Solving Equations

Dramatic colors were once reserved for the rich and powerful. Indigo dye (a shade between blue and violet), for example, was originally derived from a tropical plant grown in India and imported to Europe at great expense as early as the Greek and Roman empires. Today, indigo is produced synthetically in large quantities and provides much of the color in blue jeans. The processes for making and mixing dyes, inks, paints and other coloring agents have changed enormously, thanks in large part to our understanding of chemistry and mathematics. Color remains an important subject for artists, but its mastery now requires math and science as well. One modern and colorful medium which uses mathematics to produce changing colors in virtually unlimited variety is the computer monitor.

Bolts of Dyed Silk Fabric
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Whether or not you engage in manipulating colors, modeling real world problems with functions and using the language of algebra to find solutions is a very important and useful skill. The power and the beauty of algebra can help you take control of almost any quantitative problem.

Task: In this activity you will <u>solve equations</u> to make the Color Mixer go from one color and end on another in a set period of time.

Math Machines Program:

RGB Color Functions

Activity Files: Shift001, Shift002, …

Load the files and perform the following tasks. Your entries must be completely simplified to be correct.

Math Machines'
Color Functions

Timeout: Inf s

Time
t = 10.9 s

Color Box

Functions | Values (%)

r = 94-3*(t-3)-t   59.4

g = 100-4*t   56.4

b =   0.0

Intensity vs. Time

RUN | STOP | Holding Output | EXIT
RUN | STOP | Continue | EXIT

1. <u>Load Shift001</u>. Set the Time-out so that the two colors end with the same intensity

    r = 10+3*t

    g = 100-5*t

    Time-out = _____ sec.   Run *Color Functions* to test your solution.

2. <u>Load Shift002</u>. Set the Time-out so that the two colors end with the same intensity

    r = 100-50*sqrt(t)

    g = 50*t

    Time-out = _____ sec.   Run *Color Functions* to test your solution.

    Replace r & g with the following and find the Time-out.

    r = 91-7*sqrt(t)

    g = 14*t

    Time-out = _____ sec.   Run *Color Functions* to test your solution.

3. <u>Load Shift003</u>. Set the Time-out so that red goes to black in the least amount of time.

    r = 7*t^2-51*t+92

    Time-out = _____ sec. Run *Color Functions* to test your solution.

    Create a linear function g so that at the Time-out value above the color box goes from black to green before r > 0. Reset the time out to stop when the color box is green at 100% intensity.

    r = 7*t^2-51*t+92

    g = _____

    Time-out = _____ sec. Run *Color Functions* to test your solution.

    Note: If r, g or b is negative at any time, the functional value is 0. If either of them are above 100, the functional value is 100.

    $$r, g, b = \begin{cases} 100 & f(t) > 100 \\ f(t) & 0 \le f(t) \le 100 \\ 0 & f(t) < 0 \end{cases}$$

    With the same functions that are in the r & g windows, reset the time-out so that at in the shortest time possible both red and green are at 100% intensity = Bright Yellow.

    Time-out = _____ sec. Run *Color Functions* to test your solution.

4. <u>Load Shift004</u>. Set the Time-out so that "orange" goes to the color that has the same amount of red and green intensity and identify the color by its RGB number by multiplying each of the intensity's (in decimal form) by 255 (rounding to a whole number) and refer to the color chart.

    r = 100-10*t

    g = 65-3*t

    Time-out = _____ sec.

    Color = _____

5. <u>Load Shift005</u>. Set the Time-out so that "Dark Violet" goes to the color that has the same amount of red and blue intensity. Find the RGB for the result by multiplying each of the intensity's (in decimal form) by 255 (rounding to a whole number) and refer to the color chart and identify the color.

    r = 1.2222*t^2-15.333*t+58

    b = (-11/4)*t+83

    Time-out = _____ sec.

    Color = _____

    Move the function in r to g and create a new function for r so that at the Time-out value above, the color box ends with "Light Coral". Note: "Dark Violet" will not be the starting color.

    r = _____

    g = 1.2222*t^2-15.333*t+58

    b = (-11/4)*t+83

    Time-out = _____ sec.

    Color = _____

6. <u>Load Shift006</u>. Replace red and green so that the color box starts with Magenta and moves to "Light Slate Gray" = **RGB 119 136 153**. Note: To calculate the color intensity of each of these values, divide by 255 and multiply by 100%.

    r = 100

    g = 0

    b = -3/8*t^2-.25*t+100

    Time-out = _____ sec.

Color	RGB	Color	RGB	Color	RGB	Color	RGB
alice blue	240,248,255	dark slate gray	47,79,79	light sea green	32,178,170	papaya whip	255,239,213
antique white	250,235,215	dark turquoise	0,206,209	light sky blue	135,206,250	peach puff	255,218,185
aqua	0,255,255	dark violet	148,0,211	light slate gray	119,136,153	peru	205,133,63
aqua marine	127,255,212	deep pink	255,20,147	light steel blue	176,196,222	pink	255,192,203
azure	240,255,255	deep sky blue	0,191,255	light yellow	255,255,224	plum	221,160,221
beige	245,245,220	dim gray / dim grey	105,105,105	lime	0,255,0	powder blue	176,224,230
bisque	255,228,196	dodger blue	30,144,255	lime green	50,205,50	purple	128,0,128
black	0,0,0	firebrick	178,34,34	linen	250,240,230	red	255,0,0
blanched almond	255,235,205	floral white	255,250,240	magenta / fuchsia	255,0,255	rosy brown	188,143,143
blue	0,0,255	forest green	34,139,34	maroon	128,0,0	royal blue	65,105,225
blue violet	138,43,226	gainsboro	220,220,220	medium aqua marine	102,205,170	saddle brown	139,69,19
brown	165,42,42	ghost white	248,248,255	medium blue	0,0,205	salmon	250,128,114
burly wood	222,184,135	gold	255,215,0	medium orchid	186,85,211	sandy brown	244,164,96
cadet blue	95,158,160	golden rod	218,165,32	medium purple	147,112,219	sea green	46,139,87
chart reuse	127,255,0	gray / grey	128,128,128	medium sea green	60,179,113	sea shell	255,245,238
chocolate	210,105,30	green	0,128,0	medium slate blue	123,104,238	sienna	160,82,45
coral	255,127,80	green yellow	173,255,47	medium spring green	0,250,154	silver	192,192,192
corn flower blue	100,149,237	honeydew	240,255,240	medium turquoise	72,209,204	sky blue	135,206,235
corn silk	255,248,220	hot pink	255,105,180	medium viole tred	199,21,133	slate blue	106,90,205
crimson	220,20,60	indian red	205,92,92	midnight blue	25,25,112	slate gray	112,128,144
cyan	0,255,255	indigo	75,0,130	mint cream	245,255,250	snow	255,250,250
dark blue	0,0,139	ivory	255,255,240	misty rose	255,228,225	spring green	0,255,127
dark cyan	0,139,139	khaki	240,230,140	moccasin	255,228,181	steel blue	70,130,180
dark golden rod	184,134,11	lavender	230,230,250	navajo white	255,222,173	tan	210,180,140
dark gray / dark grey	169,169,169	lavender blush	255,240,245	navy	0,0,128	teal	0,128,128
dark green	0,100,0	lawn green	124,252,0	old lace	253,245,230	thistle	216,191,216
dark khaki	189,183,107	lemon chiffon	255,250,205	olive	128,128,0	tomato	255,99,71
dark magenta	139,0,139	light blue	173,216,230	olive drab	107,142,35	turquoise	64,224,208
dark olive green	85,107,47	light coral	240,128,128	orange	255,165,0	violet	238,130,238
dark orange	255,140,0	light cyan	224,255,255	orange red	255,69,0	wheat	245,222,179
dark orchid	153,50,204	light golden rod yellow	250,250,210	orchid	218,112,214	white	255,255,255
dark red	139,0,0	light gray / light grey	211,211,211	pale golden rod	238,232,170	white smoke	245,245,245
dark salmon	233,150,122	light green	144,238,144	pale green	152,251,152	yellow	255,255,0
dark sea green	143,188,143	light pink	255,182,193	pale turquoise	175,238,238	yellow green	154,205,50
dark slate blue	72,61,139	light salmon	255,160,122	pale violet red	219,112,147		