Teacher Guide – Painting By Numbers

Introduction – Painting By Numbers (Teacher Instructions in Italic)

The teacher should use any available computer technology (including smart phones) to view videos and images on any subject the teacher is familiar with and will interest the students. Stimulate discussion of how the computer/television/phone creates millions of colors of light.

Questions to Ask:

1. How many colors do students see on the screen? Answer: Millions
2. Is there a light “bulb” for each color? Answer: No
3. How many different lights are creating the image?
   a. 1 with millions of lenses (LCD monitors and phones)
   b. Millions of LED lights

Advanced Activity:

WARNING: THIS ACTIVITY HAS THE SAME RISKS AS ANY VIDEO GAME OR IMAX THEATRE FOR STUDENTS WHO SUFFER FROM SEIZURES. STARING AT 3D STEREO IMAGES CAN CAUSE HEADACHES.

1. Prepare an image for display on a computer screen or projector
   a. Create two shapes with different colors (red, green, or blue) on the screen
   b. Separate them horizontally
2. Display the prepared image
3. View the image through a red, green, or blue lens (scientific filter or transparency)
   a. The red lens will reflect red light and make the red shape invisible
   b. Blue lenses make blue shapes invisible, green would do the same
4. View the image with a different color lens over each eye
   a. Each eye will see the same shape in a different spot
   b. This is a basic method for 3D television and images

The world is a colorful place when light shines. How many colors can you see in the images shown? How many colors are there? How many colors can you see on a television or computer screen?

Materials: (Each of the following is required per group)

- 1 sheet of thick paper with printed pattern
- Tempera paint
- Cups (6 or more)
- Stir sticks
- Paint brush
- Well plates
- Plastic droppers (1 mm size preferred)

Procedures – Custom Colors

The teacher can choose to use any combination of three paint colors:

- Red, yellow, and blue – true primary pigment colors
- Red, green, and blue - used in computer graphics

The additive (creating light) and subtractive (absorption by paint) powers of light is different because of the way the human eye works and the path light takes.

White and black are not colors of light. They are phenomena observed by the human eye.

White is when the eye sees multiple colors and can’t tell the difference
Black is the absence of light.
1. What are the three colors of tempera paint you have? 

Using the droppers to mix paint requires patience and multiple attempts. The easiest method is to not completely release the bulb of the dropper. If supplies are not limited allow student to fill the dropper completely.

2. Use two droppers, one for each color, to mix equal amounts (ratio of 1:1) of two colors of paint in a well plate using Fig. 1 and the teacher demonstration.

![Figure 1: Technique for mixing an equal ratio of two colors of paint](image1)

3. Use the additional sheet of art paper and paint the squares below the color label. Then mix a 1:1 ratio of the colors in a cup to paint the square in the box on the right. Record the color you observe.
   - a. Red + Yellow = Orange
   - b. Red + Blue = Purple
   - c. Blue + Yellow = Green

4. Mix equal amounts of all three colors a ratio of 1:1:1.
   - a. What color does it make? Black/Brown/Maroon
   - b. How many units of volume do you have? 3

5. Mix unequal amounts of the primary colors of paint in the empty wells on your plate using Fig. 2.

![Figure 2: Technique for mixing an equal ratio of two colors of paint](image2)

**Development – Custom Colors**

1. What are the three primary colors of pigments you started with?
2. Can you mix any other colors to create a primary color?  

NO

3. What are the three **secondary colors of pigments** created by mixing the primary colors at 1:1 ratios?  

\[ \text{Red} + \text{Blue} = \text{Purple}, \text{Red} + \text{Yellow} = \text{Orange}, \text{Yellow} + \text{Blue} = \text{Green} \]

4. What happens when you mix uneven ratios 2:1 of primary colors?  

You get different colors or shades of color.

5. How did you measure the amount of each color of paint?  

I measured the amount of paint by drops or volume.

**Assessment – Custom Colors**

*To allow students to paint custom colors provide additional paper (art paper or thick cardstock). If students are building a calculator for later sections have students paint the wheel below on one side and write the answers for #4 on the other side.*

1. Use your paint supplies and extra cups to mix multiple shades of paint.
2. Change the ratio of each color you mix to fill in the color wheel on an additional sheet*.
3. Match the paint color you create to a colored pencil to fill in the color wheel below.

![Color wheel](image)

**Figure 3: Color wheel creating by mixing different ratios of paint.**

4. Create your own custom paint: mix multiple colors together at any ratio.
   a. Write the ratio of paint drops for your color (Red:Yellow:Blue)  
      \[ \text{Any ratio} \]
   b. Create a name for your color  
      \[ \text{Any name} \]
Introduction – Light Show

The teacher should use a spectroscope or prism to separate the colors of a “white” light source into a rainbow of colors. Students should see multiple colors (red, orange, etc.) commonly referred to as ROYGBIV. Define wavelength as another way of describing light color. Light travels like a wave. Blue light has a shorter wavelength than red.

The room lights and windows will affect this experiment. Windows should be covered and all lights should be dimmed.

Light brightness can be measured in LUX which is the amount of light adjusted to what the human perceives. The human eye sees green light the best so the same amount green and blue light appear at different brightness.

Watch the teacher demonstration of a prism or spectroscope in sunlight or indoor lights. How do you describe light? Think about what happens when people wear sunglasses?

Materials: (Each of the following is required per group)
- Light mixing kit (light bulbs require a lamp)
- Spectroscope
- Visible light power meter
- Colored pencils

Procedures – Light Show

1. Become familiar with the spectroscope and use it to view two light sources: the sun and room lights.

Figure 4: How to use a spectroscope to view the colors of a light bulb.
2. Fill in the colors over the question marks that you see inside the spectroscope near the numbers.

<table>
<thead>
<tr>
<th>Wavelength in $10^{-7}$ meters</th>
<th>Light Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>SUN</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Room Lights</strong></td>
</tr>
</tbody>
</table>

Figure 5: The colors of sunlight and room lights viewed with a spectroscope.

3. Become familiar with the light mixing kit by changing the color controls to “white” light.

4. Measure the brightness of your light source with a light meter. Hit the “Range” button on the light meter until a number other than “1.” appears on the screen.

5. Record the reading on the light meter

6. View with a spectroscope what color do you see?

7. Dim the light by pressing the bottom right yellow button.

8. Record the reading on the light meter

9. View with a spectroscope what colors do you see?

10. Fill in the table below for the different colors of light produced by the kit.

<table>
<thead>
<tr>
<th>Color Produced</th>
<th>Colors Visible in Spectroscope</th>
<th>Light Meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td><em>Red</em></td>
<td><em>Others</em></td>
</tr>
<tr>
<td>Green</td>
<td><em>Green</em></td>
<td><em>may</em></td>
</tr>
<tr>
<td>Blue</td>
<td><em>Blue</em></td>
<td><em>appear</em></td>
</tr>
</tbody>
</table>

Figure 6: Multi-color light mixing kit with controls and diagram for using light meter.
Development – Light Show

Spectroscopes measure the color of and light meters measure the intensity.

1. What are the three **primary colors of light** for your light bulb used to make white light seen in the spectroscope?

   | Yellow | Red | Green | ~6000 |
   | Cyan (light blue) | Green | Blue | ~7000 |
   | Purple | Red | Blue | ~3000 |

   **Table 1: Light mixing kit color measurements.**

2. Are these the same primary colors as the pigments? If not which color has changed?

   *No paint primary colors are Red, Blue and YELLOW instead of Green.*

3. Where the same light colors were used to make dimmer white light? **Yes**

4. Was the light meter reading the same for white and dim white? **No**

The light meter measures intensity. Another way to describe intensity is how bright the light is.

5. How bright was red light (data from Table)? ~1000

6. How bright was blue light (data from Table)? ~2000

7. How bright was purple light (data from Table)? ~3000

8. What two colors made purple light? **Red + Blue**

9. To mix paint we used drops of volume. What unit of measurement do you mix light by?

   *Primary light is mixed using brightness to create different shades of color.*

Assessment – Light Show

1. Use a spectroscope to view a picture displayed on your computer monitor (may require web access).

2. Change and record the color for the computer desktop (not Red, Green or Blue). **Purple**
3. View the computer monitor with a spectrooscope. What colors are visible? **Red and Blue**

4. How many colors of light can you see on the computer monitor with a solid background?
   
   *It should be only one color to the human eye.*

5. How many colors of light can you see when the monitor is viewed with a spectroscope?
   
   *Most monitors will show many colors when viewed through the spectroscope: more than one.*

6. Set the background color to blue.

7. How many colors of light can you see when the blue monitor is viewed with a spectroscope?
   
   *Most monitors will show only blue when viewed through the spectroscope.*

8. What other monitor colors would show as only one color when viewed with a spectroscope?
   
   *Most monitors will show only red, green, and blue as one color when viewed through the spectroscope.*
Procedures – Computer Images

1. Open a computer paint program. (Windows® Start Menu => Accessories => Microsoft Paint©)
2. Open the custom color menu shown in Figure 8.
3. Look in the lower right corner at the colors. What are the three primary colors of these computer images?
   **RED, GREEN, BLUE**

![Figure 8: Opening Microsoft Paint and the custom color palette.](image)

4. Adjust the amount of **Red, Green, and Blue**.
5. What is the biggest “amount” of each color you can use? **255**
6. Open the Image:Resize menu.

![Figure 9: Image size control menu.](image)

7. What units can be used to measure the size of the image? **Percentage & Pixels**
8. Adjust the horizontal and vertical size. Describe in sentences what happens on the screen?

The white area gets larger and smaller. The horizontal size controls width. The vertical size controls height.

9. Draw an image that is 100 pixels by 100 pixels and choose save as from the “File” menu.

10. What types of image files can you save? Click on the “Save As Type Box”.

There are many types: several types of bitmap, JPEG, GIF, TIFF, and PNG.

11. Save the file as a **256 Color Bitmap** with the name *100x100.bmp*.

12. Open the Image:Resize menu again.

13. Change the dimension unit to Pixel. Make sure the Aspect Ratio box does not have a check.

14. Enter 1280 the horizontal dimension and 800 in the vertical dimension.

15. Describe what happens on the screen? How big is the white area now?

The white area (canvas) got larger. It is the same size as the screen or bigger than the screen.

16. Save the file as a **256 Color Bitmap** with the name *1280x800.bmp*.

**Development – Computer Images**

Image files and monitors are 2-dimensional rectangular maps of pixels. A pixel is a solid square of one color. Each pixel has three lights or lenses that control the amount (brightness) of light from each color for that pixel.

```
<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>-------</td>
</tr>
</tbody>
</table>
```

Horizontal Dimension = 3 Pixels

Vertical Dimension = 3 pixels

Total Pixels = Horizontal x Vertical

= 3 x 3 = 9 pixels

Figure 10: Pixel array for a computer image or monitor.

1. Using the diagram above calculate the number of pixels in the image file *100x100.bmp*.

There are 100 horizontal columns and 100 vertical rows: 100 x 100 = 10,000.

2. Open Windows Explorer or a similar file browser to view the size of the file.
3. What is the file size for your image? __________ 30,054
4. Subtract 54 bytes from the file size. __________ 30,000
5. How many pixels are in your image (answer # 1)? __________ 10,000
6. How many bytes are stored per pixel? __________ 3
7. Why does each pixel have three bytes? (Think about the number of primary colors.)
   *It takes one byte of memory for each color in a pixel: one byte red, one byte green, one byte blue.*
8. Calculate the number of pixels in the second image 1280x800.bmp. __________ 1,024,000
9. Calculate the number of bytes to store this image. __________ 3,072,000
10. What is the unit to measure the size of files and computer memory?
    *The unit of computer memory size is a byte.*
11. What is a byte?
    *The unit of computer memory size is a byte. Opened ended question students will not be able to answer. A byte is eight binary digits. This will be answered in the next sections.*
**Materials:** (Each of the following is required per group)
- 1 sheet of thick paper with printed pattern
- Scissors
- Hole punch
- 3 book rings
- Stapler
- Markers
- Calculator

**Procedures – Counting**
1. Cut along the dotted lines of the additional sheet of paper with a pattern.
2. Create two sets of numeral tiles (0, 1, 2, 3, 4, 5, 6, 7, 8, and 9) with a hole punched in the top.
3. Create two additional tiles with 0 and 1 on them.
4. Create two tiles with your team or individual logo. Customize your calculator with color.
5. Fold the remaining piece of paper along the solid line to build a calculator using the using the diagram below. Use one digit or set of numerals.

![Diagram of calculator materials](image)

**Figure 12:** A manual calculator design with decimal numbers.

6. How high can your calculator count? __9__
7. How many numbers can your calculator display? (Zero is a number!) __10__
8. How many tiles did it take to make the numbers? __10__
9. If you want to show the result of adding 1 + 9 how must you change your calculator?
   *You must add another digit on the left.*
10. Add another digit or set of numerals to your calculator.

![Diagram of two calculator designs](image)

**Figure 13:** A manual calculator with two decimal digits and two calculators next to each other.

11. How high can your calculator count? __99__
12. How many numbers can your calculator display? (Zero is a number!) __100__
13. How many tiles did it take to make the numbers? __20__
14. Place two calculators next to each other. How high can the new calculator count? 9999

15. How many numbers can two calculator display? (Remember zero.) 10000

16. How many pieces (tiles) did it take to make the numbers? 40

**Development – Counting**

We usually use the **decimal** number system in everyday life. The word decimal has the root *dec-*: A *decade* is ten years. Your calculator is built using decimal numbers.

1. How many different numerals does the decimal system have? And what are they?

   **There are 10 numerals:** 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

2. How do you add 1 point to your calculator? Describe your actions in sentences.

   **I flip a tile over the bar.**

3. Do zeros in front of a number change the amount? Are these numbers the same? **Yes**

   49 049 0049 00000049

4. What additional mathematical step (shown by the arrows) do you perform when you add 9+1, 19+1, or 19 + 11?

   **Carrying**

   \[
   \begin{array}{c}
   109 \\
   \uparrow \\
   + 01 \\
   10 \\
   \end{array}
   \quad
   \begin{array}{c}
   119 \\
   \uparrow \\
   + 01 \\
   20 \\
   \end{array}
   \quad
   \begin{array}{c}
   119 \\
   \uparrow \\
   + 11 \\
   30 \\
   \end{array}
   \quad
   \begin{array}{c}
   10199 \\
   \uparrow \\
   + 100 \\
   \end{array}
   
   **Figure 14: Adding decimal numbers.**

5. How do you add 1 point to your calculator if the calculator reads “29”? Think about how you carry a “1” into the next digit. Answer in sentences.

   **I flip the digit on the right then carry and flip the next digit.**

   \[
   \begin{array}{c}
   \circ \quad \circ \quad + \quad \square \\
   2 \quad 9 \quad + \quad 1 \\
   \end{array}
   \quad
   \begin{array}{c}
   29 \\
   + 1 \\
   \end{array}
   \]

   **Figure 15: Adding decimal numbers with your calculator.**
6. How do you read a number: the digit on the right (3) is multiplied by 1; the digit in the middle (2) is multiplied by 10; what is the digit on the left (1) multiplied by? __________

\[
\begin{align*}
123 & \\
& \downarrow \\
1 \times ? & + 2 \times 10 & + 3 \times 1 \\
? + 20 + 3 & = 123
\end{align*}
\]

7. What would another digit to the left of the number above be multiplied by, the digit 7 in 7123? ___

8. An exponent is another way of writing a number that means multiply the number by itself. Fill in the next equation.

\[
\begin{align*}
10^2 & = 10 \times 10 = 100 \\
10^3 & = 10 \times 10 \times 10 = 1000 \\
10^4 & = ? \\
10 \times 10 \times 10 \times 10 & = 10,000
\end{align*}
\]

9. A special case is zero; any number to an exponent of 0 equals 1. Fill in the missing numbers.

\[
\begin{align*}
10^0 & = 1 \\
7^0 & = 1 \\
2^0 & = ? \\
9946528^0 & = ?
\end{align*}
\]
Procedures – Binary Calculator

This section requires time and patience. The teacher needs to build a large binary counter that the entire class can see. Walk through the process of adding 1 to the calculator. Since there is no numeral for “1+1=2” you must perform the same operation as decimal “1+9=10”. So that the binary numbers added together on the calculator gives 1+1 = 10. The steps are to restart at 0 and carry a “1” into the next digit

1. Modify your calculator by removing all the numbers except “0” and “1”. Add a third digit (a set of “0” and “1” tiles).

![Figure 16: Binary calculator display.](image)

2. How do you add with only “0” and “1” with no other numerals? When you add “1+1” you get “0” plus you have to carry a “1” into the next digit

\[
\begin{array}{ccc}
00 & + & 01 \\
\hline
01 & + & 01 \\
\hline
10 & + & 01 \\
\hline
100 & & \\
\end{array}
\]

3. Start at “000” and count by adding one to your calculator. Fill in the table below.

<table>
<thead>
<tr>
<th>Count</th>
<th>Left Digit</th>
<th>Middle Digit</th>
<th>Right Digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

4. How many numbers can you display with 1 digit? 

5. How many numbers can you display with 2 digits? 

6. How many numbers can you display with 3 digits?
7. Place two calculators next to each other. How many patterns can you make out of four binary digits on a calculator?

*There are 16 different numbers that can be displayed.*

8. How many patterns do you think you can arrange with 8 digits? Show any math calculations you do.

*Every digit added doubles the amount of numbers displayed. 1 digit = > 2 numbers, 2 digits = > 4 numbers. With 8 digits \( 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^8 = 256. *
Development – Binary Numbers

1. The word decimal has the prefix *dec-* which stands for 10 as in a *decade* is ten years. How many digits are in a *binary* system and what are they. (Hint: How many wheels do *bicycle*es have?)

*There are 2 numerals: 0 and 1.*

2. The number 123\(_{10}\) (the subscript says the number **BASE** is 10 or decimal) can be rewritten using exponents

\[
123_{10} \quad \text{Base 10}
\]

\[
1 \times 10^2 + 2 \times 10^1 + 3 \times 10^0 = 123
\]

100’s Digit 10’s Digit 1’s Digit

\[
100 + 20 + 3 = 123
\]

What is the decimal equivalent value of binary numbers 111\(_2\) and 101\(_2\)?

\[
111_{2} \quad \text{Base 2}
\]

\[
1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 7_{10}
\]

4’s Digit 2’s Digit 1’s Digit

\[
101_{2}
\]

\[
1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 5_{10}
\]

4’s Digit 2’s Digit 1’s Digit

3. Can you finish the table below?

<table>
<thead>
<tr>
<th>Binary #</th>
<th>1</th>
<th>10</th>
<th>100</th>
<th>1000</th>
<th>10000</th>
<th>100000</th>
<th>1000000</th>
<th>10000000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal #</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>16</td>
<td>32</td>
<td>64</td>
<td>128</td>
</tr>
</tbody>
</table>

*Table 2: Binary numbers and there decimal equivalent.*

4. Each *binary digit* (either a 1 or a 0) is called a *bit*. Eight bits forms a *byte*. A memory location on a hard drive or flash drive is stored in bytes. How many different values can be stored in one memory byte?

*There are 8 bits so \(2^8 = 256\) possibilities.

5. If a flash drive has 1024 bytes how many bits are there?  \(8 \times 1024 = 9192\)
6. Hexadecimal numbers use base 16 (*hex*- six, *dec*- ten). This means that the numbers 0-9 aren’t enough; we need sixteen symbols not just ten. We use the letters A-F for the other six. Can you fill in the table below?

<table>
<thead>
<tr>
<th>Hexadecimal (base 16)</th>
<th>Decimal (base 10)</th>
<th>Binary (base 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>101</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>110</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>111</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>1000</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>1001</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
<td>1010</td>
</tr>
<tr>
<td>B</td>
<td>11</td>
<td>1011</td>
</tr>
<tr>
<td>C</td>
<td>12</td>
<td>1100</td>
</tr>
<tr>
<td>D</td>
<td>13</td>
<td>1101</td>
</tr>
<tr>
<td>E</td>
<td>14</td>
<td>1110</td>
</tr>
<tr>
<td>F</td>
<td>15</td>
<td>1111</td>
</tr>
</tbody>
</table>

Table 3: Hexadecimal number table with decimal and binary equivalent.
Procedures – Computer calculator (Microsoft Windows 7 Version)

1. Open a calculator program such as Microsoft Calculator©.
2. Change the view to “Programmer”

![View menu](image1.png)

3. Record your observations next to the letters below of how the screen changes.

![Calculator program in "Programmer" mode.](image2.png)

- a) Describe in sentences how the number buttons changed.
  
  There are new buttons to click including the letters A, B, C, D, E, and F.

- b) Describe in sentences the menus on the left side of the screen.
  
  There is a menu with the options: Hex, Dec, Oct, and Bin.

- c) Describe in sentences the display below the calculator display.
  
  There are two rows of 32 zeros for a total of 64.
4. Use the menu box on the left side of the calculator (labeled as b) in Figure 18) with the options Hex, Dec, Oct, and Bin. Record the changes in the buttons for each option.

Figure 19: Calculator buttons that change for different number bases.

a. Click on “Hex”. Describe the changes.
   
   **There are new buttons to click: the letters A, B, C, D, E, and F.**

b. Click on “Bin”. Describe the changes.
   
   **There are only two buttons to click: 0 and 1.**

5. Click on the “Dec” mode. Type the number 255 into the calculator. Click on the “Hex” mode.

6. What number is displayed on the calculator display? ____________ **FF**

7. Click on the “Hex” mode. Type the number “AA” into the calculator. Click on the “Dec” mode.

8. What number is displayed on the calculator display? ____________ **170**
Development – Computer calculator (Microsoft Windows 7 Version)

1. Answer some of the question from the previous section using the calculator program.
2. Can you finish the table below?

<table>
<thead>
<tr>
<th>Binary #</th>
<th>10</th>
<th>1000</th>
<th>10000000</th>
<th>1010</th>
<th>11111</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decimal #</td>
<td>2</td>
<td>8</td>
<td>128</td>
<td>10</td>
<td>31</td>
</tr>
</tbody>
</table>

Table 4: Binary numbers to convert to decimal with a calculator.

3. Fill in the table below using the Calculator program?

<table>
<thead>
<tr>
<th>Hexadecimal (base 16)</th>
<th>Decimal (base 10)</th>
<th>Binary (base 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>A</td>
<td>10</td>
<td>1010</td>
</tr>
<tr>
<td>F</td>
<td>15</td>
<td>1111</td>
</tr>
<tr>
<td>AA</td>
<td>170</td>
<td>10101010</td>
</tr>
<tr>
<td>AF</td>
<td>175</td>
<td>10101111</td>
</tr>
<tr>
<td>FA</td>
<td>250</td>
<td>11111010</td>
</tr>
<tr>
<td>FF</td>
<td>255</td>
<td>11111111</td>
</tr>
<tr>
<td>FFFFFFFF</td>
<td>16,777,215</td>
<td>111111111111111111111111</td>
</tr>
</tbody>
</table>

Table 5: Hex numbers to convert using a calculator.
Procedures – Save and Edit a Real Webpage (Internet Explorer Version 9.0)

1. Open a well known web page from the internet using Internet Explorer.
2. Click on the tools icon or press the “Ctrl” button and the “S” button at the same time.
3. Save the file to the computer hard drive desktop.

4. Open the HTML document from the hard drive in Internet Explorer (you will have two windows).
5. Right-click on the HTML document and “Open with” WordPad or similar text editor.

Figure 20: Saving a web page to a computer hard drive.

Figure 21: Opening a web page with a text editor.
6. Describe what the webpage (.html file) looks like when opened in WordPad? Write the first three words you can read.

An HTML file has several sections. One is the page title that starts with the text `<title>`. Use the Find function press **CTRL + F** to find the text “title”

![Find function in a text editor](image)

Figure 22: Using the find function in a text editor.

7. What is the title of this webpage? _______________________

8. Edit the title to your name.

9. Save the text document.

10. Hit refresh on the web browser window that opened your file.

11. Describe any changes that occurred.

12. Another section of an HTML file is the **background color**. Find lines of text with the word “color:” Write the first three the numbers that follow the word color.

13. What type of number is used to choose the web page color? _______________________

14. What color is the webpage background? _______________________

Use the Replace function press **CTRL + H** to replace the hexadecimal numbers “FFF” with “000”.

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15. Save the text document.
17. Describe the changes that occurred.
Procedures – Edit a Webpage color (Firefox)

1. Open the web page template from the website given by the teacher using Firefox.
2. Click on the view tab at the top toolbar, or press the “Ctrl+U” button at the same time.
3. Save the file to the computer hard drive using any name, you choose. The file should be saved in a folder on the desktop named “IEAWebpage”.

Figure 24: Saving a web page to a computer hard drive.
4. Open the HTML document from the location on the hard drive using WordPad or similar text editor.

![Figure 25: Opening a web page with a text editor.](image)

**Development – Edit a Webpage color**

1. Change the entire webpage background to “Light Blue”. What is the line of text you edited? (Hint: Search for “<body style="color: rgb(0, 0, 0); background-color: rgb(0, 0, 0); alink="#000099" link="#000099" vlink="#990099">” within the HML file.)

   ```html
   <body style="color: rgb(0, 0, 0); background-color: rgb(0, 0, 0); alink="#000099" link="#000099" vlink="#990099">  
   ```

2. Change the instructions at the top of the page to “Black”. What is the line of text you edited? (Hint: Search for the instructions in the HTML file.)

   ```html
   <h1 style="color:red; font-size:20px">
   ```

3. Change of the background of all the tables to “Blue”. What is the line of text you edited? (Hint: Search for “<td style” within the code)

   ```html
   <table style="height: 70%; width: 35%; text-align: left; background-color: rgb(255, 255, 255); border="5" cellpadding="2" cellspacing="2">  
   ```

4. Find this line of code in the file: “<table border=5 cellpadding=1 cellspacing=1”’. Type 3 sentences describing the lesson you participated in today.

   (Hint: use the following line of code    <h1 style="color: #FF0000; font-size: 20px"> Insert Your Sentences Here </h1>)
5. Change color of text that you just input to color of your choice. What is the line of text you edited?

(Hint: <h1 style="color:textcolor;" is used to control color of text)