Colour Reproduction

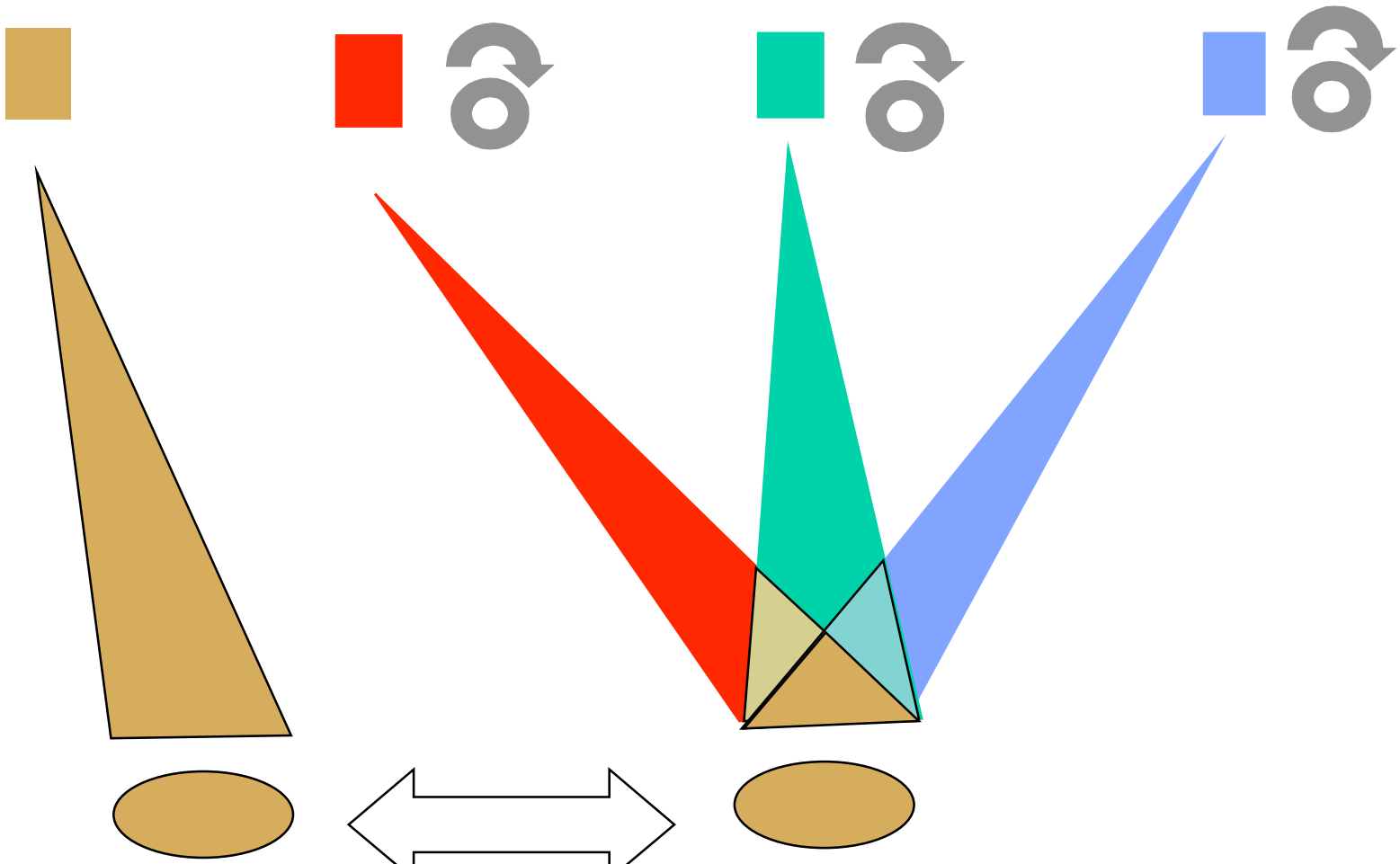
Motivates specifying color numerically (there are other reasons to do this also)

General (man in the street) observation--color reproduction *sort of* works.

Specifying Colour

Test Light

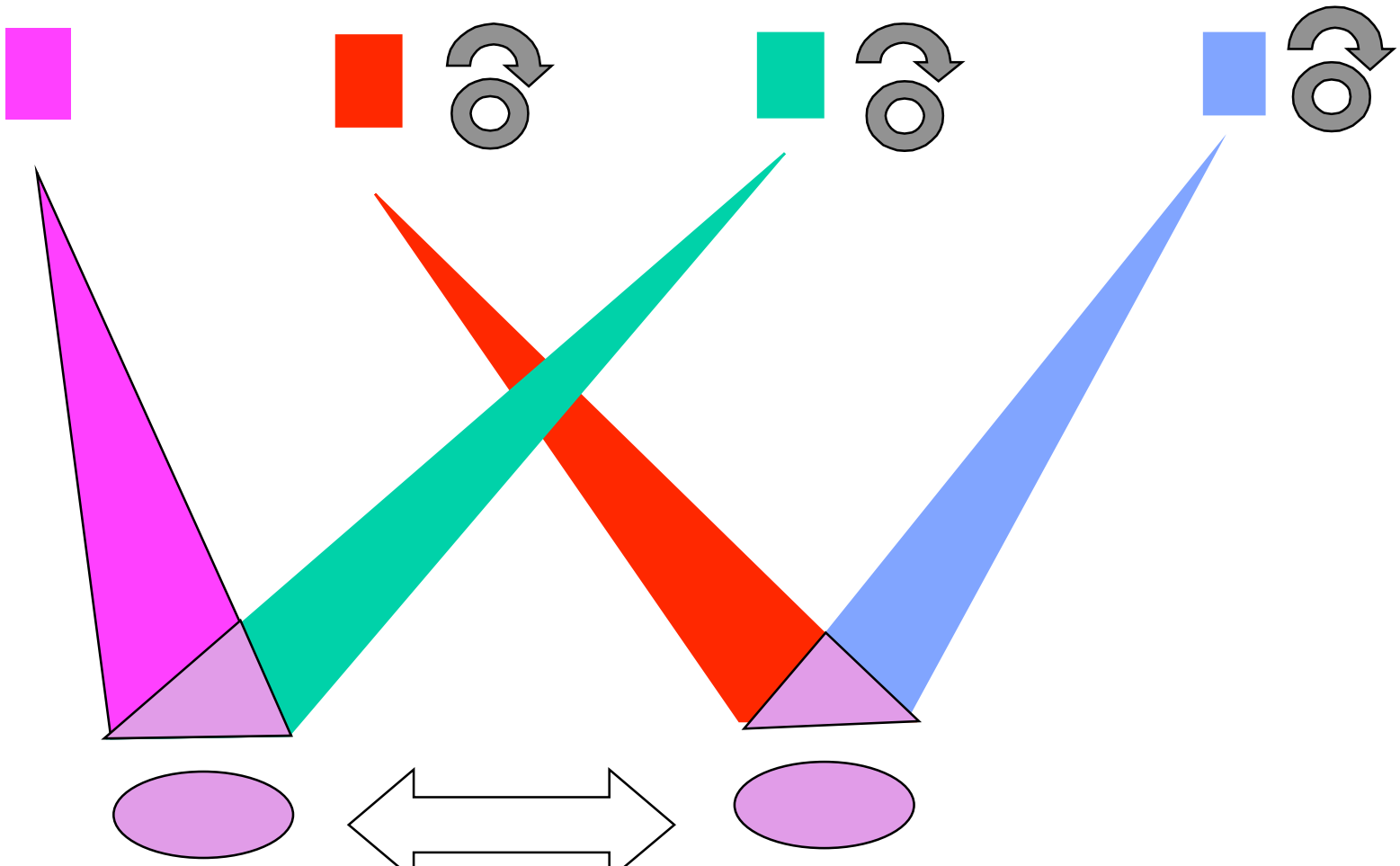
Three standard lights



Match?

Test Light

Three standard lights



Match?

Trichromacy

Experimental fact about people (with "normal" colour vision)

Specifying Colour

(50,150,75)

(50,150,75)

Specifying Colour

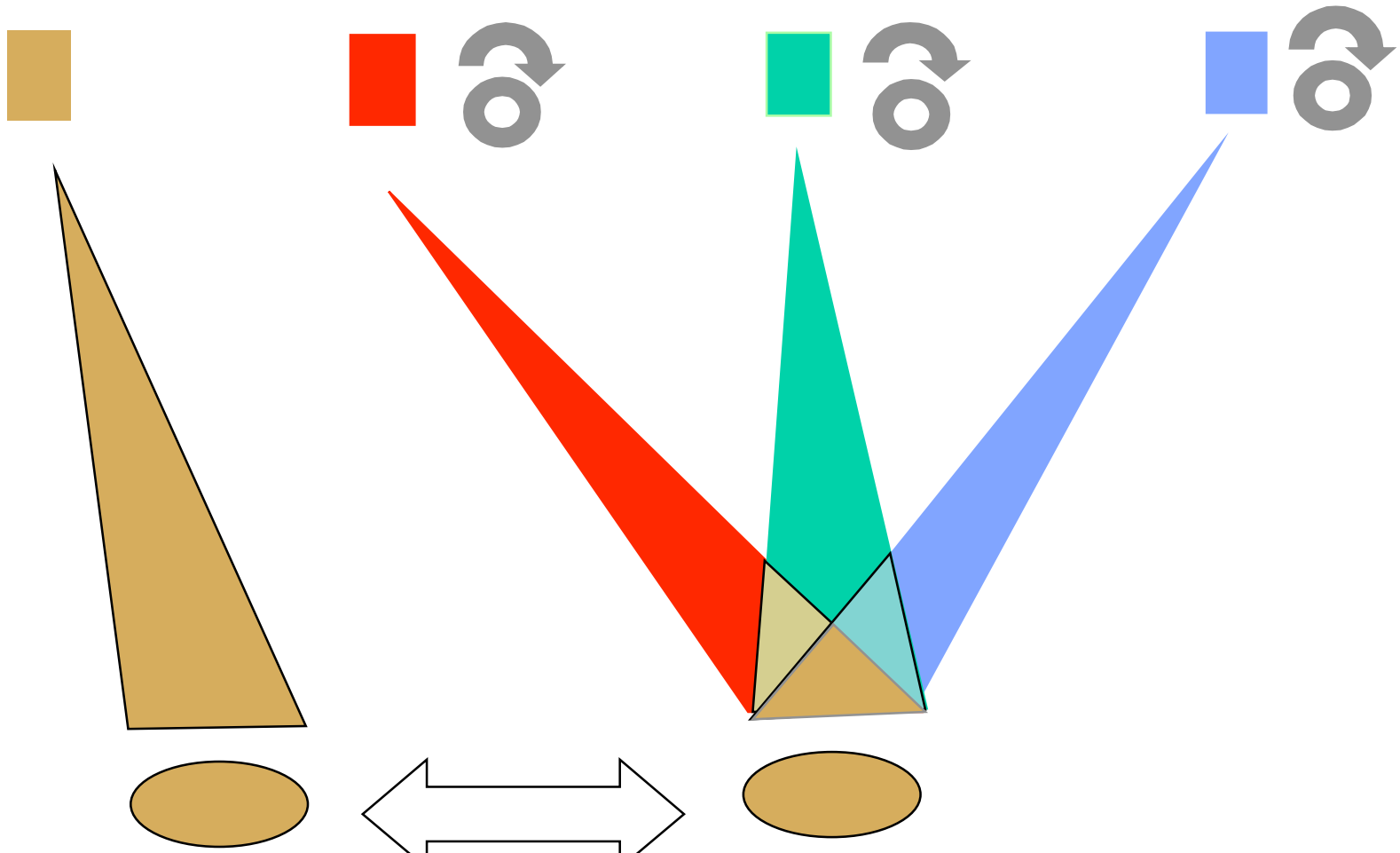
We don’t want to do a matching experiment every time we want to use a new color!

Grassman's Contribution

Colour matching is linear

Test Light

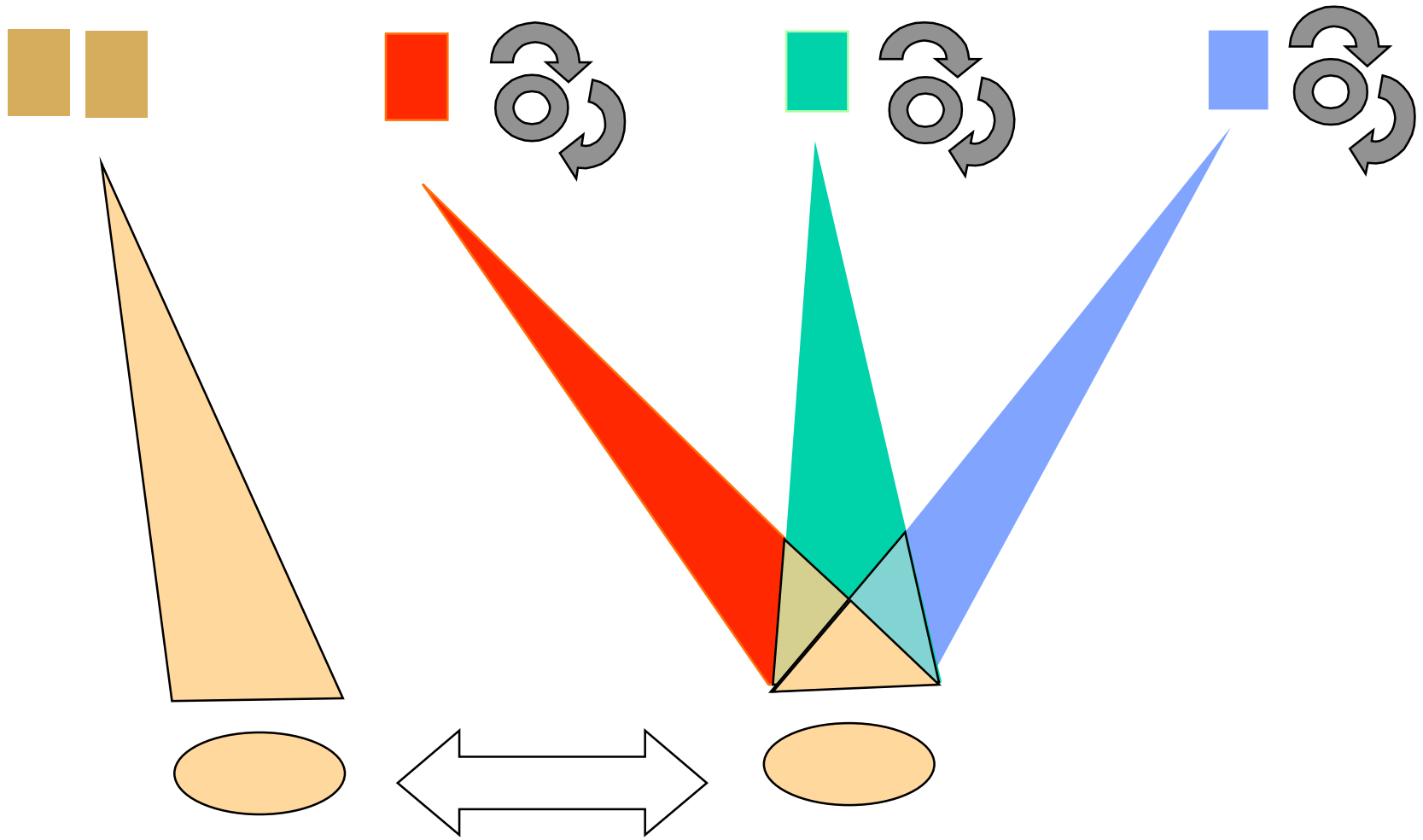
Three standard lights



Match?

Test Light

Three standard lights



Match (with twice as much)

Matching is Linear (Part 1)

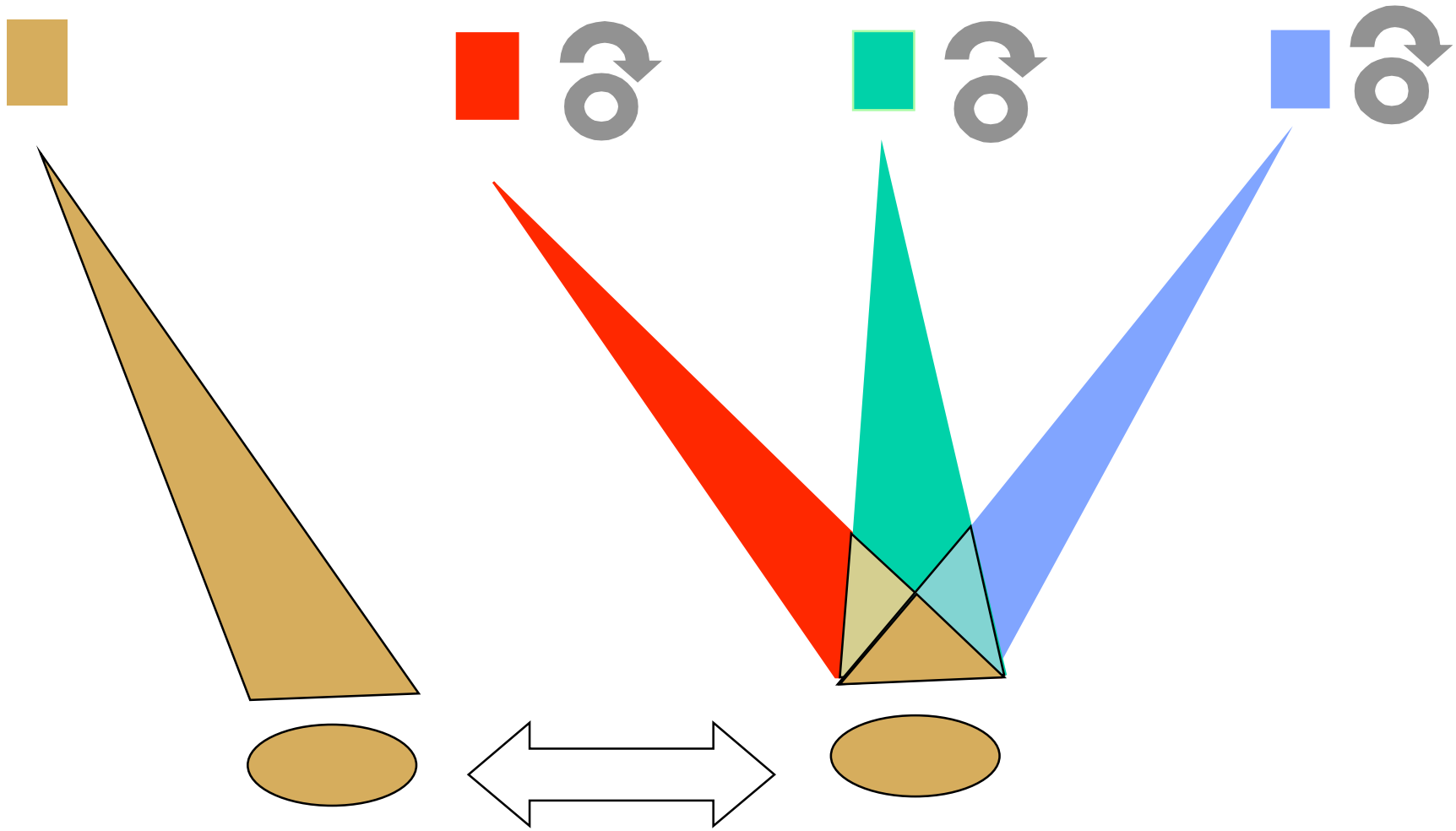
C1 is matched with (X1,Y1,Z1)

C = a*C1

C is matched with a * (X1, Y1, Z1)

Test Light
(C1)

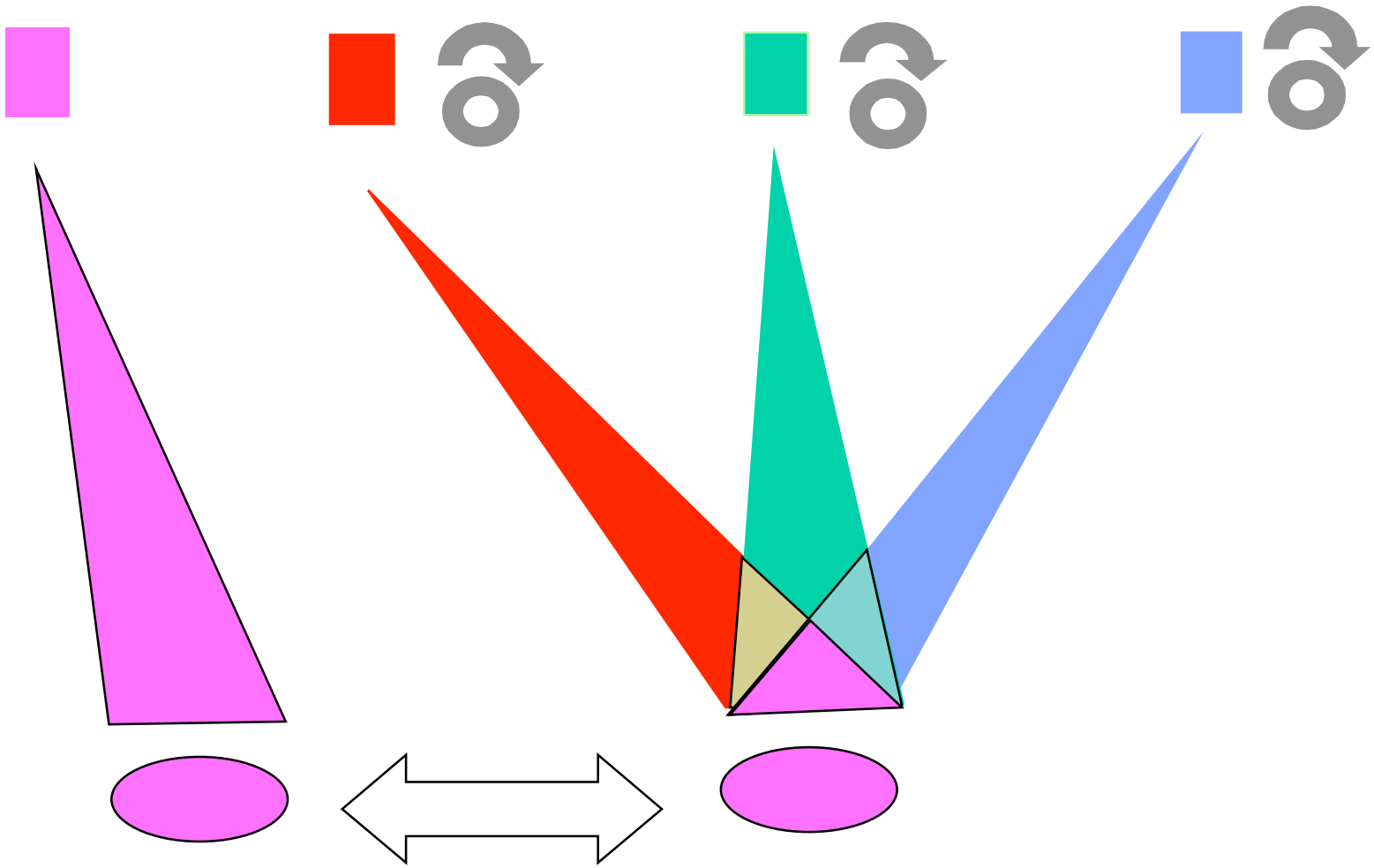
Three standard lights



Match with (X1, Y1, Z1)

Test Light
(C2)

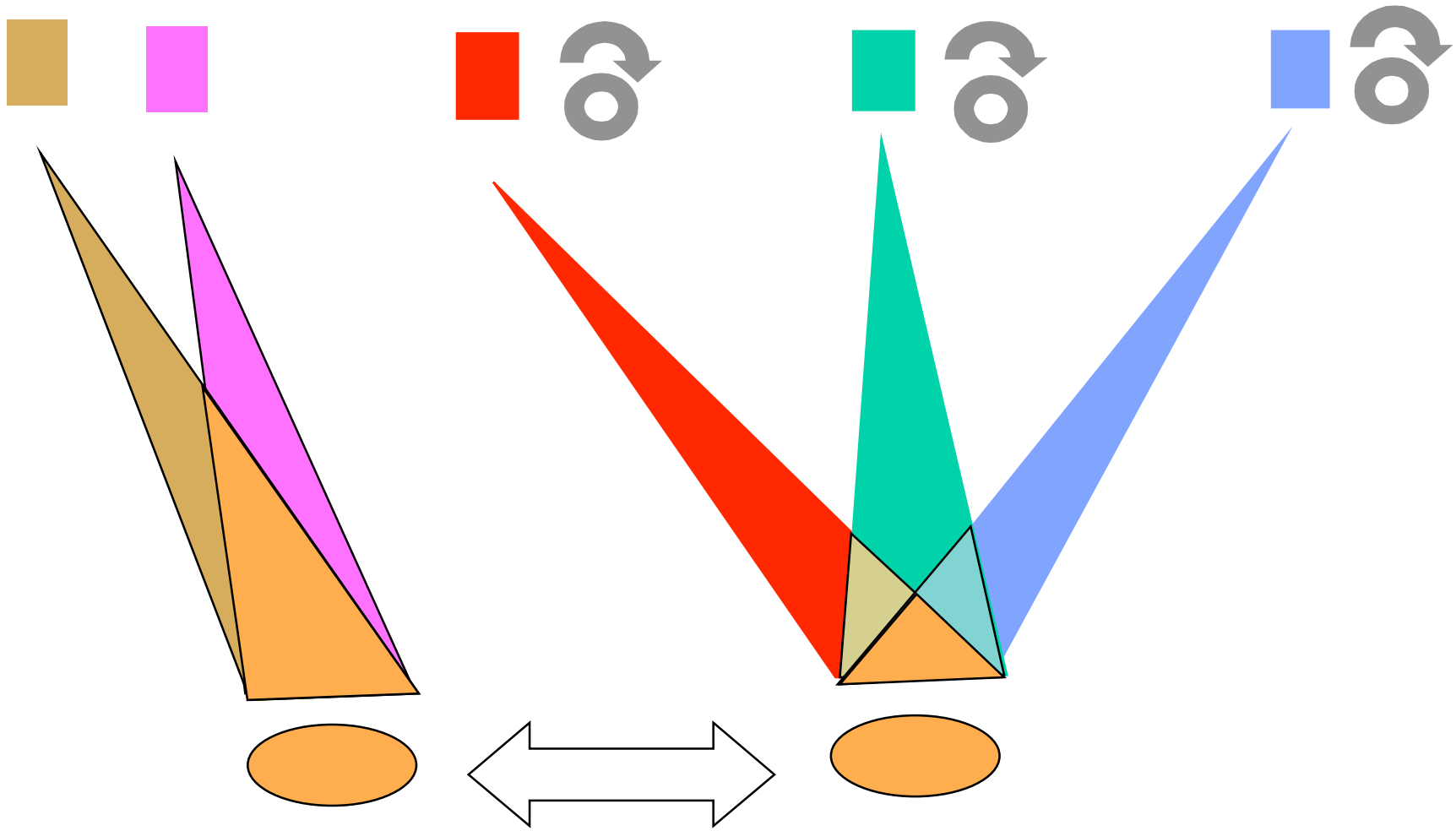
Three standard lights



Match with (X2, Y2, Z2)

Test Light

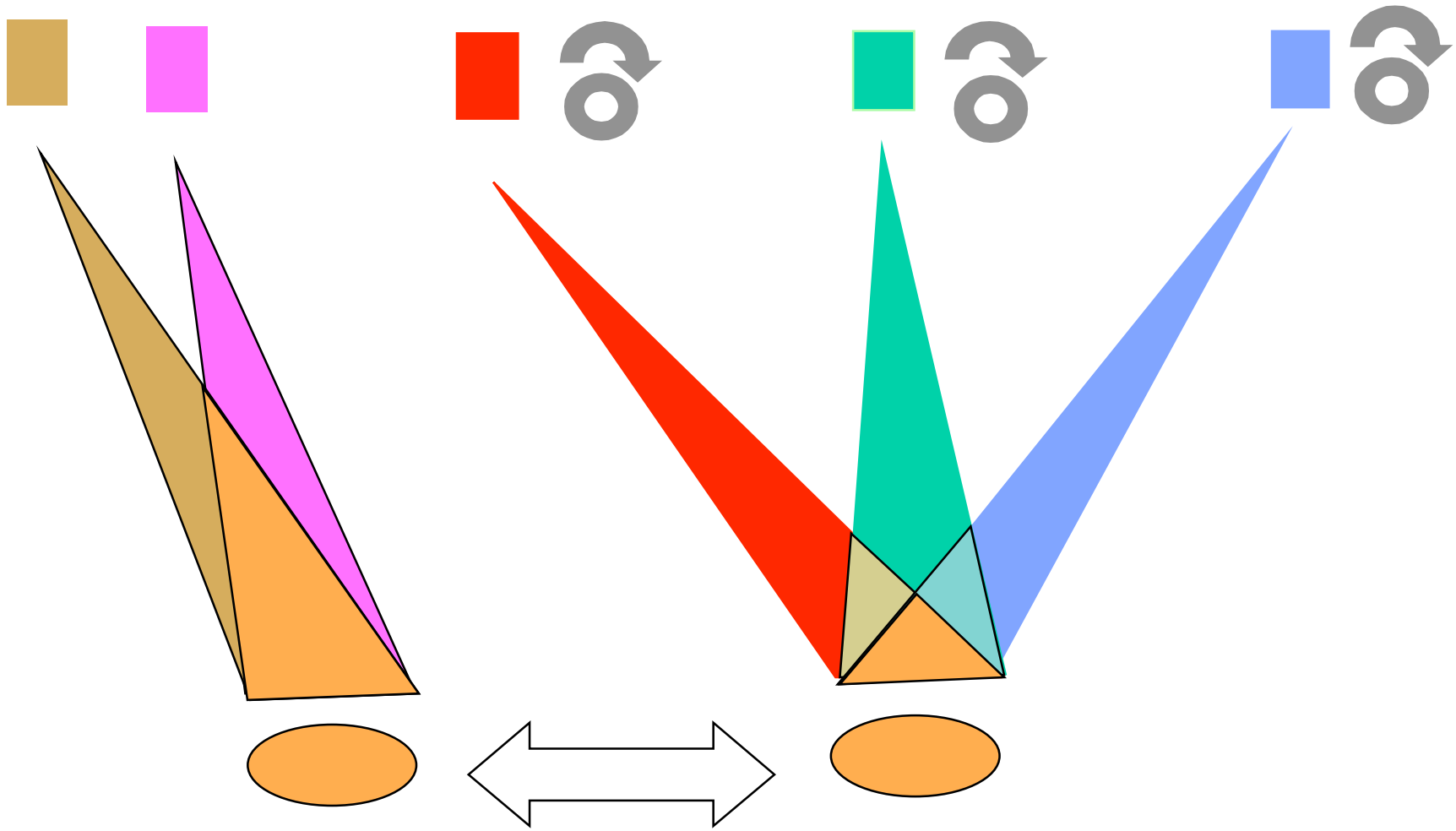
Three standard lights



Match with?

Test Light

Three standard lights



Match with (X1+X2, Y1+Y2, Z1+Z2)

Matching is Linear (formal)

$C = a*C1 + b*C2$

C1 is matched with (X1,Y1,Z1)
C2 is matched with (X2,Y2,Z2)

C is matched by

$a*(X1,Y1,Z1) + b*(X2,Y2,Z2)$

Specifying Color

On my monitor it's
(R,G,B) = (75,150,100)

Specifying Colour

But what is (R,G,B)?

Specifying Colour

R matches (X_r, Y_r, Z_r)

G matches (X_r, Y_g, Z_g)

B matches (X_b, Y_b, Z_b)

Specifying Colour

Then by
(R,G,B)=(75,150,100)
you mean (X,Y,Z),
where …..

$$X = 75^* X_r + 150^* X_g + 100^* X_b$$

$$Y = 75^* Y_r + 150^* Y_g + 100^* Y_b$$

$$Z = 75^* Z_r + 150^* Z_g + 100^* Z_b$$

(No need to match--just compute!)

Specifying Colour

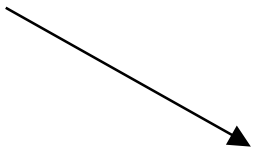
… , now that we have
specified the colour,
I can print it!

$$\begin{vmatrix} X \\ Y \\ Z \end{vmatrix} = \begin{vmatrix} X_r & X_g & X_b \\ Y_r & Y_g & Y_b \\ Z_r & Z_g & Z_b \end{vmatrix} \begin{vmatrix} 75 \\ 100 \\ 150 \end{vmatrix}$$

$$\begin{vmatrix} X \\ Y \\ Z \end{vmatrix} = \begin{vmatrix} X_r & X_g & X_b \\ Y_r & Y_g & Y_b \\ Z_r & Z_g & Z_b \end{vmatrix} \begin{vmatrix} R \\ G \\ B \end{vmatrix}$$

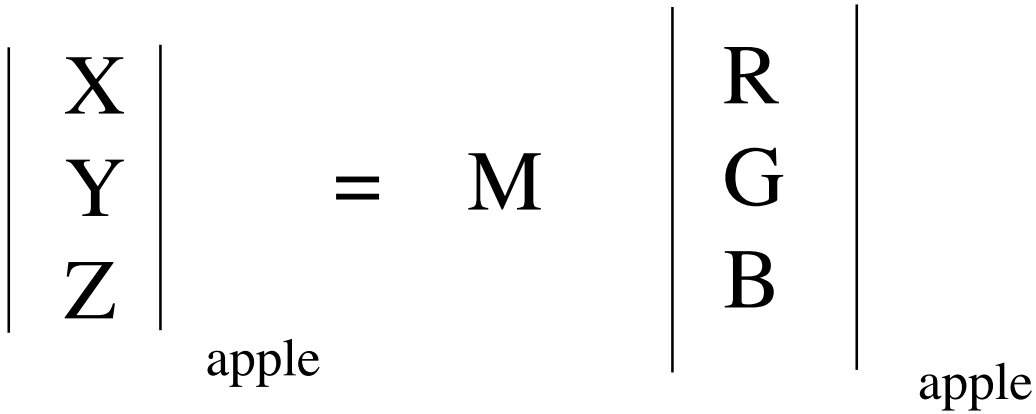
$$\begin{vmatrix} X \\ Y \\ Z \end{vmatrix} = M \begin{vmatrix} R \\ G \\ B \end{vmatrix}$$

Colour Reproduction
(Monitors & Projectors)



$$\begin{vmatrix} X \\ Y \\ Z \end{vmatrix}_{\text{apple}}$$

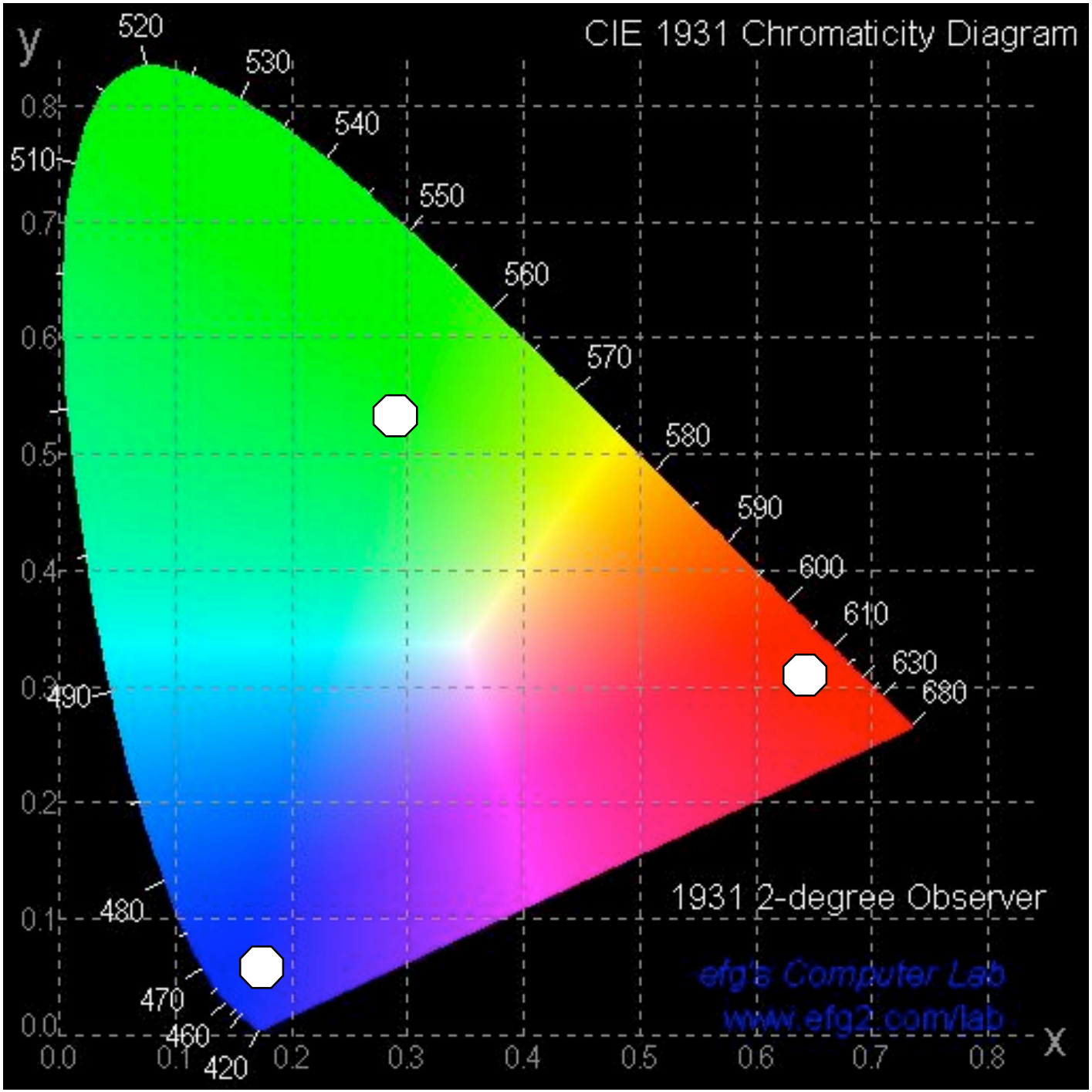
Find (R,G,B)


X
Y
Z
apple
=
M
R
G
B
apple

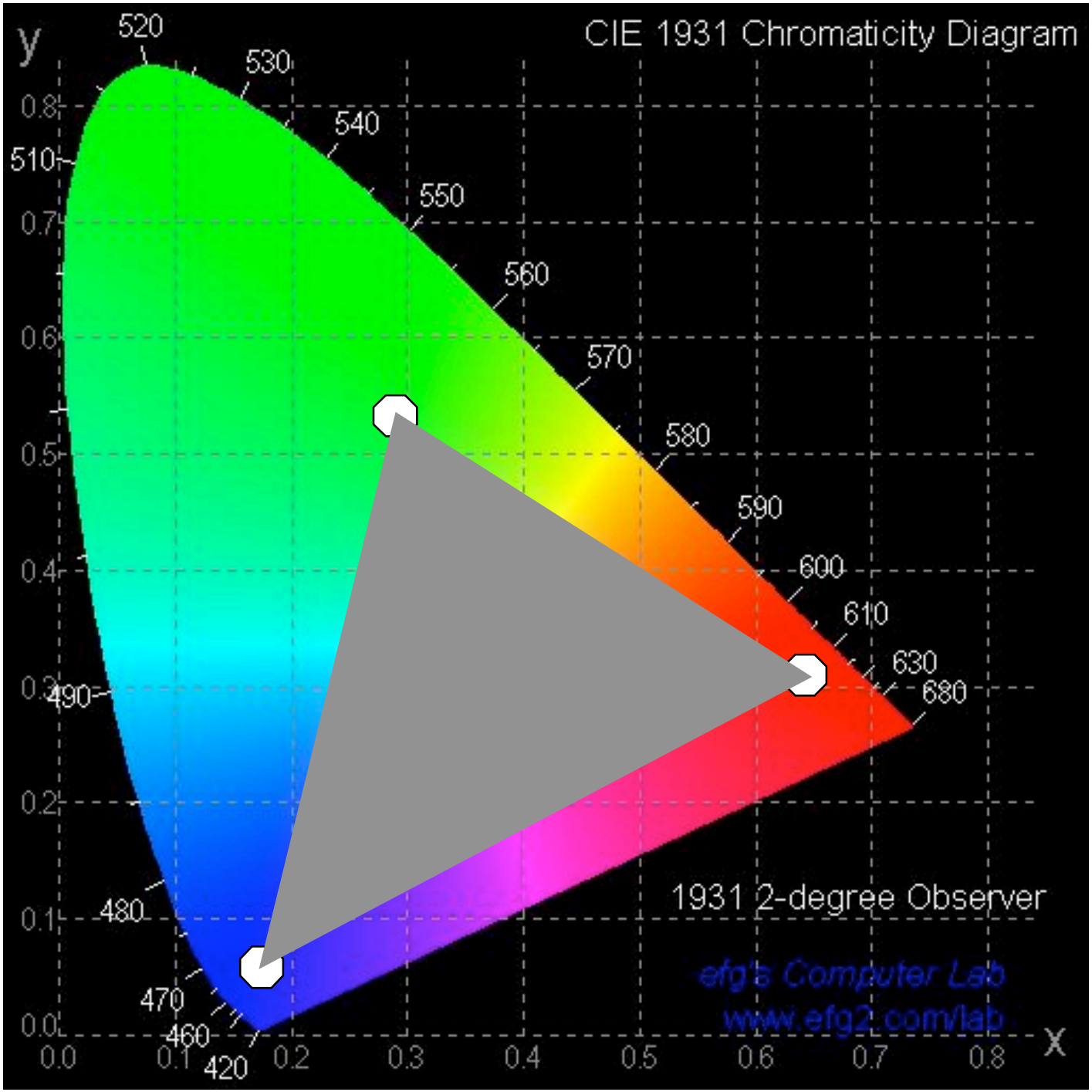
$$\begin{vmatrix} R \\ G \\ B \end{vmatrix}_{apple} = M^{-1} \begin{vmatrix} X \\ Y \\ Z \end{vmatrix}_{apple}$$

$$\begin{vmatrix} R \\ G \\ B \end{vmatrix}_{apple} = M^{-1} \begin{vmatrix} X \\ Y \\ Z \end{vmatrix}_{apple}$$

Possible problems?



Avalable
from
efg2.com



Avalable
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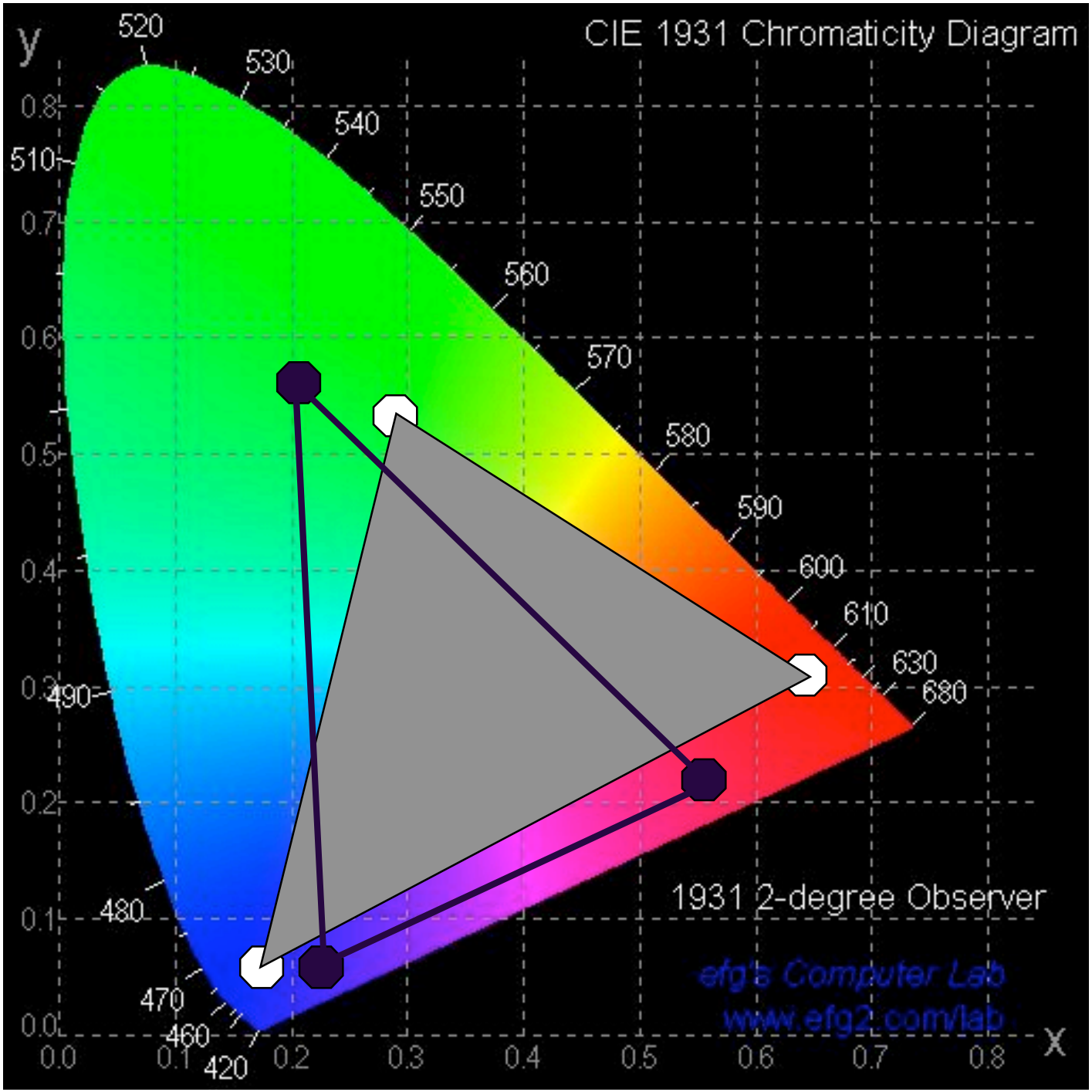
efg2.com



Avalable
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