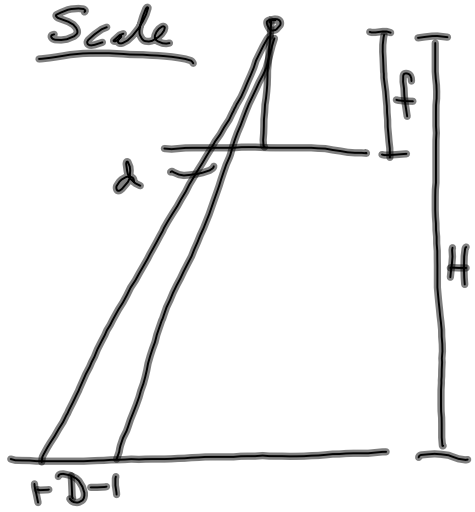
Scale



$\text{Scale} = \frac{d}{D} = \frac{f}{H}$

10-1

example

$f = 152.4\text{mm}$ (6")

$H = 1200', 365.76\text{m}$

$\frac{.1524}{365.76} = \frac{1}{2400}, \frac{0.5}{1200}$

1:2400 unitless ratio

Feb 7-4:19 PM

10-2

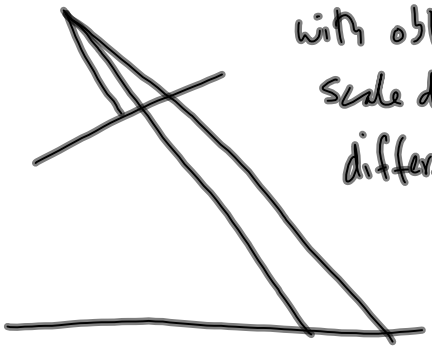
1" = 100', "100-scale"

Prefer to state scale without units,

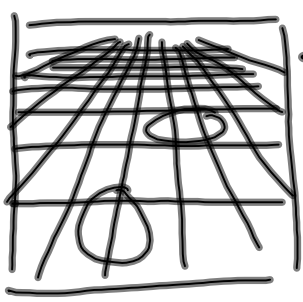
with oblique image

scale different everywhere

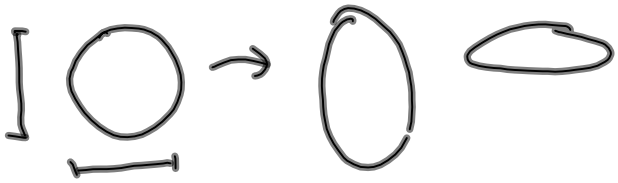
different in every direction



Feb 7-4:22 PM

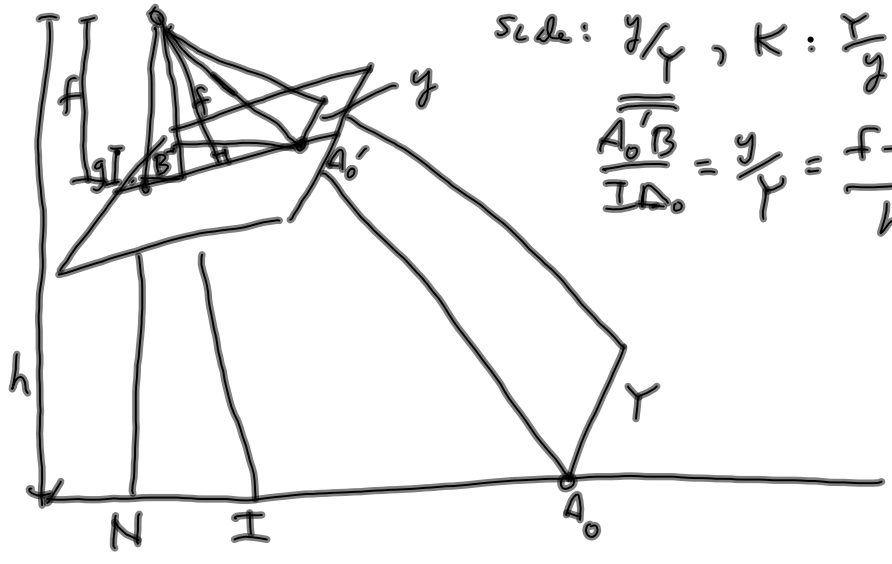


10-3



appearance of circular objects as ellipses indicates that scale is different in every direction.

Feb 7-4:22 PM



scale: y/Y, $K: \frac{Y}{y}$ 10-4

$$\frac{\overline{A_0'B}}{\overline{IA_0}} = \frac{y}{Y} = \frac{f-g}{h}$$

See detailed figures on the course web page.

Feb 7-4:22 PM

10-5

meas. system image space
(u', v') ← 3-par → system origin @ isocenter (x', y')
2-par
system object space (x, y) @ isocenter
3-par
(u, v) measured system in obj space

$3\text{par} + 2\text{par} + 3\text{par} = 8\text{par}.$

Feb 7-4:22 PM

10-6

$$x' = u'\cos\alpha' + v'\sin\alpha' + d'$$
$$y' = -u'\sin\alpha' + v'\cos\alpha' + e'$$

$$u = x\cos\alpha + y\sin\alpha + d$$
$$v = -x\sin\alpha + y\cos\alpha + e$$

$$\frac{y}{y'} = k, \quad y = y'k$$

$$k = \frac{IA_0}{BA_0'} = \frac{h}{f-g} = \frac{h}{f - x'\sin t} = \frac{h/\sin t}{f/\sin t - x'}$$

$\rightarrow f = f'\sin t$ $\quad g = x'\sin t$ $\quad \boxed{k = \frac{h'}{f' - x'}}$

$\rightarrow h = h'\sin t$

see detailed derivation on web page.
K: reciprocal of usual scale expression

Feb 7-4:22 PM

10-7

$y = \frac{y' h'}{f' - x'}$

$BA_0'I$: isosceles

$BA_0' = A_0'I = x'$

$x = k(BA_0')$

$x = kx'$

$x = \frac{h' x'}{f' - x'}$

2 parameters f', h' define transformation between xy & $x'y'$

each with origin at isocenter point (obj & image)

plug first of 3-par transformations into these two equations (from previous page)

Feb 7-4:22 PM

10-8

$$y = \frac{h'(u' \cos\alpha' + v' \sin\alpha' + d')}{f' - (u' \cos\alpha' + v' \sin\alpha' + d')}$$

$$y = \frac{h'(-u' \sin\alpha' + v' \cos\alpha' + e')}{f' - (u' \cos\alpha' + v' \sin\alpha' + d')}$$

after substitution

⋮

see rest of derivation at web links

Interpolation nearest neighbor ✓

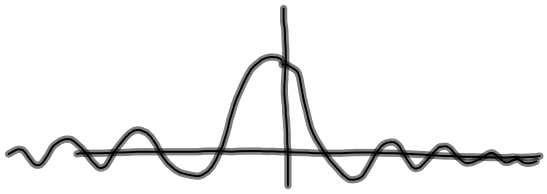
bilinear ✓

Feb 7-4:22 PM

Bicubic interpolation

10-9

approximation of "sinc" function



Feb 7-4:22 PM