

# Moving

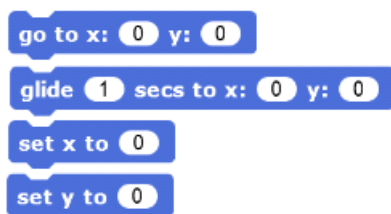
Wednesday, October 5, 2016 10:09 AM

There are lots of ways to move in SNAP. When you work on the platform game, your character needs to move left, right, and jump. Those movements must be combined so you can jump right or jump left.

Let's review two common ways of moving.

## Absolute position

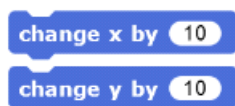
Some motion blocks tell the sprite exactly where to go



If you're using the **glide** or **go to** block, remember that you're telling the sprite a *specific* and *final* destination. This destination can be a number like 120 (what we call a *constant* because it doesn't change) or an *expression* which might include some math.

## Relative position

Some motion blocks tell the sprite how much to *change* instead of *where to go*.



In programming, there are often many ways to solve a problem. Sometimes we choose one approach because it's faster to write; sometimes another approach is simpler. For example, do the following scripts do the same thing? Which one is easier to understand? Why?



Questions to ask when programming your platform game:

1. When I press left arrow or right arrow, do I know the exact position of where the sprite is going?
2. When two different scripts move the sprite at the same time, what happens? (For example, **space** to jump and **left arrow** to move left)

## Gravity

Gravity is important for making your game feel realistic. Think about what happens in real life: gravity *accelerates* an object toward Earth.<sup>1</sup> When you jump off the ground, you eventually slow down and start falling back down. If there were no gravity, you'd keep flying off into the universe. You can simulate this by using different values when you change your position. Instead of just one "change x by 10" block you might combine several of these to make different movements. Try it and see what happens to your

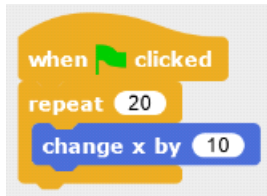
sprite.

## Advanced topic: easing functions

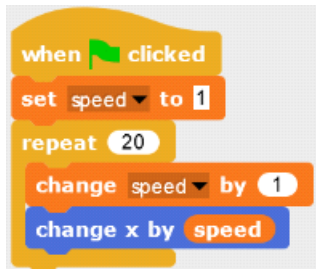
**NOTE: Don't read until you have finished your game or you're bored!**

For those students who already have experience with SNAP and need an extra challenge, you can try animating sprites in your world using *easing functions*. Right now you probably move your sprites using what we call *linear easing* because the sprite doesn't *accelerate* or *decelerate*<sup>2</sup>, it's either moving at a constant speed, or not moving. If you implemented gravity in your platform game, you've already made an easing function, you just didn't know it!

Suppose we want to move our sprite faster and faster. How can we do this? We know there's the **change x** block:



But this always changes by the same amount. The *rate of change*<sup>3</sup> is 10 steps per loop *iteration*. We call this linear movement. We can go *nonlinear* which means the *rate of change* is actually changing. To do this, we have to change the rate every time our loop runs.



What happens when you run this script? By how much does the sprite move the first time? Can you make it so the sprite speeds up and then slows down?

If you're comfortable with equations, you can even use an *easing function* to determine how fast you're going (the *speed* variable above).

A *quadratic* easing function uses a quadratic equation (not the quadratic formula!!) to change the speed as a function of time. Just like you wrote functions like  $y = x^2$  in algebra class, we can write a function like:

$$speed = 10 - \frac{1}{10} time^2$$

[Play with this formula online.](#) When time is 0, what is *speed*? When (*time*) does *speed* become 5? Overall, what is happening to speed over time? Is it slowing down (getting smaller) or speeding up (getting larger)? How would you change the formula to make the opposite effect?

Finally, try making your sprite move by using the easing function in a loop. Hint: you want to **change x** by the *value* of the easing function, not **change speed** by that value.

There are other easing functions like sine waves, sawtooth, etc. You can even see some special effects like [backing](#), [bouncing](#), [elasticity](#), etc.

Footnotes for science geeks:

<sup>1</sup> actually gravity accelerates objects toward each other, but the planets and sun are SO BIG that they are basically the only things that cause enough attractive force.  $F=ma$ ,  $F = Gm_1m_2/r^2$

<sup>2</sup> deceleration is just negative acceleration. In physics, what does a velocity mean?

<sup>3</sup> the rate of change is called the *derivative* in math & physics speak. Change in  $x$  is written  $dx$  or  $\dot{x}$