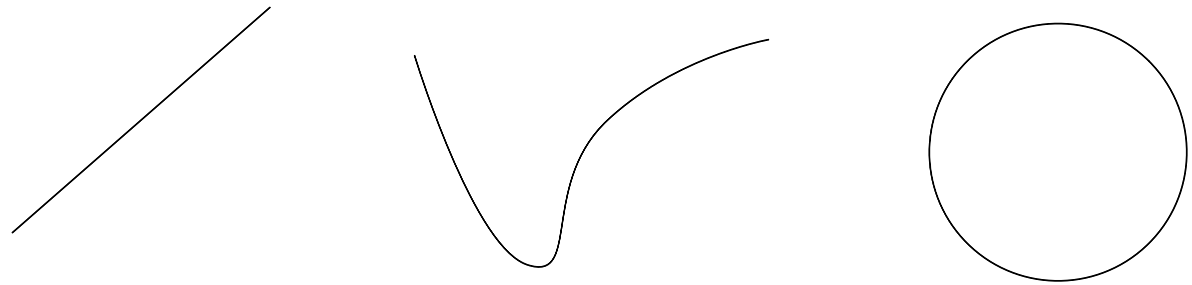
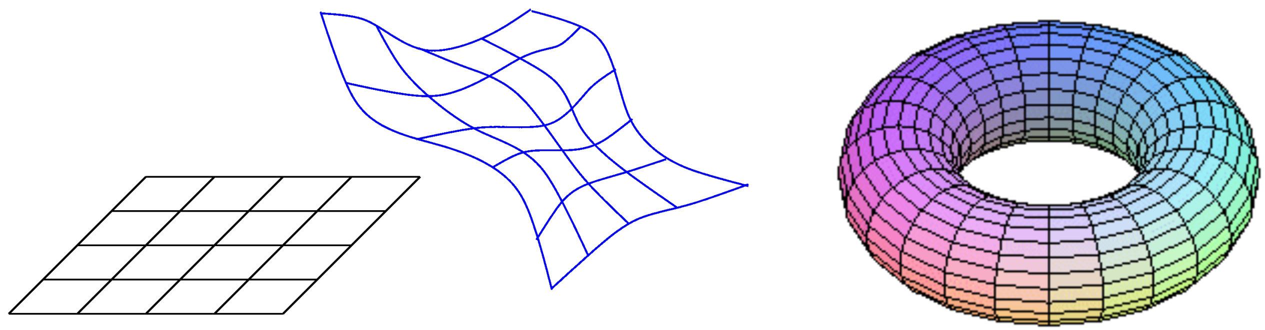
CMSC427
Drawing a line: Functional, implicit and parametric curves

Beyond the pixel - curves, surfaces and solids

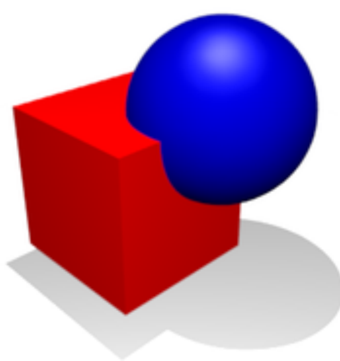
Curves



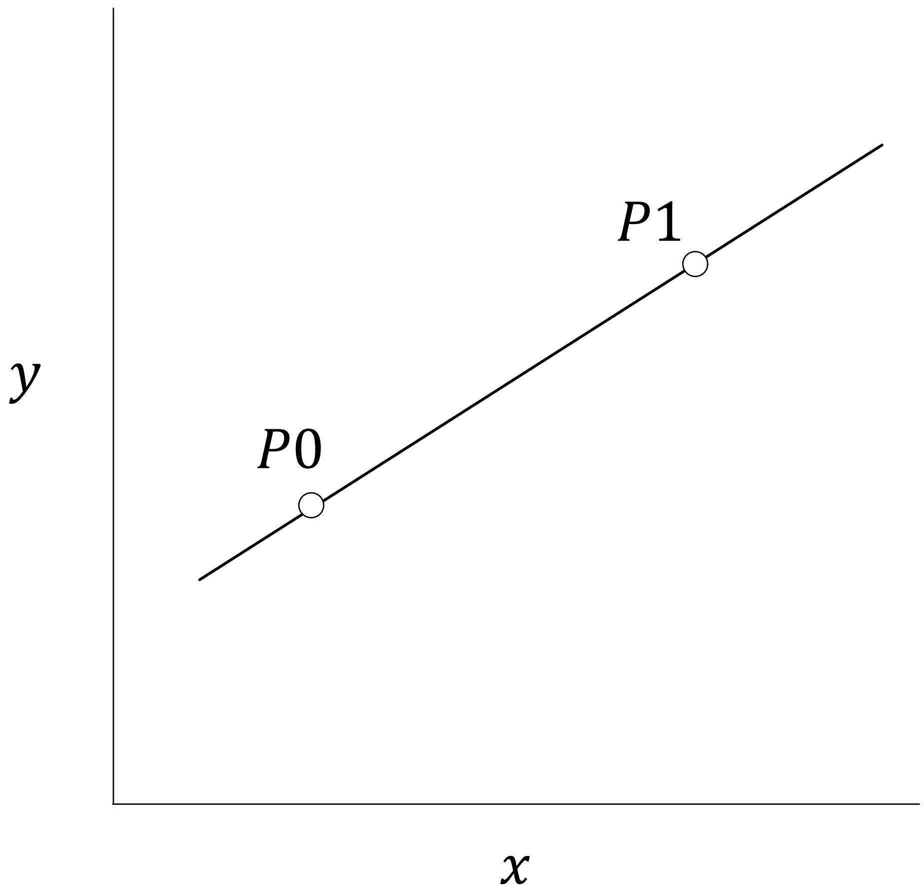
Surfaces



Solids



Drawing a line segment



$$y = mx + b$$

$$P0 = (x0, y0)$$

$$P1 = (x1, y1)$$

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for x = x0 to x1
  y = mx+b
  putpixel(x,y)
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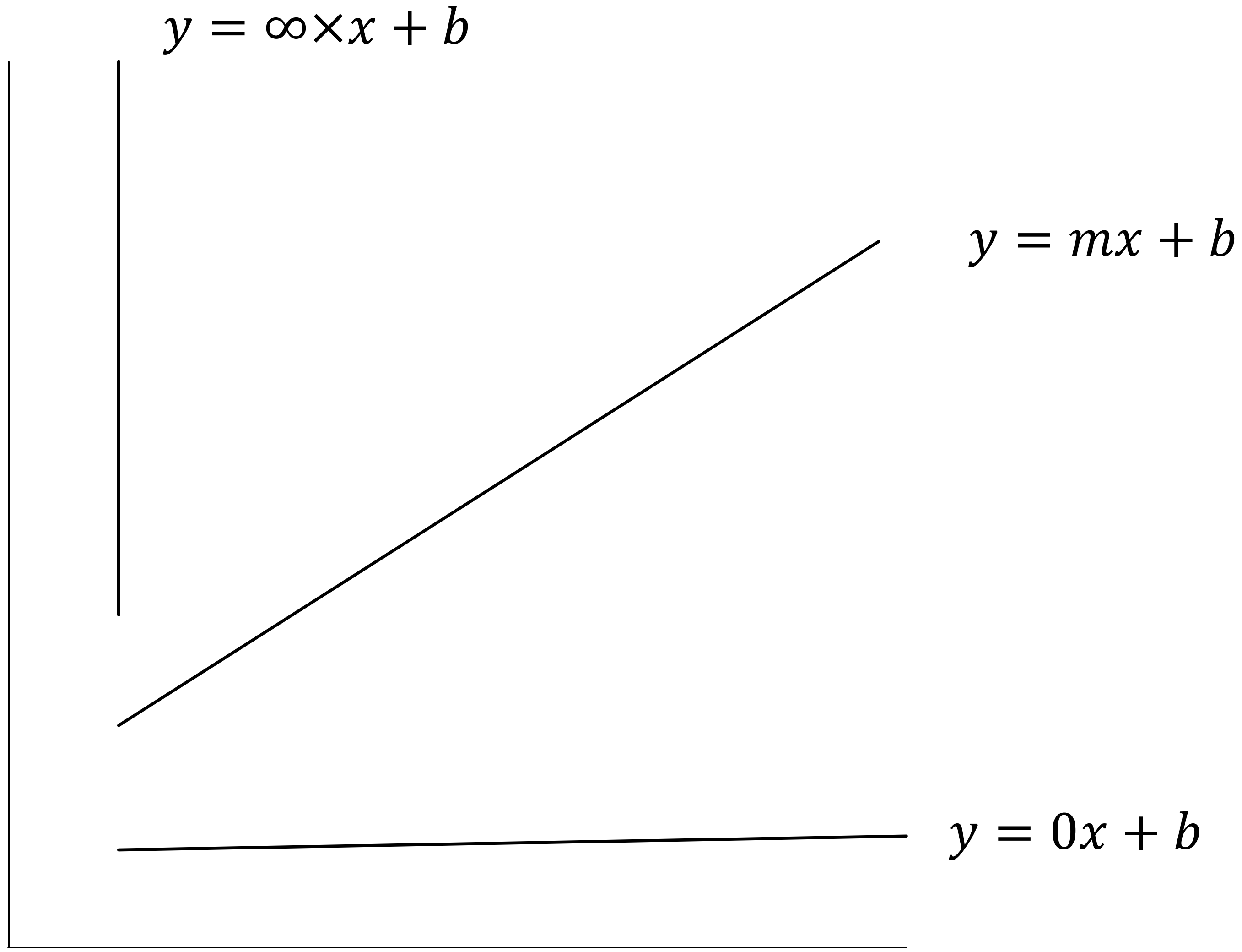
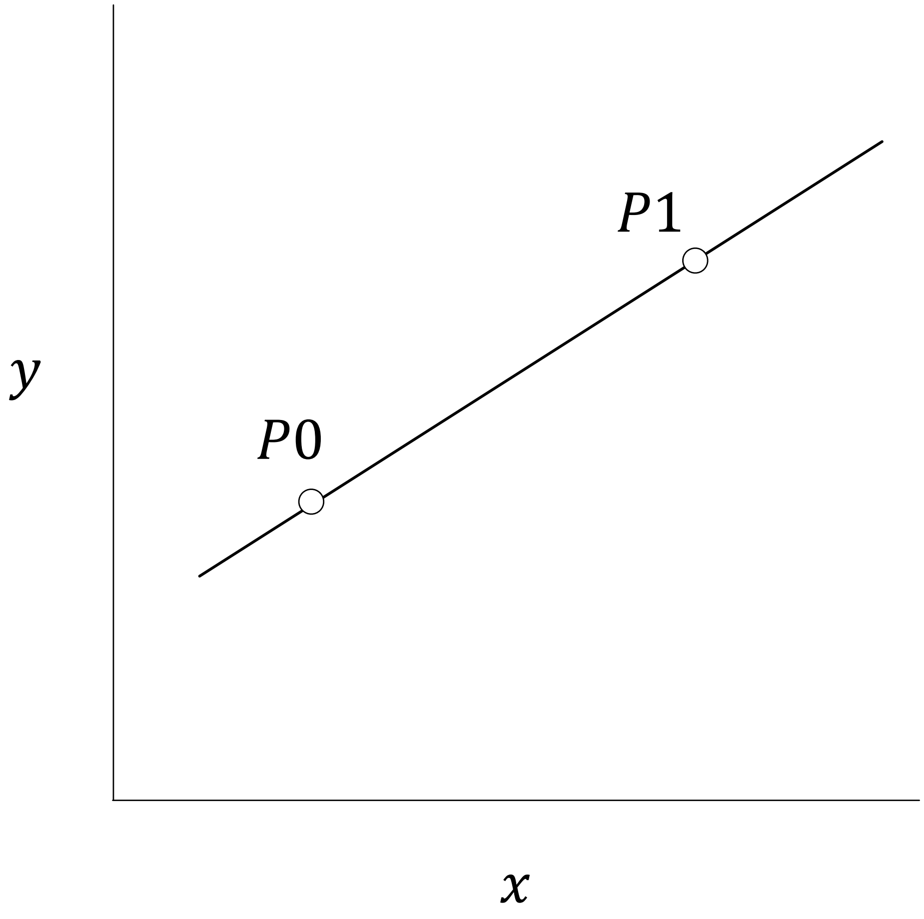
Drawbacks of standard formula: special cases



Solution: parametric form



$$x = t\ dx + p0x$$
$$y = t\ dy + p0y$$

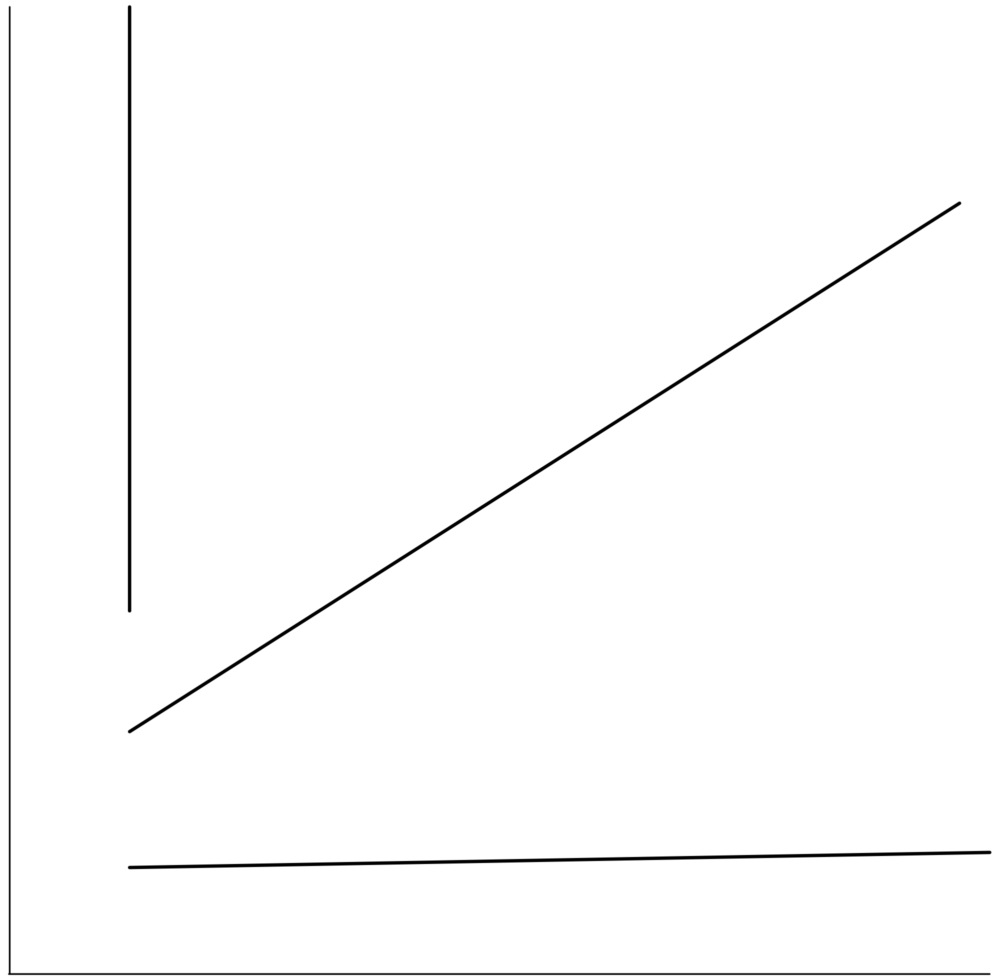
$$m = \frac{dy}{dx} = \frac{y1 - y0}{x1 - x0}$$

$$0 \le t \le 1$$

or

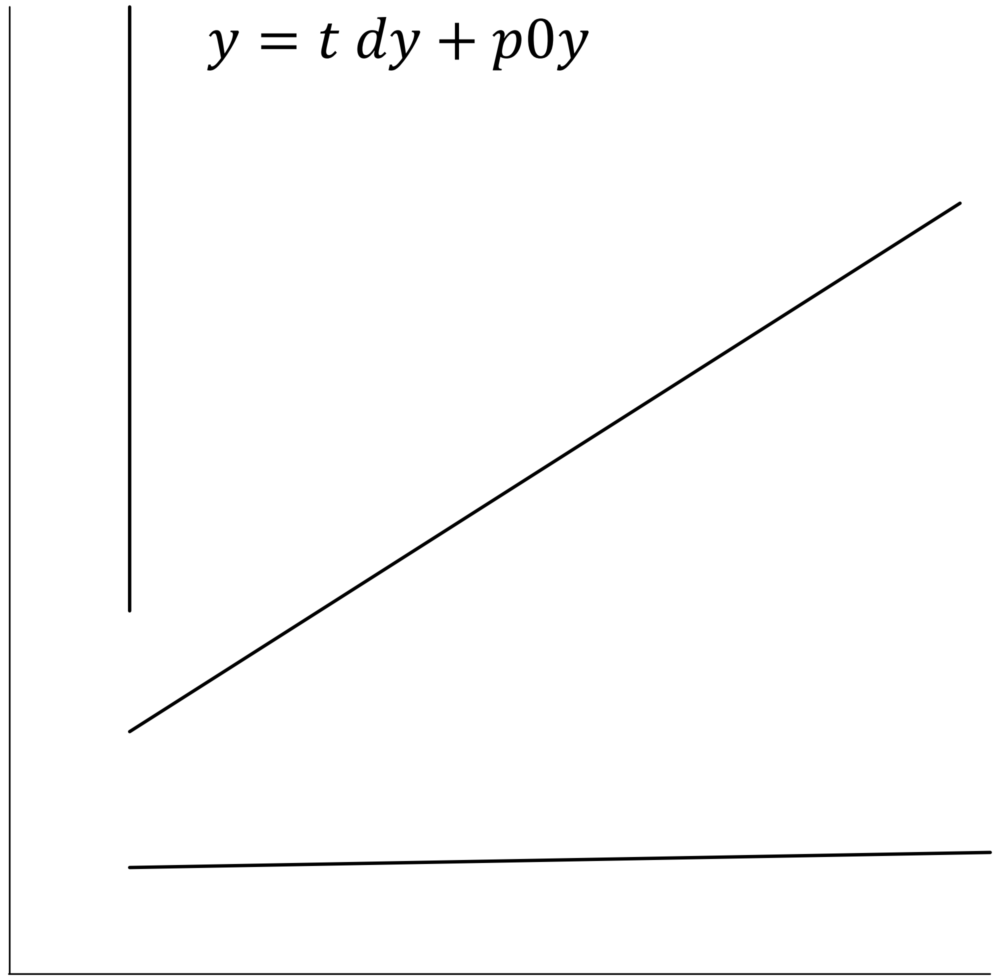
$$t \in [0,1]$$

Work for special cases?



$$x = t\ dx + p0x$$
$$y = t\ dy + p0y$$

Work for special cases?

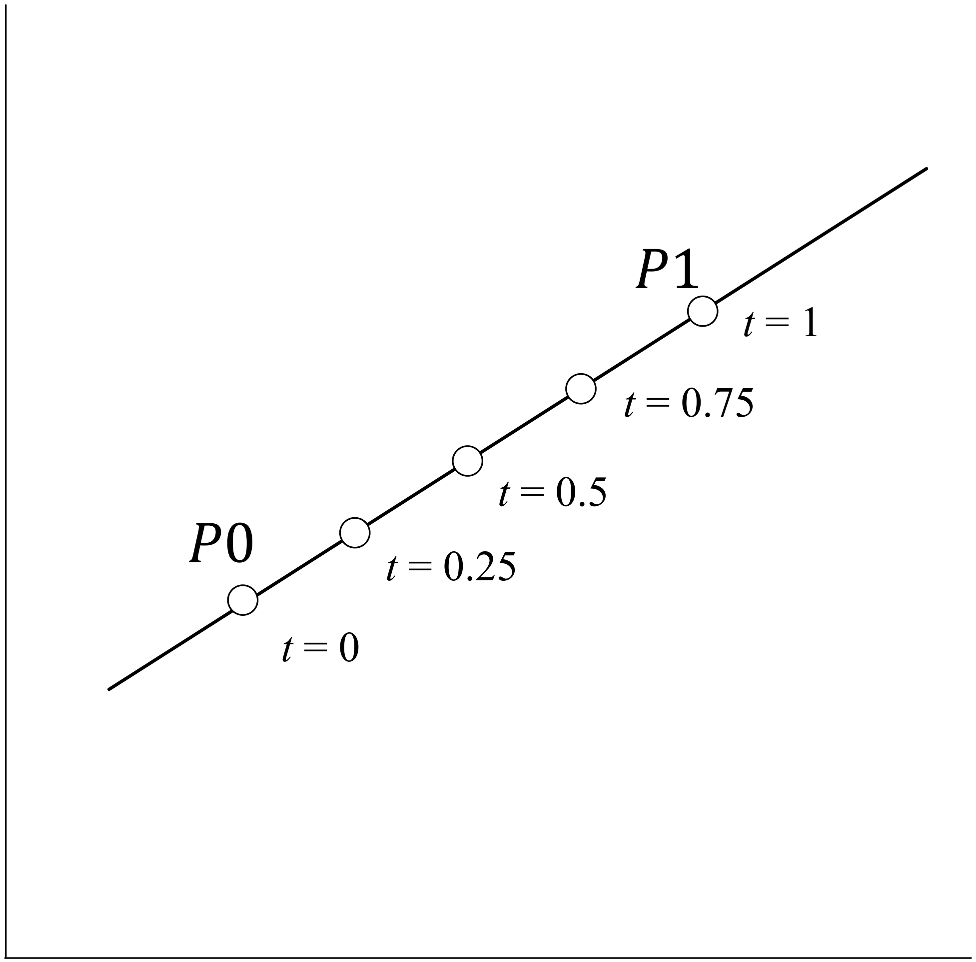


$$x = t \times \mathbf{0} + p0x$$
$$y = t\,dy + p0y$$

$$x = t\,dx + p0x$$
$$y = t\,dy + p0y$$

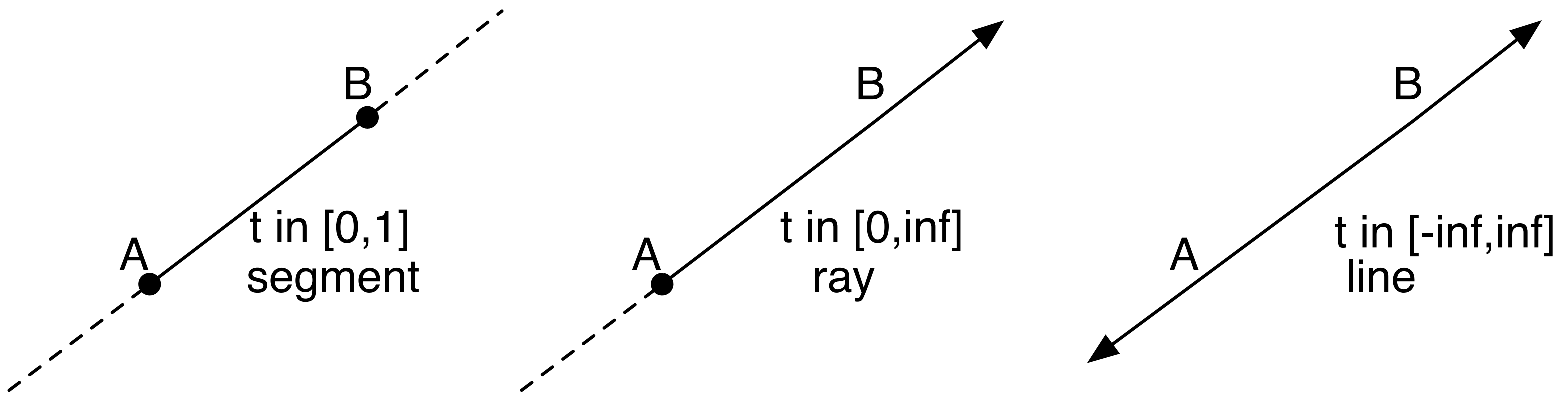
$$x = t\,dx + p0x$$
$$y = t \times \mathbf{0} + p0y$$

Using t for proportional placement (midpoint, etc)

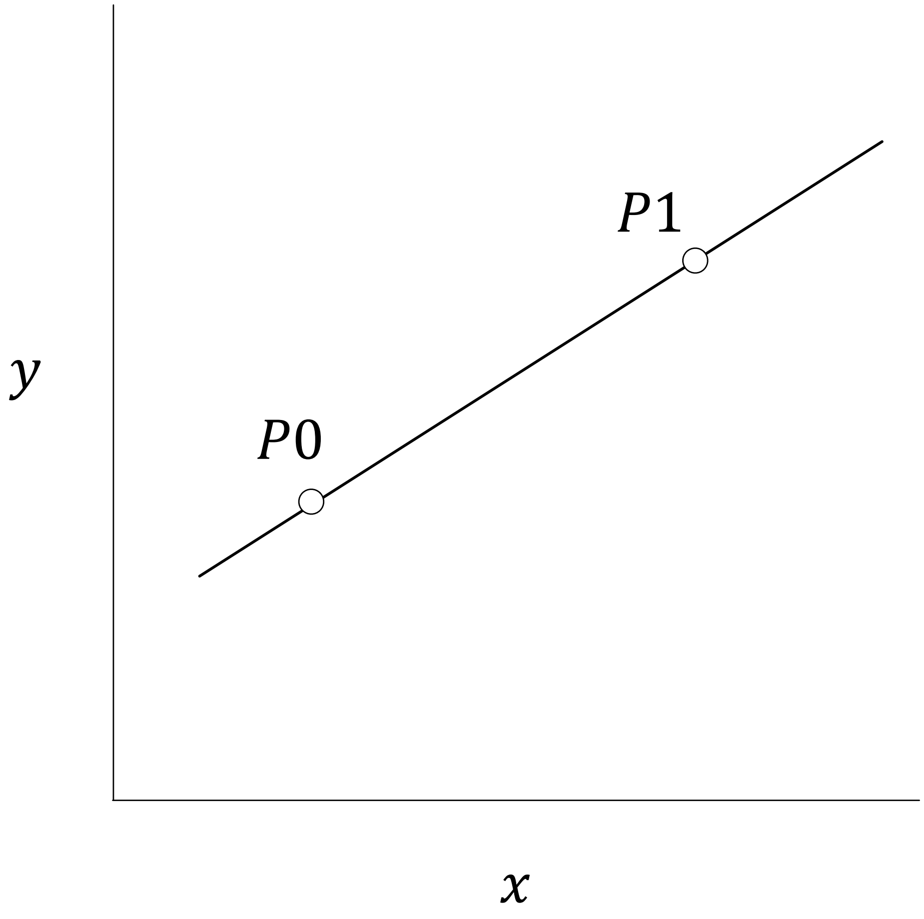


$$x = t\ dx + p0x$$
$$y = t\ dy + p0y$$

Varying the range of t: line, line segment and ray



Must t be linear?



$$x = t^2\,dx + p0x$$

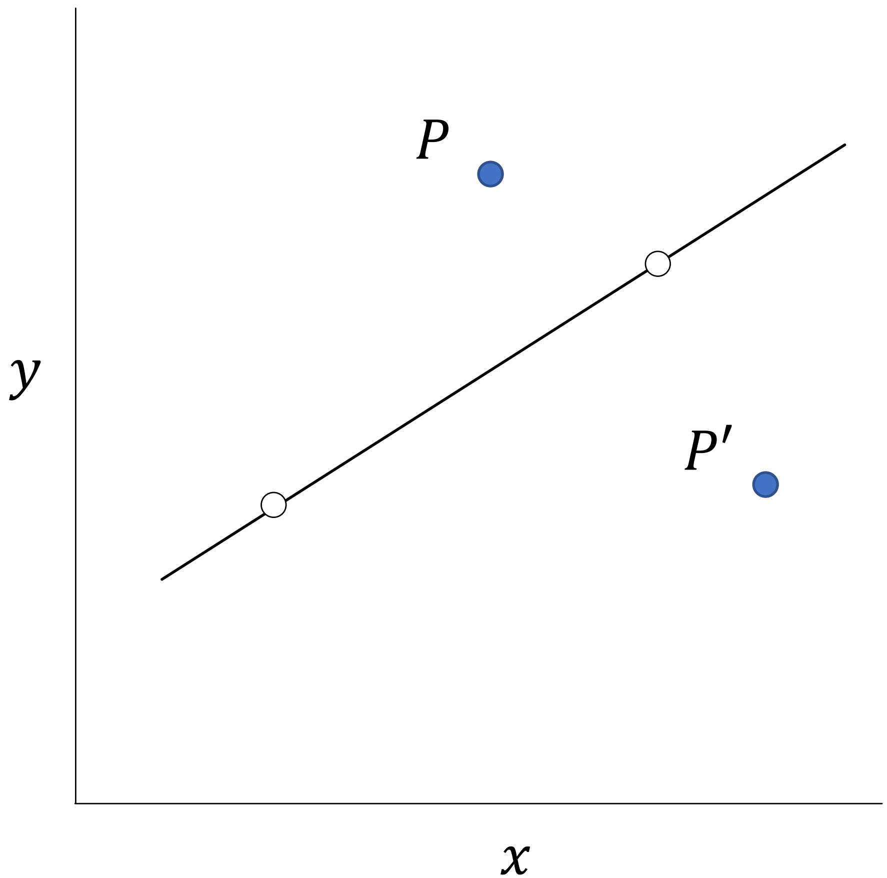
$$y = t^2\,dy + p0y$$

$$0 \leq t \leq 1$$

or

$$t \in [0,1]$$

Any use to y=mx+b?

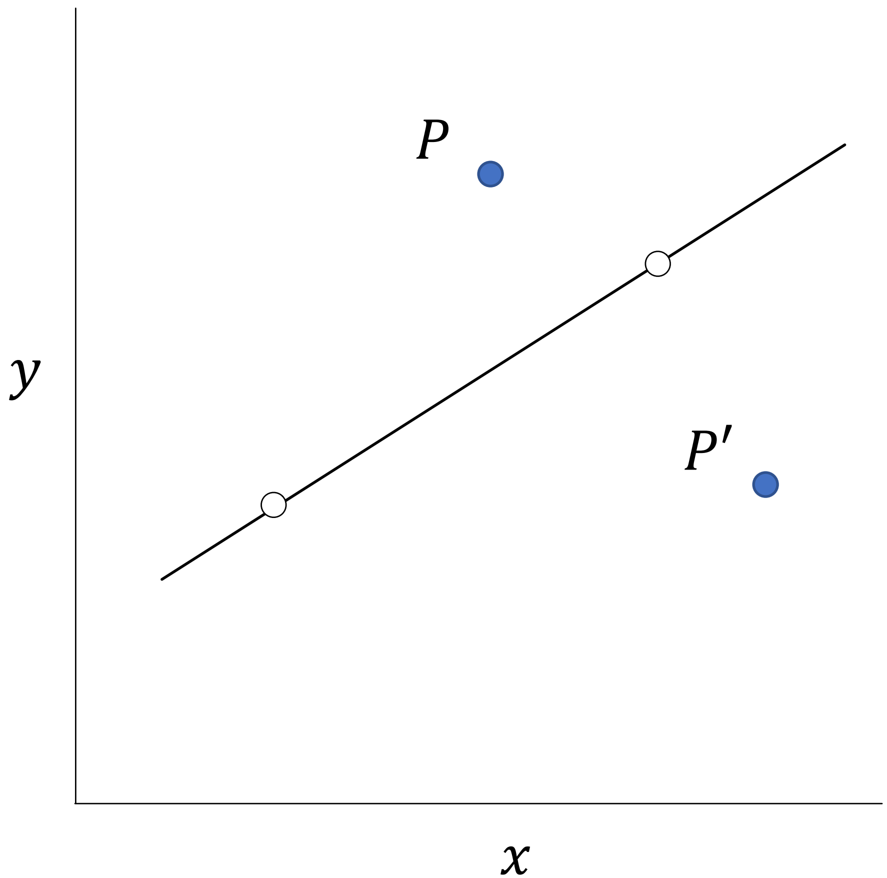


Functional line equation

$$y = mx + b$$

Are P and P' above or below the line?

Any use to mx+b?



Functional line equation

$$y = mx + b$$

Are P and P’ above or below the line?

$y > mx + b$ above

$y < mx + b$ below

What you should know

1. Why functional equations are problematic
2. How to draw a with parametric equation
3. How to use ranges of t for segments, rays and lines
4. Using implicit and functional equations for shape inside/outside tests