths/triangle01.svg)

Paths – SVG 1.1 (Second Edition)

<http://www.w3.org/TR/SVG/paths.html#PathDataClosePathCommand>

Screen clipping taken: 25/07/2018 8:39 PM

If the following code is copied into the <body> of your “multimedia” web page, you will see some amazing shapes. Alter the highlighted code to make your own shape:

<h2>200 pixel vector triangle the same as the bitmap - just 6 lines of code!</h2>

<!-- Code below taken from Paths – SVG 1.1 (Second Edition) -->

<!-- http://www.w3.org/TR/SVG/paths.html#PathDataClosePathCommand -->

<svg width="400" height="400" viewBox="0 0 400 400"

xmlns="http://www.w3.org/2000/svg" version="1.1">

<desc>A path that draws a triangle 200 pixels wide by 200 high</desc>

<rect x="2" y="2" width="396" height="396"

fill="LightYellow" stroke="black" stroke-width="4" />

<path fill="red" stroke="blue" stroke-width="2"

d="M 100 100 L 300 100 L 200 300 z" />

<!-- <defs> -->

</svg>

<h2>600 pixel vector triangle - still just 6 lines of code (about 360 characters, so less that half a kilobyte)</h2>

<!-- Code below taken from Paths – SVG 1.1 (Second Edition) -->

<!-- http://www.w3.org/TR/SVG/paths.html#PathDataClosePathCommand -->

<svg width="800" height="800" viewBox="0 0 800 800"

xmlns="http://www.w3.org/2000/svg" version="1.1">

<desc>A path that draws a triangle 600 pixels wide by 600 high</desc>

<rect x="4" y="4" width="792" height="792"

fill="LightYellow" stroke="black" stroke-width="6"/>

<path d="M 100 100 L 700 100 L 400 700 z"

fill="red" stroke="blue" stroke-width="4" />

</svg>

<h2>this is my modification of an SVG image:</h2>

<!-- Code below taken from Paths – SVG 1.1 (Second Edition) -->

<!-- http://www.w3.org/TR/SVG/paths.html#PathDataClosePathCommand -->

<svg width="8cm" height="8cm" viewBox="0 0 800 800"

xmlns="http://www.w3.org/2000/svg" version="1.1">

<desc>Draw your own path</desc>

<path d="M 50 50 L 250 50"

fill="red" stroke="blue" stroke-width="20" />

</svg>

<h2>A fancier vector drawing from GitHub - less than 40 lines of code (1048 characters, so around 1kb of file size)</h2>

<h3>https://github.com/oreillymedia/Using\_SVG/blob/master/ch01-overview-files/rasterization.svg</h3>

<!-- SVG code -->

<svg viewBox="0 0 480 350"

xmlns="http://www.w3.org/2000/svg" xml:lang="en"

xmlns:xlink="http://www.w3.org/1999/xlink" >

<style>

text {

font-family: Tahoma, sans-serif;

text-anchor: middle;

font-size: 18px;

fill: currentColor;

}

path {

stroke: dimgray;

stroke-width: 4;

stroke-dasharray: 8 4;

}

</style>

<pattern id="low-res" patternUnits="userSpaceOnUse"

width="20" height="20">

<g id="dots">

<circle fill="red" r="5" cx="10" cy="5" />

<circle fill="lime" r="5" cx="5" cy="15" />

<circle fill="blue" r="5" cx="15" cy="15" />

</g>

</pattern>

<pattern id="high-res" patternUnits="userSpaceOnUse"

width="8" height="8" viewBox="0 0 20 20">

<use xlink:href="#dots" />

</pattern>

<g fill="url(#low-res)">

<text x="120" y="100%" dy="-1em" >Low-Resolution Display</text>

<path id="shape"

d="M100,10 C200,0 300,250 120,200 S50,300 200,300 C0,200 0,20 100,10Z" />

</g>

<g transform="translate(240,0)" fill="url(#high-res)">

<text x="120" y="100%" dy="-1em" >High-Resolution Display</text>

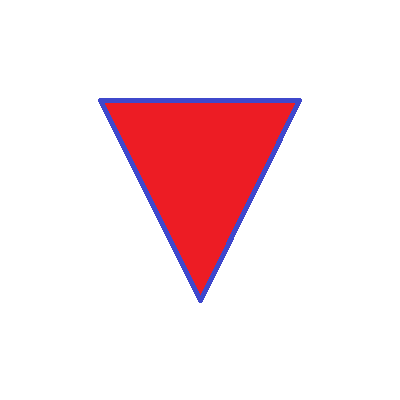
<use xlink:href="#shape" />

</g>

</svg>

# Back to bitmap images:

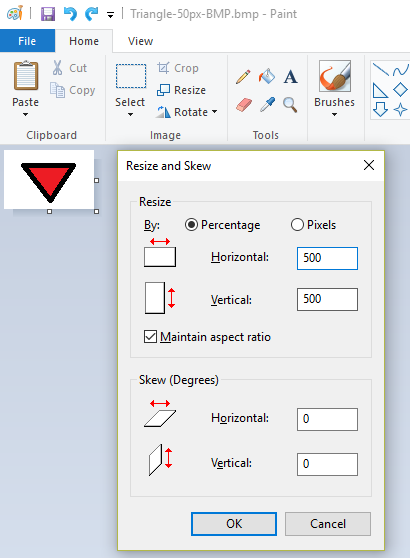
## This bitmap image is 200 x 200 pixels sitting on a canvas of 400 x 400 pixels:



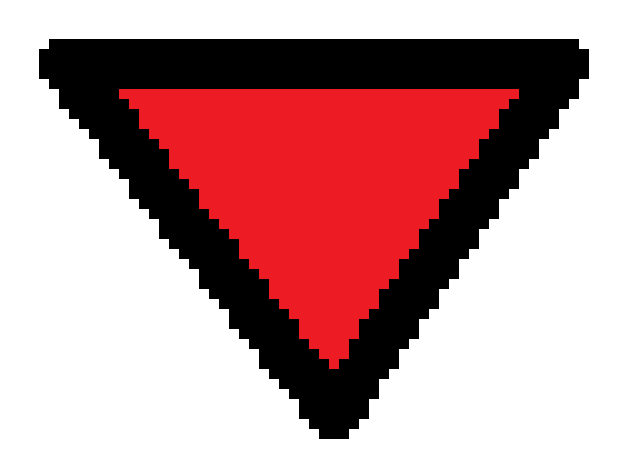
### Here is a smaller graphic:



Expanding in Paint can be done with the resize tool as 500% (5 times as big) and then again at 200% (10 times in all):



### Enlarging 10 times in Paint shows clear pixilation (aliasing):



### Enlarging in Word shows anti-aliasing:

