



# HAWKES LEARNING Accessibility

## Our Goal

**Our goal is to achieve Web Content Accessibility Guidelines (WCAG) 2.0 Level AA conformance for all of our materials.** We are reaching beyond technical compliance to improve usability as well as accessibility— thereby creating the best possible experience for every student.

## Our Commitment

Hawkes is dedicated to providing all students an engaging learning environment on the web. We understand that students have different needs, so we strive to make our product as flexible as possible. Our mission is to deliver an easy-to-use interface that allows students of all abilities to focus on learning the course material, not how to use the system.

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## How Do We Achieve Compliance?

### Standardization and Best Practices

Hawkes integrates best practices for accessibility with the proper semantic use of HTML, MathML, CSS, and SVG. We have developed several best practices documents for HTML, MathML, and SVG; these are living documents that continue to evolve as the markup languages do.

## **Innovation**

We are using web technologies such as CSS and JavaScript in new and creative ways to quickly update our content. In particular, we are using JavaScript along with CSS to highlight the underlying structure of HTML and MathML code and to reveal the alternative text for SVG images so we can verify conformance to standards without having to look through lines of source code. We are also using XSL in a variety of ways to ensure that MathML expressions are constructed correctly and efficiently. As long as our content has the proper structure and markup, our development teams can focus on coming up with new and elegant solutions to quickly retrofit the code to be compatible with any future technologies or platforms.

## **Testing**

To make sure our end product will be successful, we test frequently. Throughout the development process, we utilize various web accessibility testing tools, examples of which can be found in the Resources section of the accessibility website. The techniques found in our best practices documentation are tested using the screen reader JAWS and NVDA (with the MathPlayer 4 plugin).

During our testing, we occasionally uncover bugs that impact the accessibility of our web content but are outside of our control. When this happens, we report the bugs to the makers of the relevant technology. Feedback has been given to Freedom Scientific (makers of JAWS) regarding issues in the audio rendering of MathML.

## **Service**

Hawkes employees are proud to provide exemplary service to our customers in the shared pursuit of student success. Our team is always available to support and serve instructors, disability coordinators, and students. Live chat is available 24-7 at [chat.hawkeslearning.com](https://chat.hawkeslearning.com). To contact us by phone, call (843) 571-2825 Monday–Friday, 8:00AM–10:00PM ET.

**Students who experience any accessibility issues are encouraged to email [accessibility@hawkeslearning.com](mailto:accessibility@hawkeslearning.com).**

# Screen Readers and Hawkes Material

Through the course of the accessibility initiative at Hawkes, we have tested with a variety of different screen reader programs based on availability and popularity. Here you'll find our recommendations for screen reader programs that work best with Hawkes on the web!

## What is a Screen Reader?

Many people envision a screen reader as a device that is external to the computer. In actuality, a screen reader is a piece of software that exists on a user's computer. Screen reader software receives information from other applications and transforms that information into speech. In many instances this simply means reading aloud the text that is on the screen to the user. Additionally, screen readers provide navigational aids to the user. In terms of web content, this means allowing the user to navigate through a web page by announcing when a user has reached a button, link, heading, or other element of interest. Screen readers with advanced functionality can generate lists of hyperlinks or headings and "jump" to them. Overall, this means that screen readers rely on well-structured web pages for easy navigation.

## Hawkes Screen Reader Recommendations

The Hawkes Accessibility Team recommends using the NVDA screen reader in the Firefox browser for Windows users. ChromeVox is recommended for MacOS users. MathPlayer 4 must be installed for NVDA to read mathematics. MathPlayer 4 can be obtained for free from Design Science (<http://dessci.com/en/products/mathplayer/>). We used several different screen reader applications, primarily Jaws and NVDA, to test our material while determining best practices and updates to the interactive portions of questions. However, during testing, the Accessibility Team felt that the interpretation of mathematics and information provided for interactive portions of our material by NVDA was more robust than JAWS. Additionally, we concluded that JAWS implementation of equation navigation was unintuitive (see SR specific section for JAWS), validated as well by user testing. ChromeVox, although not as heavily tested as NVDA or JAWS by our Accessibility Team, seems promising, especially in regards to customer feedback and is recommended for MacOS users.

## Keyboard Shortcuts by Screen Reader

Below are useful keyboard shortcuts for specific screen readers to aid users in navigating Hawkes material. The use of the plus sign indicates that keys should be pressed together. Use of greater than indicates that a key press should follow the keystrokes prior to the greater than sign.

## JAWS Keyboard Shortcuts

Key Combination	Description
Insert	JAWS Key
Down Arrow	Read the next line
Up Arrow	Read the previous line
Insert + F6	List Headings
Insert + F7	List Links
Alt + Down Arrow	Read the next sentence
Alt + Up Arrow	Read the previous sentence
Ctrl + Down Arrow	Read the next paragraph
Ctrl + Up Arrow	Read the previous paragraph
Ctrl + Alt + Left Arrow	In a table, Move left one column
Ctrl + Alt + Right Arrow	In a table, Move right one column
Ctrl + Alt + Up Arrow	In a table, Move up one table row
Ctrl + Alt + Down Arrow	In a table, Move down one table row
Enter	Engages the math viewer mode.

## NVDA Keyboard Shortcuts

Key Combination	Description
Insert	NVDA Key
Down Arrow	Read the next line
Up Arrow	Read the previous line
NVDA + F7	Open navigation dialog
Ctrl + Down Arrow	Read the next paragraph
Ctrl + Up Arrow	Read the previous paragraph
Ctrl + Alt + Left Arrow	In a table, Move left one column

Key Combination	Description
Ctrl + Alt + Right Arrow	In a table, Move right one column
Ctrl + Alt + Up Arrow	In a table, Move up one table row
Ctrl + Alt + Down Arrow	In a table, Move down one table row
Enter	Engages the math navigation mode.

### ChromeVox Keyboard Shortcuts

Key Combination	Description
Shift + Alt	ChromeVox modifier key
ChromeVox + A > A	Turn ChromeVox on/off
ChromeVox + Down arrow	Navigate forward
ChromeVox + Up arrow	Navigate backward
ChromeVox + Right arrow	Move right
ChromeVox + Left arrow	Move left
ChromeVox + Dash	Decrease navigation granularity
ChromeVox + Equal sign	Increase navigation granularity
ChromeVox + Back slash	enter structured content, such as tables or math
ChromeVox + Backspace	exit structured content, such as tables or math
ChromeVox + M > S	Toggle structure and semantics mode for math

## Common Math Structures

The mathematics in Hawkes material is encoded in the MathML language. The use of MathML provides a structure that allows screen readers to navigate an equation and provide context necessary for correct announcement. There are several different screen reader applications that can interpret MathML, including NVDA, JAWS, and ChromeVox. The style in which mathematics is announced is dependent on the screen reader and can vary. The following are examples of common layouts that students will encounter when using the Hawkes math material:

**A very simple math equation appears below.**

$$1 + 1 = 2$$

## **JAWS Simple Math**

When encountering mathematics encoded in MathML while using JAWS, JAWS will announce simple equations. When JAWS finishes reading the equation, JAWS will announce "math content" to alert the user that what was read was mathematics. During the announcement of the equation, the user can press the **Enter** key to engage the Math Viewer mode. Using the up and down arrow keys, the user can tell JAWS to focus in on a certain part of the equation or broaden what will be announced. Using the left and right arrow keys, the user can navigate the equation at the level selected by pressing up and down arrow keys. MathViewer appears as a pop-up that can be dismissed by pressing **ESC** .

## **NVDA Simple Math**

When encountering mathematics encoded in MathML using NVDA with MathPlayer 4 installed, NVDA will announce simple equations. When NVDA finishes reading the equation, NVDA will announce "math" to alert the user that what was previously announced was mathematics. During the announcement of the equation the user can press the **Enter** key to engage the math navigation. Using the up and down arrow keys the user can tell NVDA to focus in on a certain part of the equation or broaden what will be announced. Using the left and right arrow keys the user can navigate the equation at the level selected by pressing up and down arrow keys.

## **ChromeVox Simple Math**

When encountering mathematics encoded in MathML using ChromeVox, it will announce the equation. In the case of simple equations, the equation will be read as it appears. Users can increase the granularity using ChromeVox + = to have ChromeVox announce different parts of the equation.

**Multi-line equations are complicated structures that are very common. These equations are laid out in a math table. Each row represents a line in the equation:**

$$x - 3 = 7$$

$$x - 3 + 3 = 7 + 3$$

$$x = 10$$

## **JAWS MathML Tables**

When encountering mathematics encoded in a MathML table using JAWS, it will announce the number of columns and rows in the table, announce "math content," and then allow the user to move along. To determine what is in the table the user can engage MathViewer mode. While in a mathematical table, the user can use the arrow keys to move left and right, up and down, and between table cells. The user can press enter again in table cells to navigate through the equation enclosed in the table cell. Pressing the **ESC** key will move the user back to table view, and hitting **ESC** again will dismiss the MathViewer pop-up.

## **NVDA MathML Tables**

When encountering mathematics encoded in a MathML table using NVDA, it will often announce the table either as a matrix or multi-line equation and then announce line by line. While this announcement is happening the user can press **Enter** as before to enter navigation mode. Pressing **Ctrl + Down Arrow** or **Ctrl + Up Arrow** in navigation mode will allow the user to move between the lines of the equation or rows of the matrix.

## **ChromeVox MathML Tables**

When ChromeVox encounters mathematics that is encoded in a MathML table one of two things may be announced depending on whether or not **semantic** mode (ChromeVox + **M > S**) has been activated. In the standard mode ChromeVox will announce the MathML table as if the table is a matrix. In this mode each cell will be announced as "Element x y" where x and y are numbers corresponding to the column and row. If semantic mode is turned on then ChromeVox will announce the table as a multi-line equation (unless the table does represent a matrix) and specify what is on each line of the equation.

**In some cases, two columns are used to represent the left and right hand side of the equals sign. Included is the same equation from the previous example to make the distinction clear:**

$$x - 3 = 7$$

$$x - 3 + 3 = 7 + 3$$

$$x = 10$$

## **JAWS HTML Tables**

In contrast to the MathML tables mentioned before there will also be times that HTML tables will be encountered. Some times these will be data tables and sometimes they will be used to associate work notes with lines of an equation. In these cases users can use **Ctrl + Alt + Arrow** keys to move up and down rows, and left and right in columns. When moving between rows or columns the headings of the row or column should be announced.

## **NVDA HTML Tables**

In contrast to the MathML tables mentioned before there will also be times that HTML tables will be encountered. Some times these will be data tables and sometimes they will be used to associate work notes with lines of an equation. In these cases users can use **Ctrl + Alt + Arrow** keys to move up and down rows, and left and right in columns. When moving between rows or columns the headings of the row or column should be announced.

## ChromeVox HTML Tables

In contrast to the MathML tables mentioned before there will also be times that HTML tables will be encountered. Some times these will be data tables and sometimes they will be used to associate work notes with lines of an equation. For the case where equations are involved it is suggested to not use the structured navigation mode provided by ChromeVox and simply read the linearized table.

**In some cases each row of an equation will have notes that relate to the row. In these cases we use a table to lay out the equation and associate the notes with each row as follows.**

$$\begin{aligned} 32 + 28 &= 32 + (20 + 8) && \leftarrow \text{Rewrite 28 as } 20 + 8. \\ &= 32 + (8 + 20) && \leftarrow \text{Use the Commutative Property of Addition.} \\ &= (32 + 8) + 20 && \leftarrow \text{Use the Associative Property of Addition.} \\ &= 40 + 20 && \leftarrow \text{Add inside the parentheses first.} \\ &= 60 && \leftarrow \text{Simplify.} \end{aligned}$$

## Screen Reader Browser Pairings

Screen readers require certain information to be communicated through the browser in order to get the best experience. Mozilla Firefox provides the highest degree of support for screen reader technology when paired with NVDA, the Hawkes Learning Accessibility Team's screen reader of choice. When testing with screen readers, JAWS was limited to Internet Explorer for MathML interpretation; therefore, JAWS has been primarily tested with Internet Explorer. However, JAWS is now able to interpret math equations in Firefox, which is the recommended browser. ChromeVox is an add-on for the Google Chrome browser and must be used with Google Chrome. No matter the browser or screen reader, it is imperative to use the latest version.

## Navigating Image Descriptions

One of the most challenging aspects of web accessibility is the task of creating text alternatives for images. When creating text alternatives the context in which the image exists must be taken into account as well as the information an image imparts to a user. Most images across the web are limited to brief text alternatives, which may not provide enough information for mathematical diagrams.

Hawkes material primarily uses Scaled Vector Graphics (SVG) for images, graphs, and mathematical diagrams within our materials. One of the benefits of Scaled Vector Graphics is the ability to include both a simple title, or name, for an image and a longer description of that image. This allows Hawkes content editors to create structured descriptions of images used within the materials that provide information necessary for students to understand what is being conveyed. How this information is conveyed to students is somewhat dependent on the assistive technology they are using.

The following text represents the title and description of the graph below. Users of assistive technology will find both the title and description are also embedded within the image. We are providing this example so that users of assistive technology can become accustomed to what they will experience when they encounter Scaled Vector Graphics images within the on-line materials. Screen reader users should be able to use their screen reader technology to read through the title and description in the same way they read through the rest of the content.

**Title:** Graph of  $f(x) = x^4 - 18x^2$

**Description:** A graph of the function  $f(x) = x^4 - 18x^2$ . The graph is a smooth curve that begins from the left by falling concave upward to the local minimum at  $(-3, 81)$ , then rises to  $(-\sqrt{3}, -45)$  where it changes to concave downward. The curve reaches a local maximum at  $(0, 0)$  and decreases to  $(\sqrt{3}, -45)$  where it changes back to concave upward. Finally, the curve reaches another local minimum at  $(3, -81)$  and increases steeply to the right.

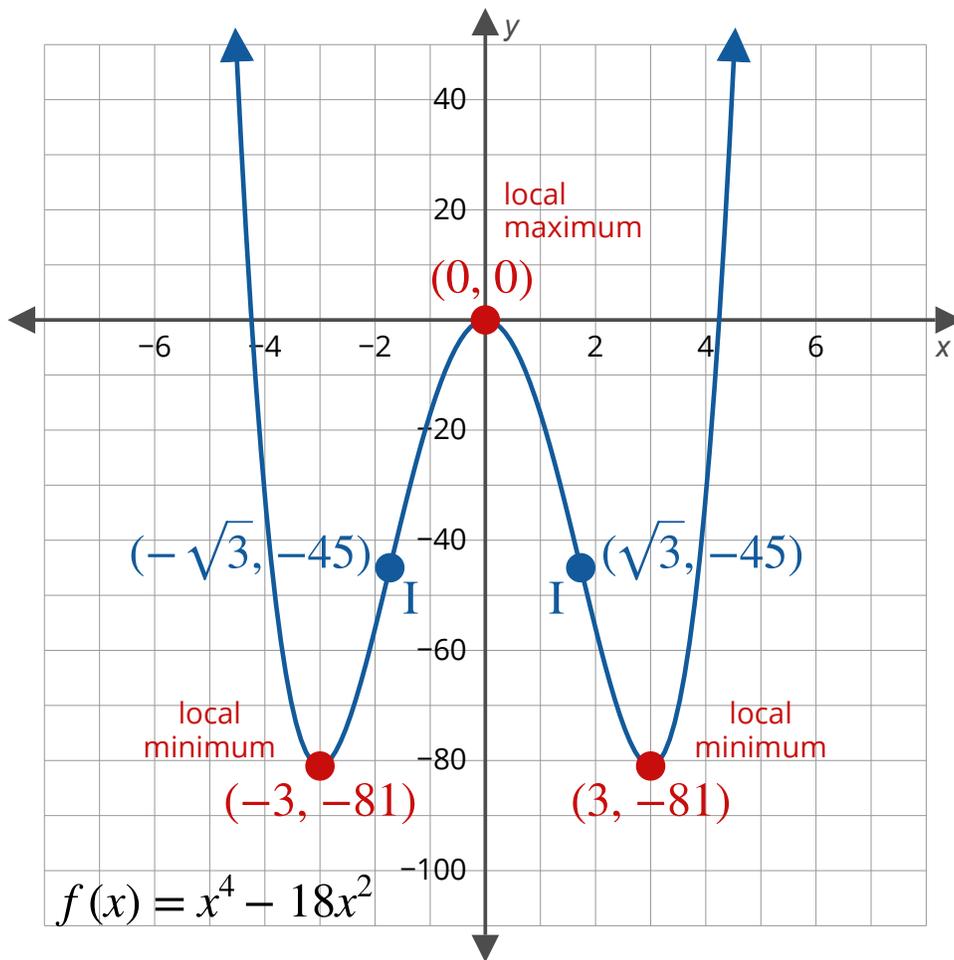
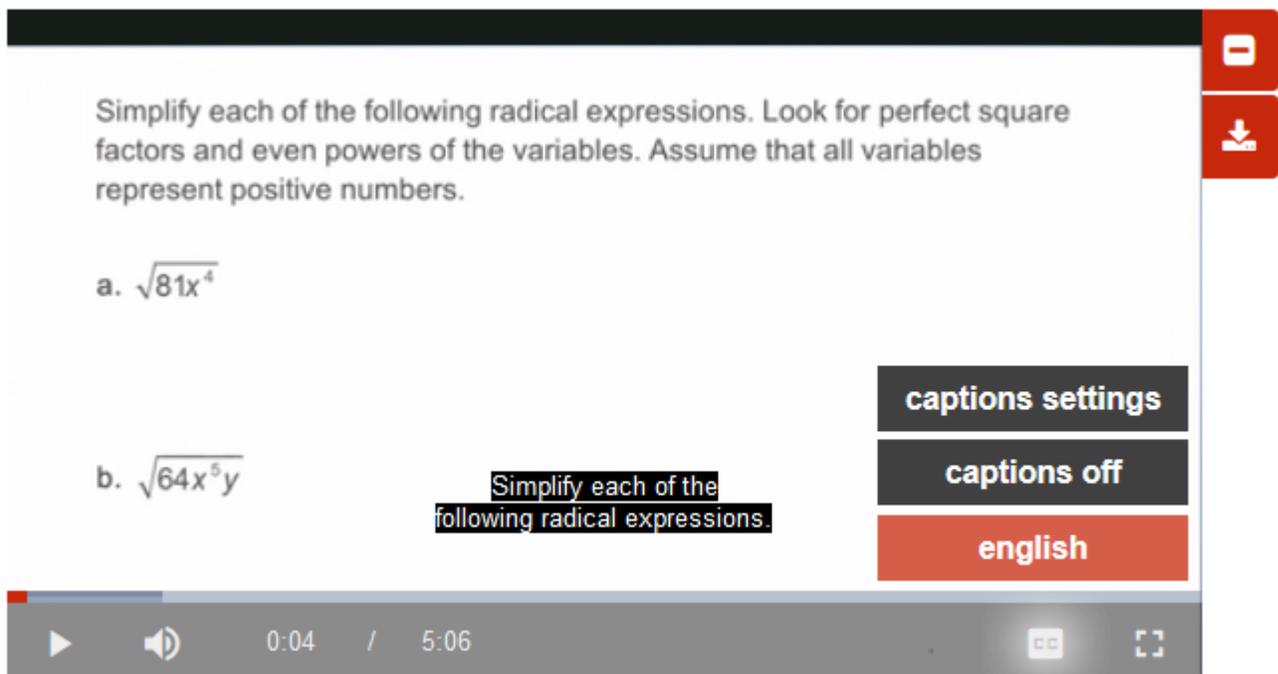


Image with title and description example

# Closed Captioning: Accessing captions

Hawkes has a variety of videos used within the materials to help explain topics, examples, or even how to use the system. We understand the importance of captioning videos for the benefit of everyone. Some videos for examples have the option of downloading a transcript of the captions.

To access captions you can either click on the [cc] button on the video player or use the **tab** key on your keyboard to navigate to the [cc] button. Activating the [cc] button will display a menu of caption choices as well as options. Choose the language that will fit your needs from the available options and captions will appear!



Transcripts are sometimes available for videos that appear within examples in Learn mode. Downloading a transcript is simple. Using your mouse or keyboard navigate to the button labeled with the following symbol  and text "Transcript". The text label of "Transcript" will be revealed when the button can be activated via keyboard or mouse. Upon activating the transcript button if a transcript exists for that video the browser will prompt you to save the file. Save the file to a location on your computer you can easily access. You will be able to open that file and read the transcript for the video any time you want!

Simplify each of the following radical expressions. Look for perfect square factors and even powers of the variables. Assume that all variables represent positive numbers.

a.  $\sqrt{81x^4}$

b.  $\sqrt{64x^6y}$

Simplify each of the  
following radical expressions.



 Transcript (.doc)

# Color Contrast

## Why is Color Contrast Important?

Colors that contrast well in a web application benefit everyone but are especially helpful to users with vision impairments. When assessing color contrast in terms of compliance with accessibility standards, the most important criteria is whether text in the application has a high enough contrast with its background to be easily read. *All* Hawkes online materials use compliant colors for text and backgrounds, which allows most students to use Hawkes materials without aids. In instances where a higher degree of contrast between text and background is desired additional contrasting tools are needed. Fortunately, such tools exist to allow students to modify how the Hawkes materials look. Here we present two free tools for use in Windows using Firefox and Chrome.

### High Contrast Extension

"High Contrast" is a Google Chrome extension that can be used to provide a variety of color options, including color inversion and gray scale.

#### Using the High Contrast

The High Contrast plugin provides several options for controlling the color in a web application. In Windows users have the option of using a high contrast theme, but, notably, this does not affect Scaled Vector Graphics. When utilizing the High Contrast plugin, users can enable the high contrast app and then choose how they would like to view content. The two most notable choices are converting all web content to grey scale or inverting colors. Both options offer a more robust theme than that provided by Windows and will affect all web content regardless of how it is created or displayed

#### Installing High Contrast in Google Chrome

Installing High Contrast via Chrome can be done by selecting the High Contrast for Chrome Link (<https://chrome.google.com/webstore/detail/high-contrast/djcfdncoelnlbdjfhinnjlhdjlikmph?hl=en-US>) extension link or by follow these steps:

- a. Open the menu in the upper right hand corner of the browser ☰
- b. Move the cursor to **More tools**
- c. Select **Extensions**
- d. Select the **Get more extensions link**
- e. Search the store for **High Contrast** (under Extensions)

Once the link is located, select the **+ ADD TO CHROME** button. A half moon icon will appear in the top right corner of the browser.

#### Using High Contrast for Chrome

- a. Select the High Contrast icon, then choose the type of display you are interested.
- b. Set to default will make the current choice the default display for all websites while High Contrast is enabled.
- c. Examine all options to decide the best fit for the situation.

## Stylus

"Stylus" is an extension for Google Chrome, and Mozilla Firefox that allows a user to define their own styles for web pages. This extension can be used as a workaround for high contrast themes in Windows inside and outside of Hawkes materials.

### Using Stylus

CSS (Cascading Style Sheets) describe how HTML elements are displayed and can control multiple pages at once. Stylus allows users to specify their own CSS properties and restyle a single URL, collection of URLs, or every page they visit. It can also be used to help with color inversion and high contrast mode.

### Installing Stylus

Stylus is installed differently on Firefox and Chrome. For links to install Stylus on additional web browsers please visit their website (<https://add0n.com/stylus.html>).

## Firefox

### Installing Stylus for FireFox

Installing Stylus via Firefox can be done by following these steps:

1. Open the menu in the upper right hand corner of the browser , then select the **Add-ons Icon**  (or press Ctrl+Shift+A)
2. Select **Get Add-ons** from the menu on the left.
3. Search for **Stylus**.
4. Select the **Install** button.
5. Restart Firefox when prompted

### Using Stylus for Firefox

1. Click on the Stylus icon
2. Choose **Write new style**
3. Select **Blank style...**
4. Follow the Manually Adding the CSS steps in the Styling section below.

## Chrome

### Chrome Installation

Installing Stylus via Chrome can be done by following these steps:

1. Open the menu in the upper right hand corner of the browser ☰
2. Move the cursor to **More tools**, then select **Extensions**
3. At the bottom of the extensions page select the **Get more extensions link**
4. Search the store for **Stylus**, it is located under Extensions
5. Select the **+ ADD TO CHROME** button.
6. An icon with an S inside of it will appear in the top right corner of the browser.

#### **Chrome Use**

1. Select the Stylus icon.
2. Choose **Manage installed styles**.
3. At the new window select the **Write new style** button.
4. Follow the Manually Adding the CSS steps in the Styling section below.

#### **Manual Styling and When It's Necessary**

High contrast mode is used by people with different visual disabilities to improve usability. In general users of high contrast mode will have some severe degree of color blindness and will need colors that contrast highly to read and interact with a webpage and even their computer. What high contrast mode on Windows is unable to do is to target Scaled Vector Graphics (SVG). The reason for this is that SVG uses different color properties than a normal HTML markup. Below is a guide to help a student with visual disabilities to set up their own color scheme or using one that Hawkes hosts.

#### **Manually Adding The CSS**

1. Copy the following code:

```
*[stroke="#000080"]{
  stroke:#FFFFFF;
}
*[fill="#000080"]{
  fill:#FFFFFF;
}
*[stroke="#0000ff"]{
  stroke:#FFFFFF;
}
*[fill="#0000ff"]{
  fill:#FFFFFF;
}
*[stroke="#000000"]{
  stroke:#FFFFFF;
}
*[fill="#000000"]{
  fill:#FFFFFF;
}
*[stroke="#C000C0"]{
  stroke:yellow;
}
*[fill="#C000C0"]{
  stroke:yellow;
}
```

2. Paste the code in the text area for Stylus.
3. Give the style whatever name you want and select save. An image of what the end result should look like is located below.

## Sections ⓘ

\*Code 1

```
1 ▾ * [stroke="#000080"] {  
2   stroke: □ #FFFFFF;  
3   }  
4 ▾ * [fill="#000080"] {  
5   fill: □ #FFFFFF;  
6   }  
7 ▾ * [stroke="#0000ff"] {  
8   stroke: □ #FFFFFF;  
9   }  
10 ▾ * [fill="#0000ff"] {  
11   fill: □ #FFFFFF;  
12   }  
13 ▾ * [stroke="#000000"] {  
14   stroke: □ #FFFFFF;  
15   }  
16 ▾ * [fill="#000000"] {  
17   fill: □ #FFFFFF;  
18   }  
19 ▾ * [stroke="#C000C0"] {  
20   stroke: ■ yellow;  
21   }  
22 ▾ * [fill="#C000C0"] {  
23   stroke: ■ yellow;  
24   }
```

Applies to ⓘ Everything

Specify

Add another section

Beautify