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How to Calculate Print Resolution

Step By Step

Topics Covered

- The resolution of the human eye with 20/20 vision
- Calculating pixels per inch (PPI) for prints at typical viewing distances

A print's resolution in pixels per inch (PPI) can be determined once you assign physical dimensions to an image. In this guide, we use an 8 × 10-inch print as our example.

Understanding the human eye's resolving power lets you choose the minimum PPI needed for a print to appear sharp. By printing at a slightly higher resolution than the eye can distinguish, individual pixels become invisible at normal viewing distances. There's no need to use maximum resolution for every print—higher settings increase ink use, print time, and file size without visible benefit.

Understanding Human Eye Resolution

For someone with standard 20/20 vision, the eye can resolve details separated by approximately 1 arc-minute (1/60th of a degree). We use angular measurements because perceived size depends on viewing distance.

Step 1: Determine Optimum Viewing Distance

A good rule of thumb is to multiply the print's diagonal measurement by 1.5.

For an 8 × 10-inch print:

$$\text{Diagonal} = \sqrt{(8^2 + 10^2)} = \sqrt{164} \approx 12.81 \text{ inches}$$

Optimum viewing distance = $12.81 \times 1.5 \approx 19.2$ inches (rounded to 19 inches for simplicity)

Convert to millimeters: $19 \times 25.4 = 483$ mm.

Step 2: Calculate the Eye's Resolvable Detail Size

Use this formula:

$$p = 2 \times d \times \tan(\alpha/2)$$

Where:

- p = smallest resolvable size (mm)
- d = viewing distance (483 mm)
- $\alpha = 1$ arc-minute = 0.016667°

$$\alpha/2 = 0.008333^\circ$$

$$\tan(0.008333^\circ) \approx 0.0001454$$

$$p = 2 \times 483 \times 0.0001454 \approx 0.140 \text{ mm}$$

Step 3: Convert to PPI

$$\text{PPI} = 25.4 \text{ mm per inch} \div p$$

$$\text{PPI} \approx 25.4 / 0.140 \approx 181 \text{ PPI}$$

This means the eye can resolve about 181 PPI at 19 inches. To ensure the print looks perfectly sharp, use a slightly higher value—**200 PPI** is an excellent, practical choice for an 8 × 10-inch print at this distance.

You can follow these same steps with any print size and viewing distance to determine the ideal resolution. This approach delivers excellent results while keeping your files manageable.