LinaJS Tutorial

Table of Content

Overview

LinaJS implements classes for 2-dimensional points, vectors, matrices and polygons.

You will find a detailed documentation of the LinaJS API at
http://docs.arcade-js.googlecode.com/hg/lina.js/jsdoc/index.html.

It comes as part of ArcadeJS, an Open Source project hosted at

http://arcade-js.googlecode.com/

Constructors and arguments

Contructors (and some other methods) accept different argument types.

For example:

```
// Default constructor
var m1 = new Matrix3(); // Identity matrix
// Single values for x and y
var pt1 = new Point2(3, 4);
// Data objects
var pt2 = new Point2({x: 3, y: 4});
// Copy constuctor
var pt3 = new Point2(pt1);
```

In-place operations, chainining, and transformed copies

Most transformation methods work 'in-place', thus modifying the object itself:

```
pt1.translate(1, 2);
```

Most methods also return the object instance, so transformations can be 'chained':

```
pt1.translate(1, 2).rotate(Math.PI).scale(1.5);
```

If we want a new translated instance instead of modifying the original one, we must create a copy before:

```
var pt2 = pt1.copy().translate(1, 2);
```

Note pitfall:

Since modifications are in-place by default, the following example will **not** work as expected:

```
var pt1 = new Point2(0, 0);
var pt2 = pt1.translate(1, 2);  // <<-- WARNING pt1 is translated too
```

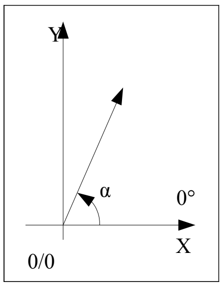
Use .copy() instead:

```
var pt2 = pt1.copy().translate(1, 2);
```

Here is another example, that defines two matrices:

```
// Define transformation matrices
var wc2cc = new Matrix3()
   .translate(-vpa.x, -vpa.y)
   .scale(ccWidth/vpa.width, -ccHeight/vpa.height)
   .translate(0, ccHeight);
var cc2wc = wc2cc.copy().invert();
```

Angles



Angles are specified in radians, starting at the positive x-axis (i.e. 0° is at three o'clock).

To rotate left by 90° we can do

```
pt1.rotate(0.5 * Math.PI);
```

or use the a conversion factor to convert from degree to radians

```
pt1.rotate(90 * LinaJS.D2R);
```

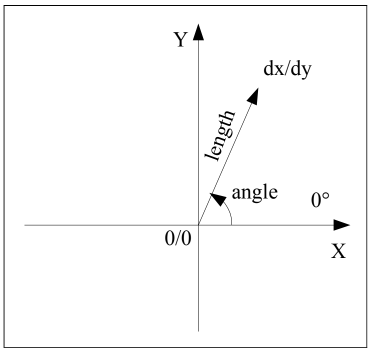
Points and vectors

Unlike some other libraries, LinaJS makes a difference between points and vectors:

	Point	**Vector**
Class	Point2	Vec2
Meaning	Represents a location.	Represents an offset (direction and distance).
Notation	(x, y)	(dx/dy)
Homogenous representation	$[x \quad y \quad 1]$	$[dx \quad dy \quad 0]$
Add - Operation	Adding a vector to a point yields a translated point. Two points cannot be added.	Adding two vectors yields another vector. A point cannot be added to a vector.

Rotation about arbitrary pivot	Moves the point to a different location and may change the distance to the center (0, 0).	Changes the direction, but not the length.

A 2-dimensional vector is implemented by the Vec2 class.



Here is an example, that adds two vectors, and creates a moved point from (1,1) by offset (2/3):

```
// Define transformation matrices
var ptOrg = new Point2(1, 1);
var ofs1 = new Vec2(2, 0);
var ofs2 = ofs1.copy().add(0, 3);
ptOrg.translate(ofs2);
```

Details on Point2 class:

http://docs.arcade-js.googlecode.com/hg/lina.js/jsdoc/symbols/Point2.html

Details on Vec2 class:

http://docs.arcade-js.googlecode.com/hg/lina.js/jsdoc/symbols/Vec2.html

Matrices

Matrices are used to store and accumulate transformations (R: rotation, T: translation, S: scale, ...).

They are especially efficient, when multiple transformations should be applied to a large number of objects. For example when transfoming polygons from world coordinates to viewport coordinates.

```
// Define transformation matrices
var wc2cc = new Matrix3()
   .translate(-vpa.x, -vpa.y)
   .scale(ccWidth/vpa.width, -ccHeight/vpa.height)
   .translate(0, ccHeight);
// Transform points
for(var i=0; i<points.length; i++) {
   points[i].transform(wc2cc);
}
```

The Matrix3 class represent 2d homogenous transformation matrices:

$$\begin{bmatrix} R & R & 0 \\ R & R & 0 \\ Tx & Ty & 1 \end{bmatrix}$$

Internally stored as a float array with 9 elements:

$$\begin{bmatrix} m_0 & m_1 & m_2 & m_3 & m_4 & m_5 & m_6 & m_7 & m_8 \end{bmatrix}$$

interpreted as

$$\begin{bmatrix} m_0 & m_1 & m_2 \\ m_3 & m_4 & m_5 \\ m_6 & m_7 & m_8 \end{bmatrix}$$

Details:

http://docs.arcade-js.googlecode.com/hg/lina.js/jsdoc/symbols/Matrix3.html

Polygons

The internal format is a flat array of float values.

The ArcadeJS framework add an 'augmented canvas', that adds methods to the standard canvas object. For example:

Details:

http://docs.arcade-js.googlecode.com/hg/lina.js/jsdoc/symbols/Polygon2.html

Firther information

The LinaJS API is documented at

http://docs.arcade-js.googlecode.com/hg/lina.js/jsdoc/symbols/LinaJS.html