Section 7.4

"If others would but reflect on mathematical truths as deeply and as continuously as I have, they would make my discoveries."

Karl Gauss

Perspective

Have you ever looked at a painting of a pretty scene of the country side and wondered how the artist was able to capture the beauty and essence of the landscape in the picture. Or perhaps, you wondered how the artist was able to create a three dimensional effect on a piece paper of that is only one dimensional. All these effects can be created by using different types of perspective. **Perspective** is the art of drawing objects in manner that creates three dimensional effect or depth in the drawing. There are several ways to create a perspective in art. The artist can use light, shading, variance in the size of objects, and lines of sight to create depth perception in a drawing or painting. As it turns out, there are several types of perspective. In this course, we will study four types of perspective.

Types of Perspective

1) Diminishing Sizes
2) Overlapping Shapes
3) Atmosphere Perspective
4) One Point Perspective

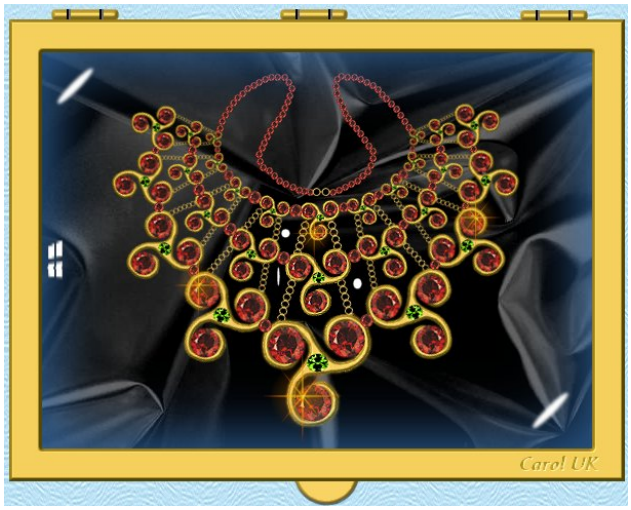
As we study each type of perspective, we will look both art work and photographs that exhibit each type of perspective.

Overlapping shapes: In overlapping shapes depth perception is created by using overlapping shapes. If one shape is placed in front of another it givens the perception that the scene is not flat.

Here are a few pictures that exhibit perspective using overlapping shapes.

Diminishing sizes: In diminishing sizes depth is created by systematically making objects smaller. Objects that are closer to the eye are naturally larger that objects that are further from the eye. In some drawings or paintings, artist use variances in sizes to create depth perception. Diminishing sizes are also prevalent in photographs. In this first example, you can see how diminishing sizes occurs in a regular photograph. Notice that the first tower of the Golden Gate Bridge is much larger that the second tower. A depth perception is created naturally in the photo due to the different sizes of the objects in the photograph. If we look closer at the photo, we can also see that the suspension cables of the bridge get smaller as the bridge gets further away.

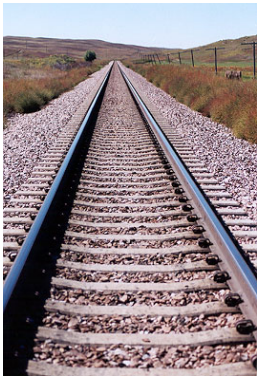
The next example is drawing called the matching necklace. The artist uses different size beads or gems to create depth perception.



Atmospheric Perspective: In atmospheric perspective depth is created by making objects that are farther away less clear by diminishing both color and shading. If you have ever looked at objects such as mountains at a distance, you will notice that they seem less vivid than objects that are closer. This effect can be captured in a painting or drawing by using different shading on objects closer to the naked eye than object farther from the eye. Again, this perspective can also be clearly seen in a photograph as well. In next photograph, you can see how atmospheric perspective appears to the naked eye in real life. Notice that object closer the camera, the hedges and people, appear to be much more vivid, where as objects further away from the camera, the mountains and clouds, are less vivid.

One-Point Perspective: In one perspective depth is creating by using a vanishing point. In this photograph, we can see that the cable car tracks meet at a vanishing point in the photograph. Notice that the vanishing point is located at a point near the end of the street or below the tower of the San Francisco Bay Bridge.

In this next photograph, you can see how the railroad tracks meet a vanishing point to create a one point perspective.

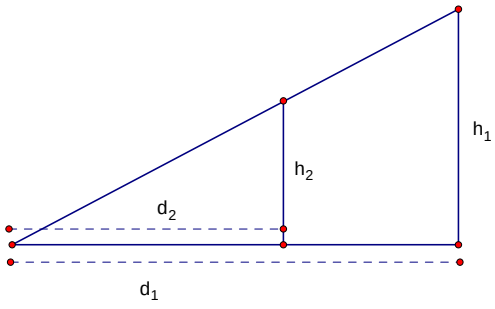


Using Proportions to Calculate Distances in a Drawing

Suppose we were asked to make a drawing with a few trees in it and we were asked to draw the trees using diminishing sizes and a vanishing point to create a perspective in the drawing. How could we use math to figure out how to space the trees apart from one another. The answer to the problem is to use similar triangles and proportions to find the correct distances. Before we work example like this, let's review a few things about similar triangles.

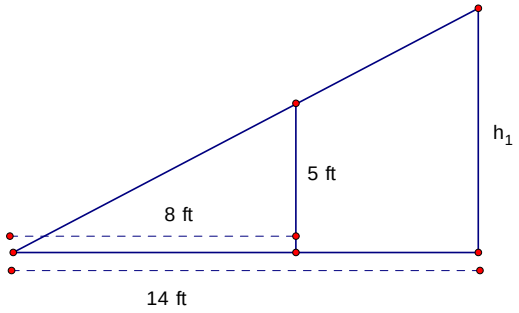
Similar Triangles and Proportions

In the diagram below is a picture of two triangles that are similar. Since these triangles are similar, the sides of two similar triangles are proportional. Given that the sides of the triangle are proportional, we can set up the following ratio between the sides. $\frac{h_1}{d_1} = \frac{h_2}{d_2}$



Now, let try using proportions to find the missing side of the triangle.

Example 1 Given that the triangles below are proportional, find h_1



Solution: Set up a proportion and solve for the missing variable which is h_1

$$\frac{h_1}{d_1} = \frac{h_2}{d_2}$$

$$\frac{h_1}{14} = \frac{5}{8}$$

$$8h_1 = 5(14)$$

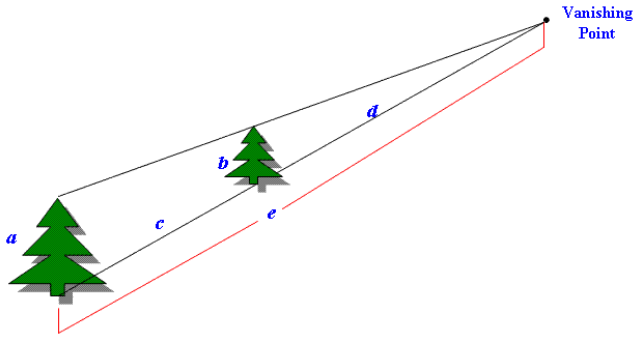
$$8h_1 = 70$$

$$h_1 = 8.75 \ ft$$

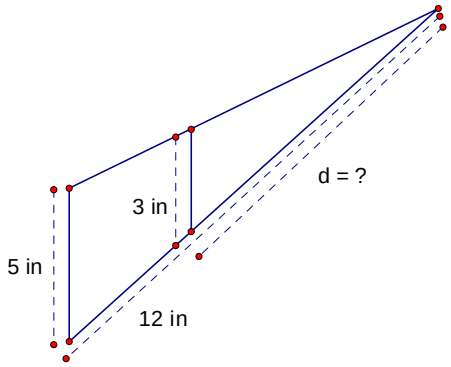
Here is an example of using a proportion to find the correct distance in drawing.

Example 2

Use the picture below and the values of a,b,c,d, and e to find the missing value.
If a =5 in, b = 3 in, and e = 12 in, find ***d***. Round your answer to 2 decimal places.



Solution: Set up a proportion and solve for d



$$\frac{a}{e} = \frac{b}{d}$$

$$\frac{5}{12} = \frac{3}{d}$$

$$5d = 3(12)$$

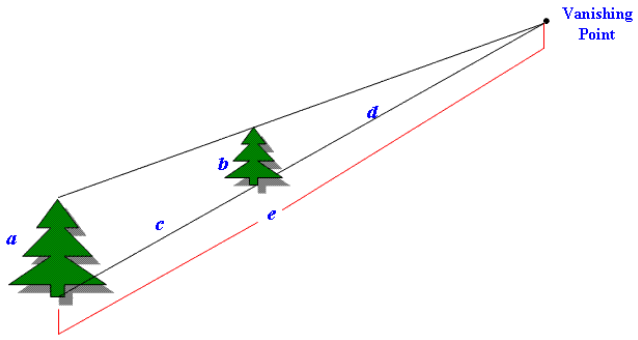
$$5d = 36$$

$$\frac{5d}{5} = \frac{36}{5}$$

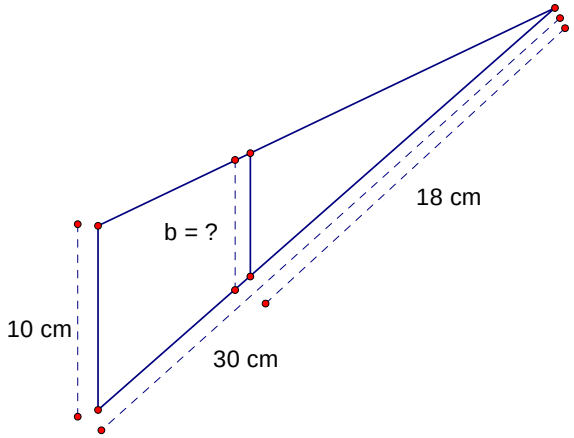
$$d = 7.2\ in$$

Example 3

Use the picture below and the values of a,b,c,d, and e to find the missing value.
If a =10 cm, d = 18 cm, and e = 30 cm, find $\boldsymbol{b}$. Round your answer to 2 decimal places.



Solution: Set up a proportion and solve for b



$$\frac{a}{e} = \frac{b}{d}$$

$$\frac{10}{30} = \frac{b}{18}$$

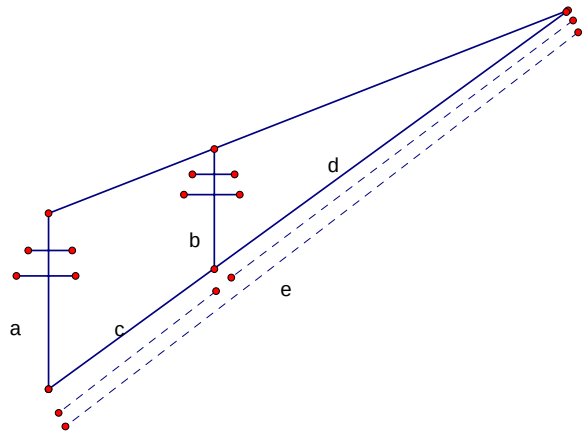
$$30b = 10(18)$$

$$30b = 180$$

$$b = 6\,in$$

Example 4

In the diagram below, the distance between the telephone poles is c, the height of the two telephone pole is a and b respectively, the distance from first telephone pole a to the vanishing point is e, and the distance from second telephone pole to the vanishing point is d. Using the diagram to find distance d and c, given that a = 3 in, b = 3 in, and e = 12 in.



$a = 3\ in$

$e = 12\ in$

$b = 2\ in$

$d = ?$

$$\frac{3}{12} = \frac{2}{d}$$

$$3d = 12(2)$$

$$3d = 24$$

$$\frac{3d}{3} = \frac{24}{3}$$

$$d = 8\ in$$

$$c = 12 - 8 = 4\ in$$

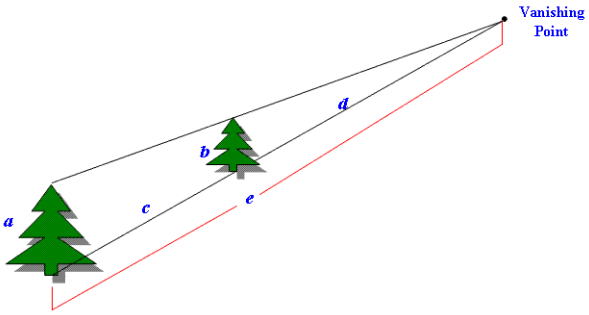
Exercises

1) Name the four types of perspective discussed in this section.

2) Give a brief description of each of the four types of perspective.

3) Describe any perspectives that can be found in the following picture.

4) Use the picture below and the values of a,b,c,d, and e to find the missing value.
If a =10 in, d = 18 in, and e = 30 in, find $\boldsymbol{b}$. Round your answer to 2 decimal places.



5) Use the picture in the above problem and the values of a,b,c,d, and e to find the missing value. If a =5 in, b = 3 in, and e = 12 in, find $\boldsymbol{d}$. Round your answer to 2 decimal places.