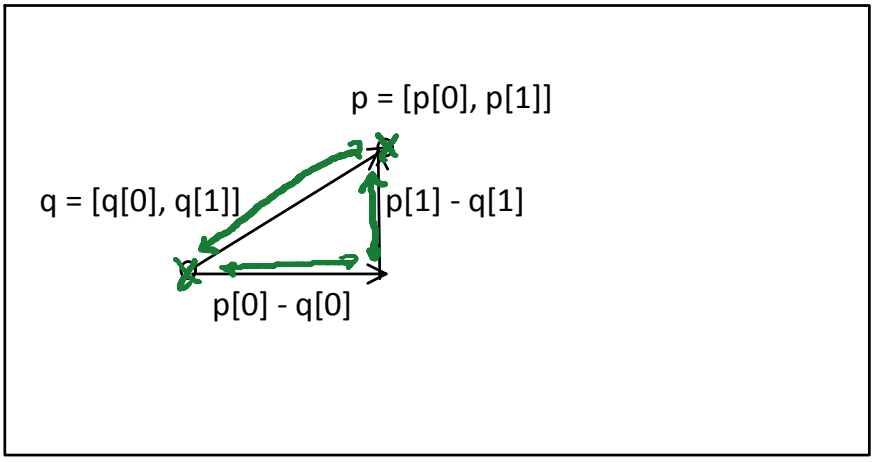
Point/point distance

Two points

Math - points on canvas
p, q

Python - list of coordinates
[p[0], p[1]], [q[0], q[1]]



Pythagorean theorem

Math

$dist(p, q)^2 == (p[0] - q[0])^2 + (p[1] - q[1])^2$

Python

```
def dist(p, q):
    return math.sqrt((p[0] - q[0]) ** 2 + (p[1] - q[1]) ** 2)
```

Vectors and motion

Vector as difference of two points

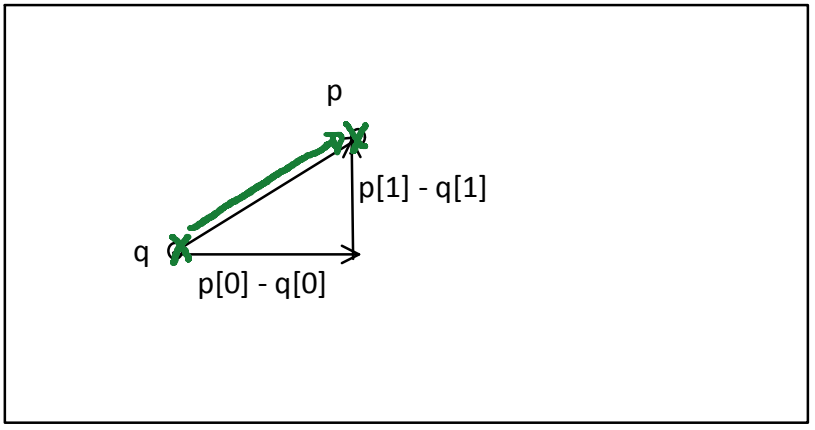
Math

v = p - q

Python - list of components

v[0] = p[0] - q[0]

v[1] = p[1] - q[1]



Move/translate point using a vector

Math

p = q + v

Python

p[0] = q[0] + v[0]

p[1] = q[1] + v[1]

Update for motion

Math - point at position p with velocity v

p = p + a * v

Python

p[0] = p[0] + a * v[0]

p[1] = p[1] + a * v[1]

Collisions

Motion update

p[0] = p[0] + a * v[0]
p[1] = p[1] + a * v[1]

Collision of point p with wall

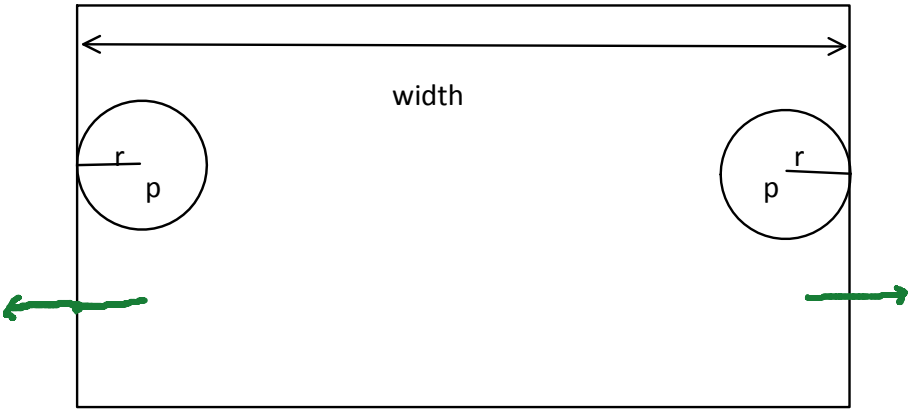
Left wall
p[0] <= 0

Right wall
p[0] >= width

Collision of ball of with center p and radius r with wall

Left wall
p[0] <= r

Right wall
p[0] >= width - r



Reflections

Motion update

p[0] = p[0] + a * v[0]
p[1] = p[1] + a * v[1]

Reflections - update the velocity vector v

Left wall
Compute reflected velocity vector
v[0] = -v[0]
v[1] = v[1]