FORCES

IN PROGRAMMING

Force is also vector.

so, object

(x, y)

more exactly

(x, y, z)

FORCE

IN PHYSICS

“Don’t underestimate the Force.”

Darth Vader

“A force is a vector that causes an object with mass to accelerate.”

Isaac Newton’s laws of motion

“A force is a vector that causes an object with mass to accelerate.”

Isaac Newton’s laws of motion

“Force equals mass times acceleration.”

Newton’s Second Law

$$\overrightarrow{\text{Force}} = \text{Mass} \times \overrightarrow{\text{Acceleration}}$$

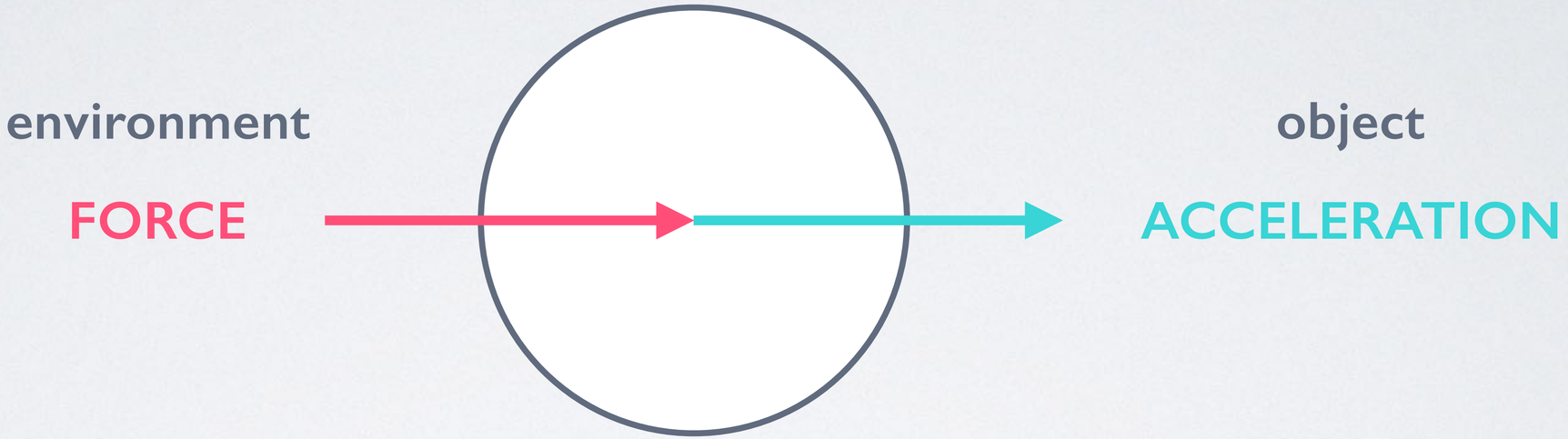
$$\vec{F} = \vec{A} \times M$$

$$\vec{A} = \vec{F} / M$$

$$\vec{A} = \vec{F} / M$$

What if we assume that all of our objects have a mass equal to *1*.

$$\overrightarrow{\text{Acc}} = \overrightarrow{\text{Force}}$$


environment
FORCE
object
ACCELERATION


ACC
VEL
POS


FORCE
ACC
VEL
POS

Weight vs. Mass? and Density?

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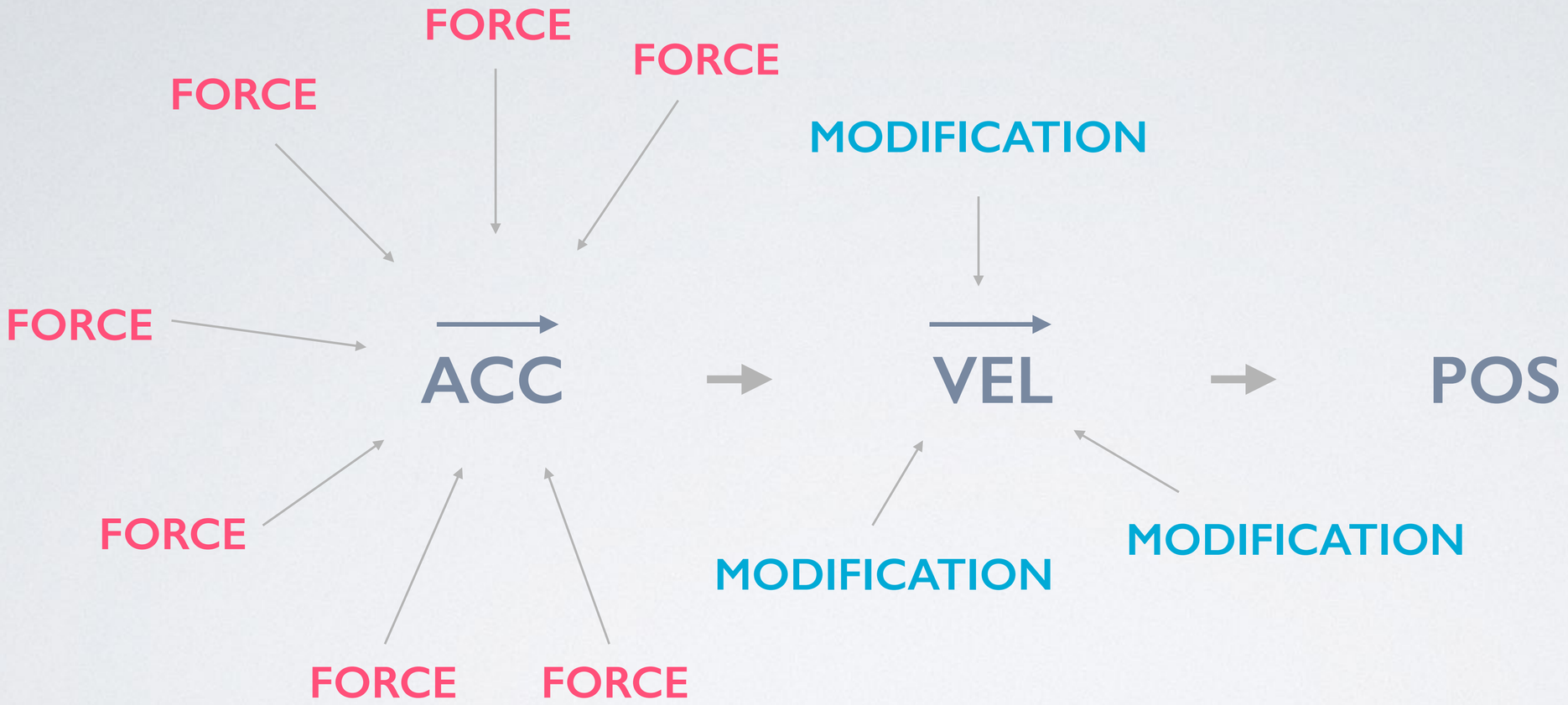
FORCE
FORCE
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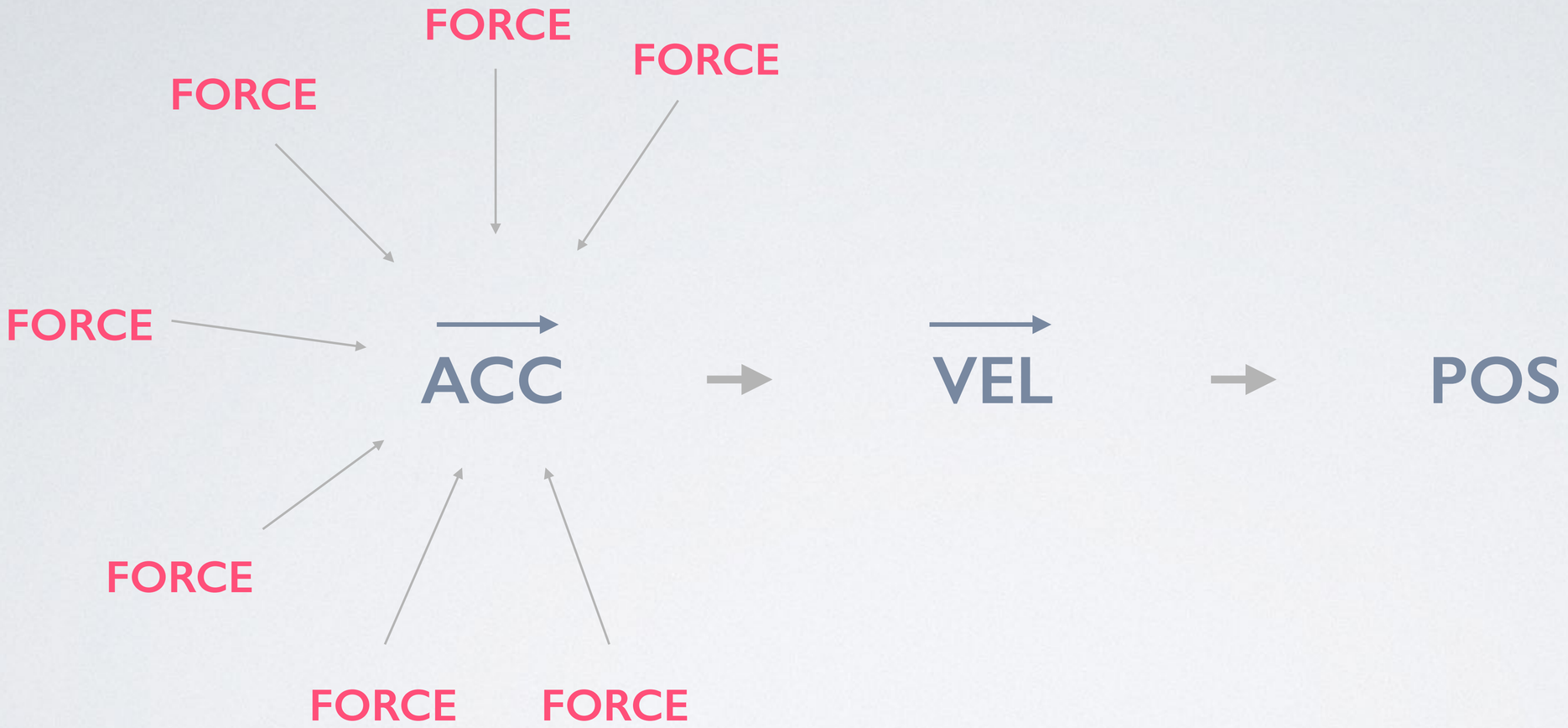
MODIFICATION
MODIFICATION
MODIFICATION
ACC
VEL
POS

FORCE ACCUMULATION

VECTOR ADDITION


FORCE
FORCE
FORCE
FORCE
FORCE
FORCE
FORCE
ACC
VEL
POS

```
acc.add(force);
```

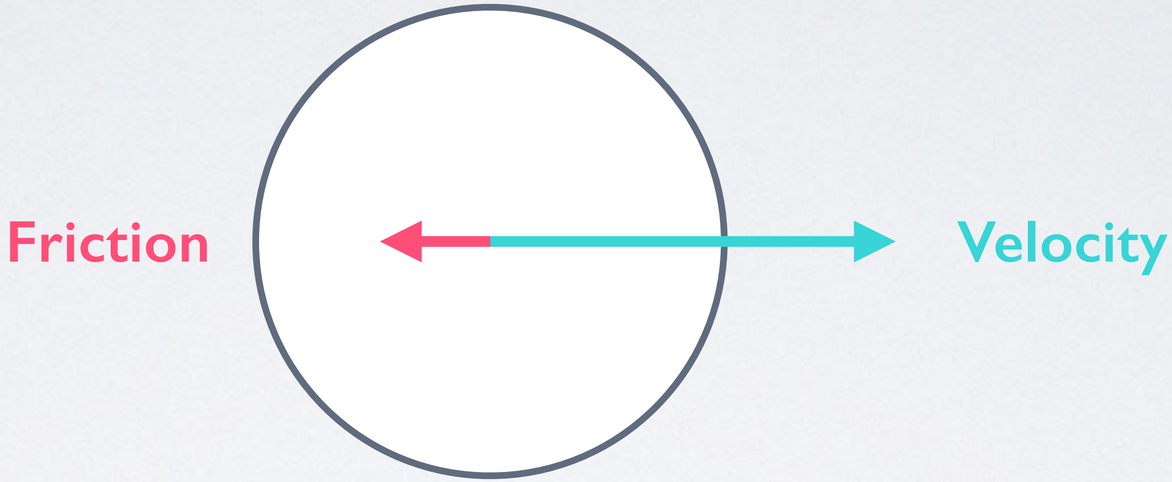
```
acc.add(gravity);
acc.add(wind);
acc.add(friction);
```

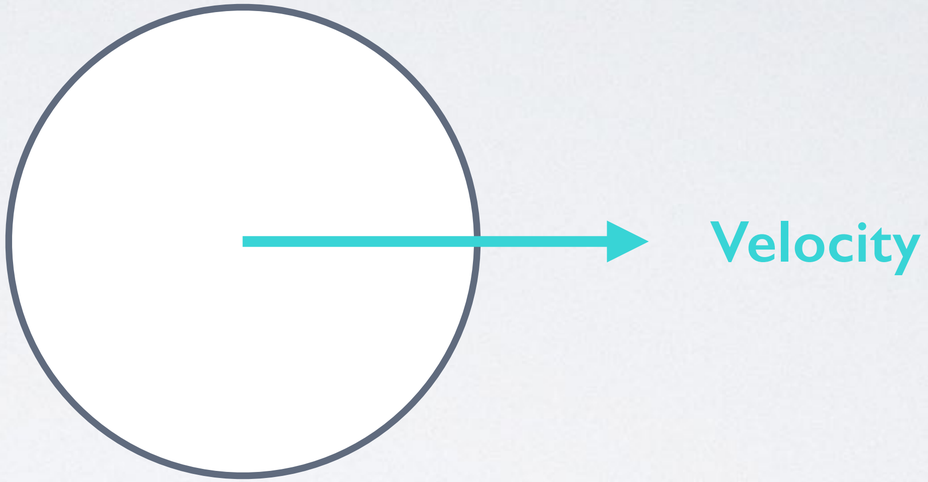
and then!

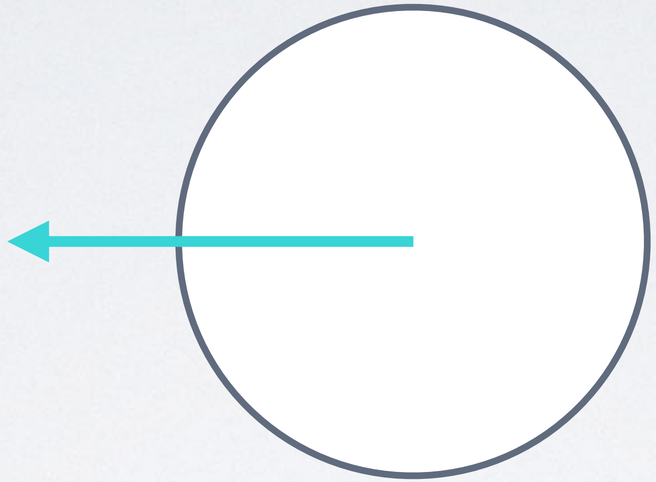
```
vel.add(acc);
acc.mult(0);
```

GRAVITY

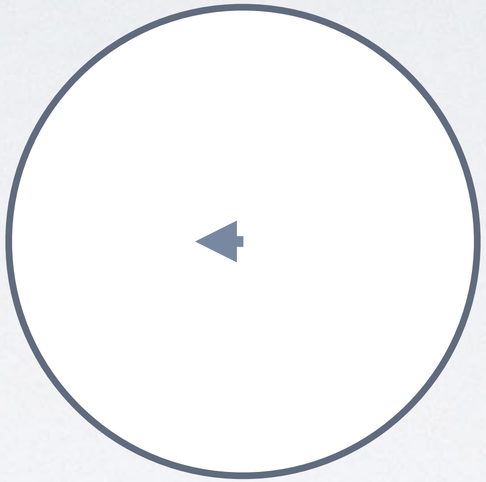
FRICTION


Friction
Velocity


Velocity

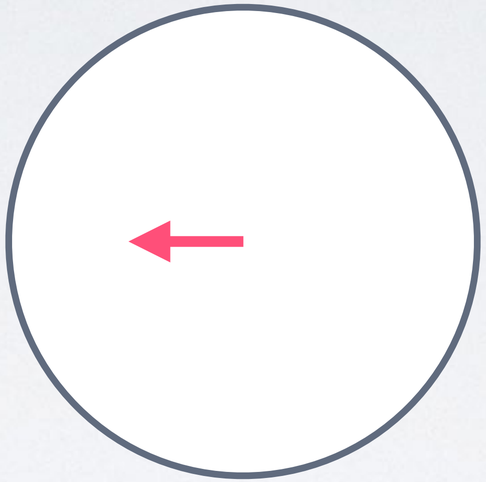


Flip the velocity!



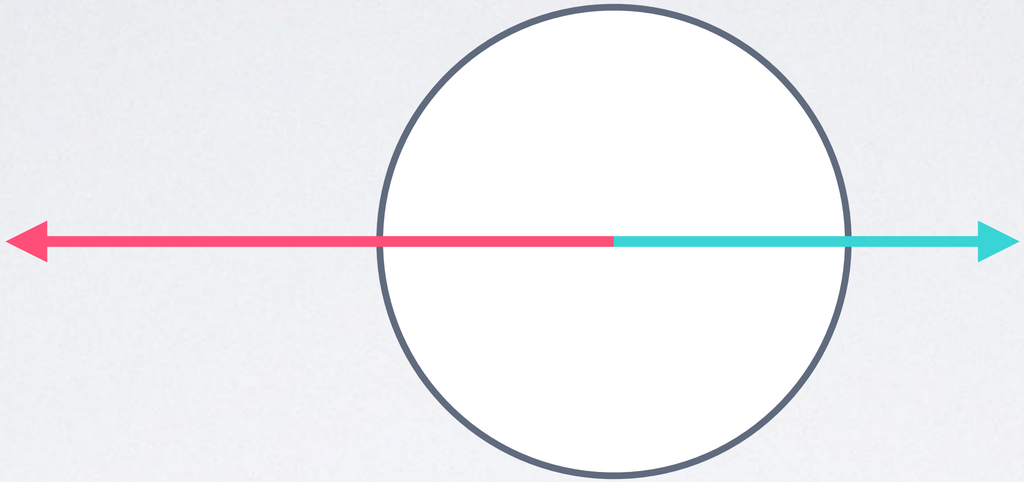
Make the magnitude 1

`f.normalize()`



Apply friction magnitude!

```
f.mult(3)
```



What if the friction is greater than the velocity?

```
f.mult(20)
```