EASING & SPLINES

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CITM 2019/2020

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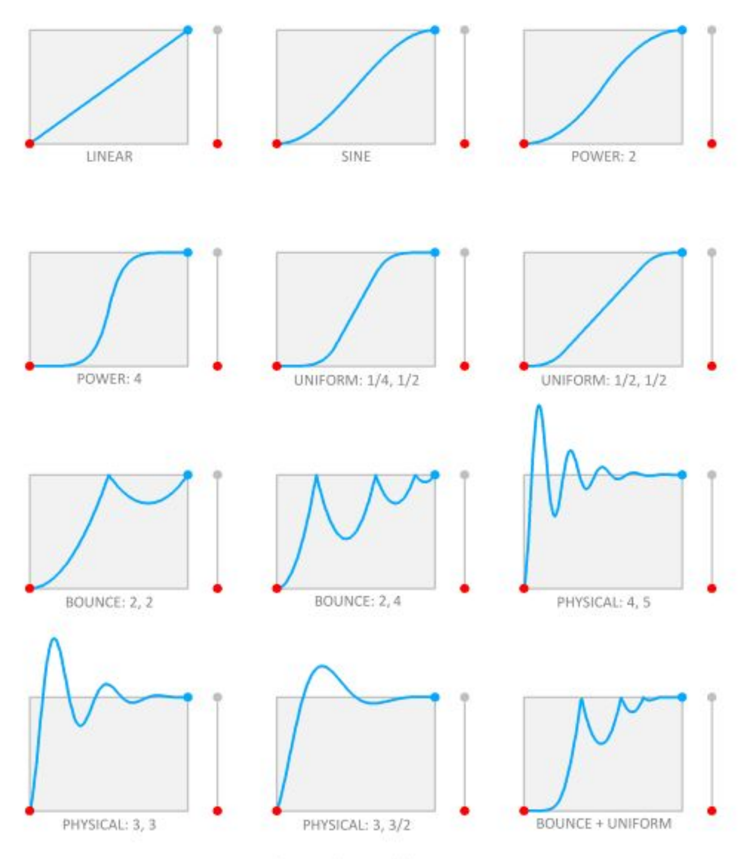
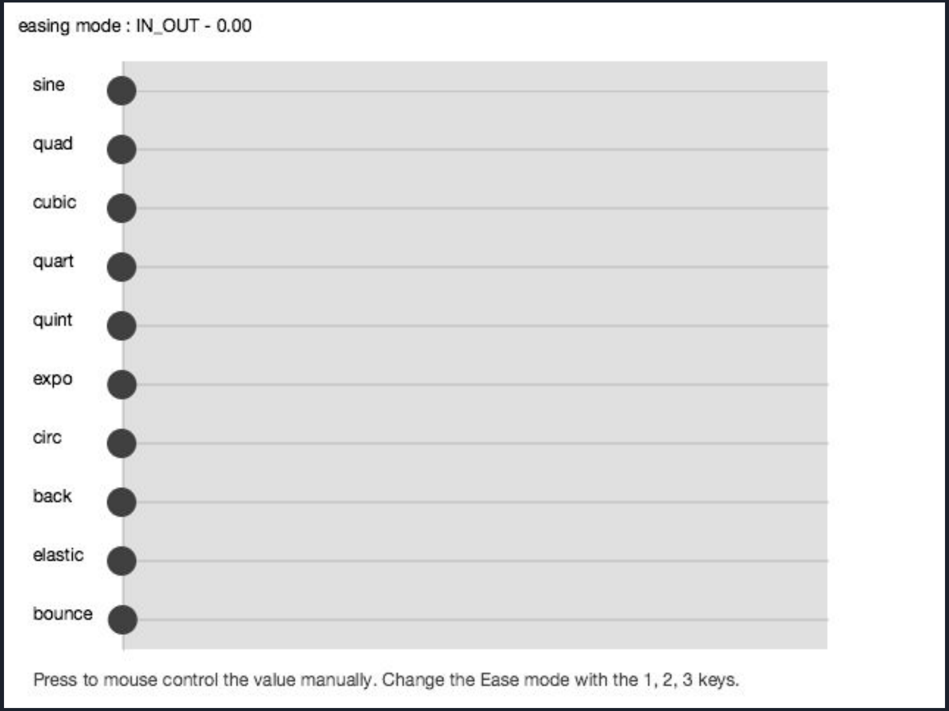


1ucasvb.tumblr.com

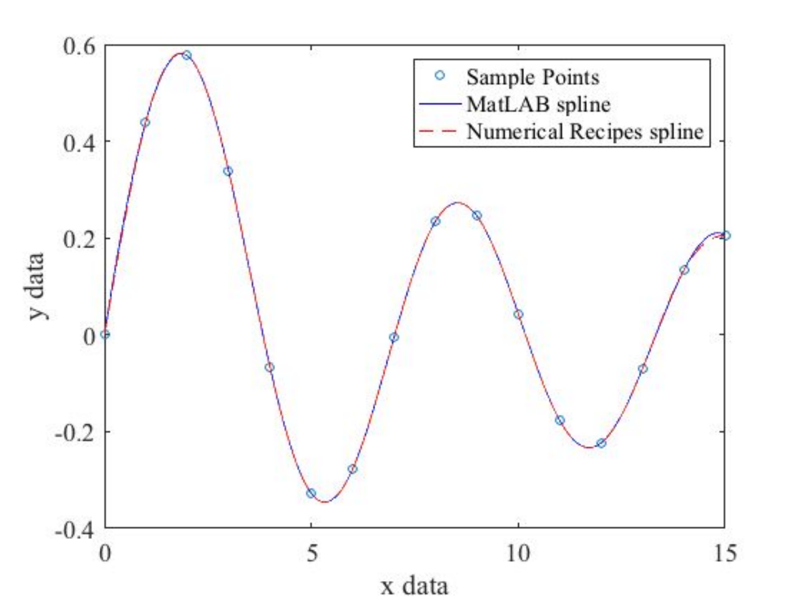
1. What is it and Why is it important?

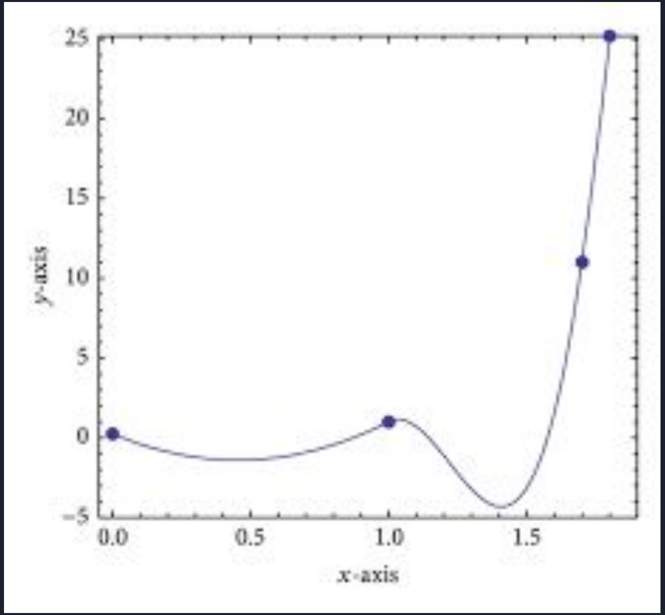


easing mode : IN_OUT - 0.00

Press to mouse control the value manually. Change the Ease mode with the 1, 2, 3 keys.

2. What is a Spline?





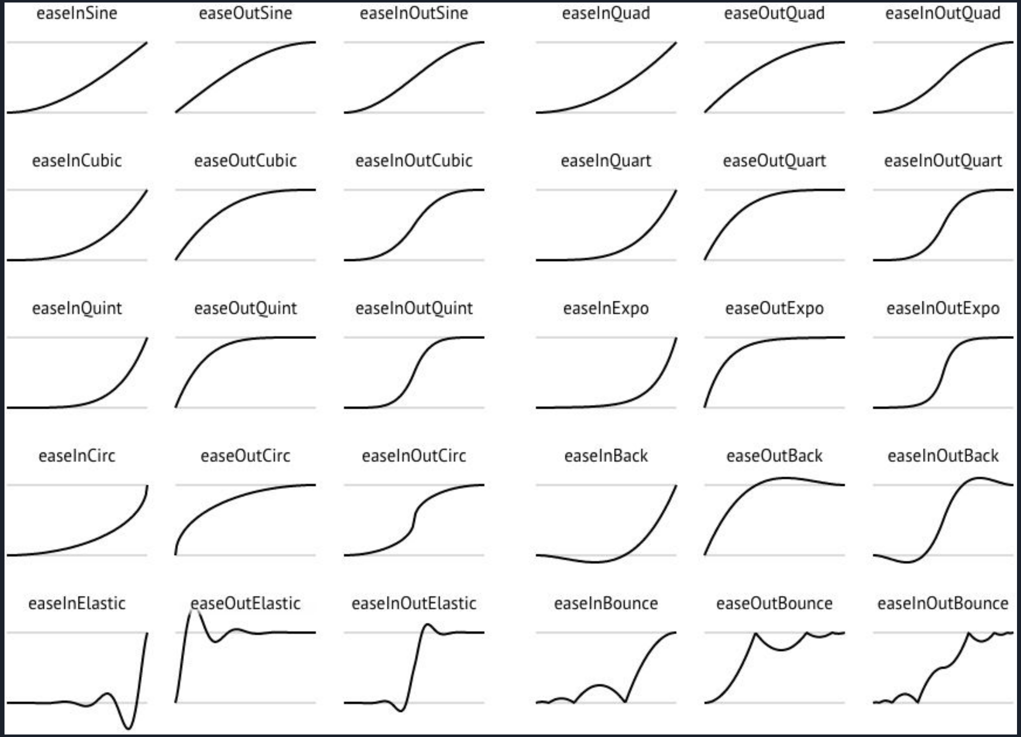
3. Spline Usability

CharacterPath Game Preview Standalone (64-bit/PCD3D_SM5)
File
Digite aqui para pesquisar
Character...
Character...
Sem títul...
14:45
16/05/2017

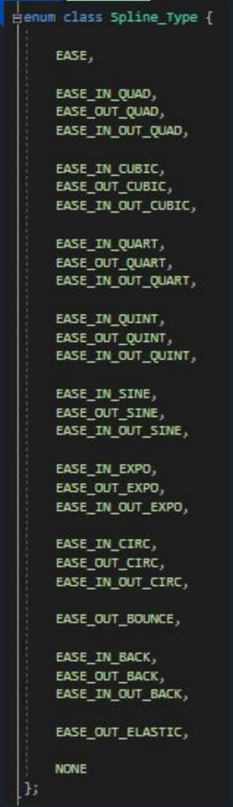
4. Easing Functions

- Initial Value
- Final Value
- Duration
- Total Elapsed Time

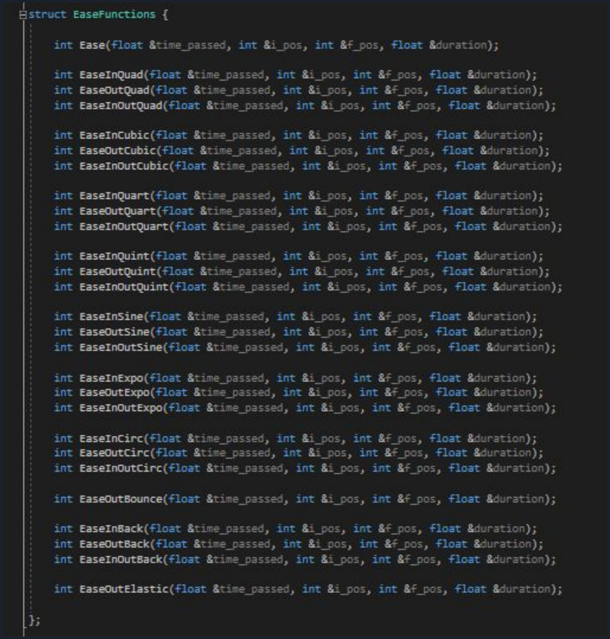
5. Splines Types



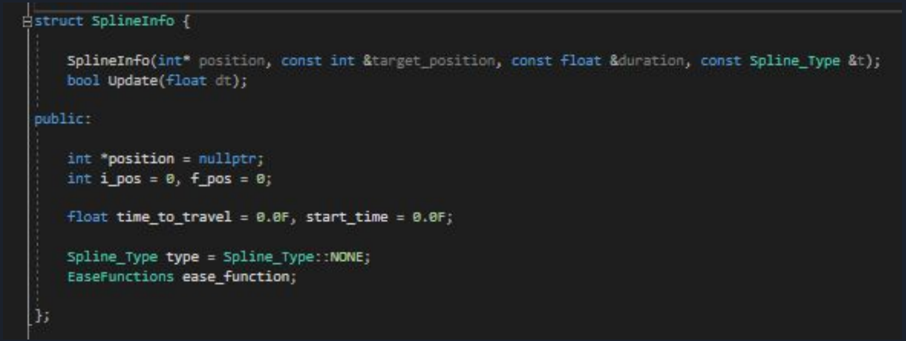
6. Introduction to the code



```
enum class Spline_Type {

    EASE,

    EASE_IN_QUAD,
    EASE_OUT_QUAD,
    EASE_IN_OUT_QUAD,

    EASE_IN_CUBIC,
    EASE_OUT_CUBIC,
    EASE_IN_OUT_CUBIC,

    EASE_IN_QUART,
    EASE_OUT_QUART,
    EASE_IN_OUT_QUART,

    EASE_IN_QUINT,
    EASE_OUT_QUINT,
    EASE_IN_OUT_QUINT,

    EASE_IN_SINE,
    EASE_OUT_SINE,
    EASE_IN_OUT_SINE,

    EASE_IN_EXPO,
    EASE_OUT_EXPO,
    EASE_IN_OUT_EXPO,

    EASE_IN_CIRC,
    EASE_OUT_CIRC,
    EASE_IN_OUT_CIRC,

    EASE_OUT_BOUNCE,

    EASE_IN_BACK,
    EASE_OUT_BACK,
    EASE_IN_OUT_BACK,

    EASE_OUT_ELASTIC,

    NONE
};
```



```
struct EaseFunctions {

    int Ease(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseInQuad(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseOutQuad(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseInOutQuad(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseInCubic(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseOutCubic(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseInOutCubic(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseInQuart(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseOutQuart(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseInOutQuart(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseInQuint(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseOutQuint(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseInOutQuint(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseInSine(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseOutSine(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseInOutSine(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseInExpo(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseOutExpo(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseInOutExpo(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseInCirc(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseOutCirc(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseInOutCirc(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseOutBounce(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseInBack(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseOutBack(float &time_passed, int &i_pos, int &f_pos, float &duration);
    int EaseInOutBack(float &time_passed, int &i_pos, int &f_pos, float &duration);

    int EaseOutElastic(float &time_passed, int &i_pos, int &f_pos, float &duration);

};
```



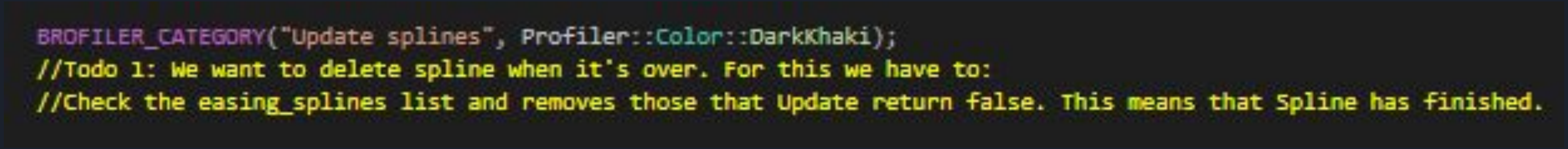
```
struct SplineInfo {

    SplineInfo(int* position, const int &target_position, const float &duration, const Spline_Type &t);
    bool Update(float dt);

public:

    int *position = nullptr;
    int i_pos = 0, f_pos = 0;

    float time_to_travel = 0.0F, start_time = 0.0F;

    Spline_Type type = Spline_Type::NONE;
    EaseFunctions ease_function;

};
```

7. Todo’s

TODO 1

We want to delete spline when it's over. For this we have to:

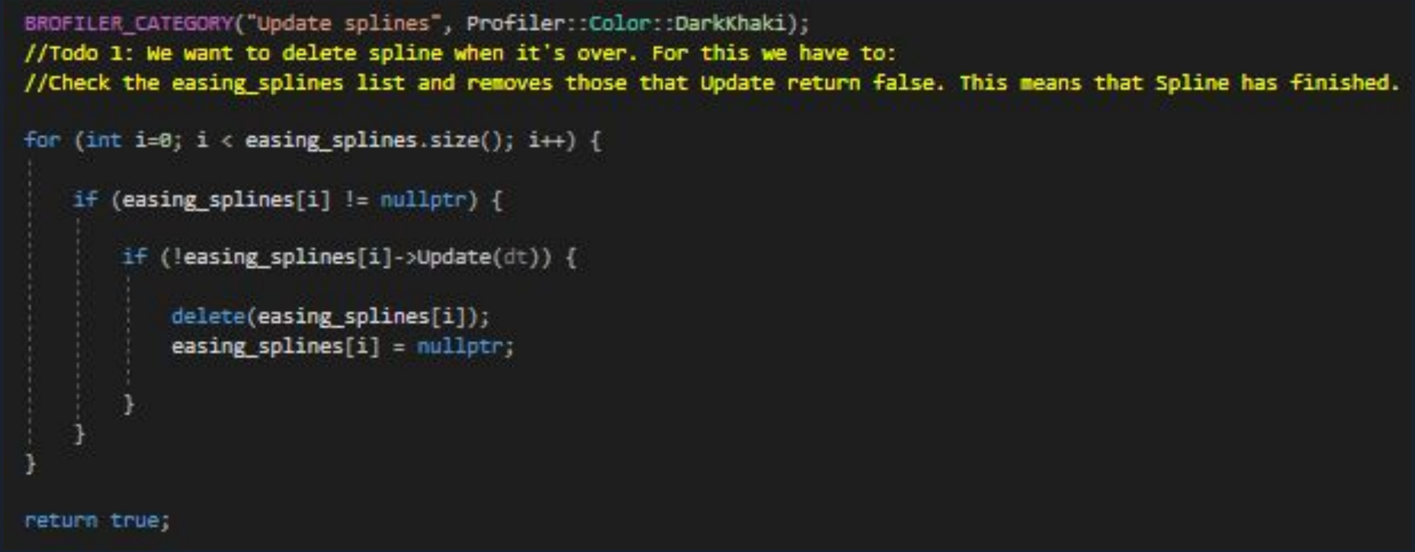
Check the easing_splines list and removes those that Update return false. This means that Spline has finished.



```
BROFILER_CATEGORY("Update splines", Profiler::Color::DarkKhaki);
//Todo 1: We want to delete spline when it's over. For this we have to:
//Check the easing_splines list and removes those that Update return false. This means that Spline has finished.
```

7. Todo’s

TODO 1: Solution

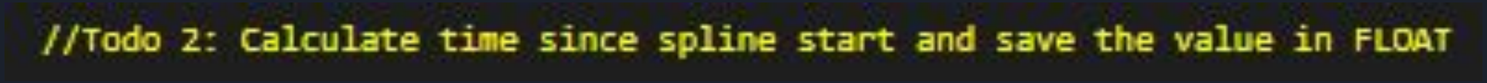


```
BROFILER_CATEGORY("Update splines", Profiler::Color::DarkKhaki);
//Todo 1: We want to delete spline when it's over. For this we have to:
//Check the easing_splines list and removes those that Update return false. This means that Spline has finished.

for (int i=0; i < easing_splines.size(); i++) {

    if (easing_splines[i] != nullptr) {

        if (!easing_splines[i]->Update(dt)) {

            delete(easing_splines[i]);
            easing_splines[i] = nullptr;

        }
    }
}

return true;
```

7. Todo’s

TODO 2

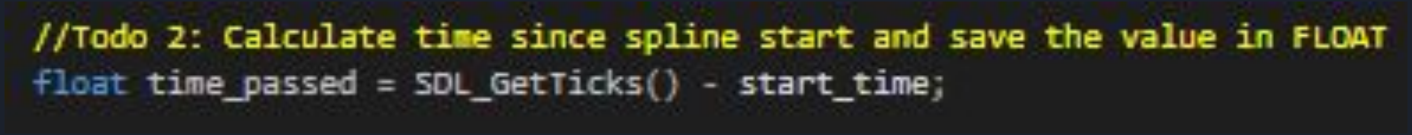
Calculate time since spline start and save the value in FLOAT



```
//Todo 2: Calculate time since spline start and save the value in FLOAT
```

7. Todo’s

TODO 2: Solution

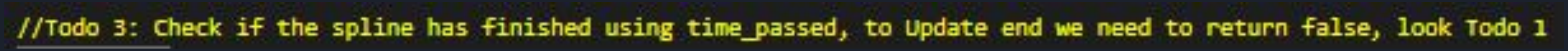


```
//Todo 2: Calculate time since spline start and save the value in FLOAT
float time_passed = SDL_GetTicks() - start_time;
```

7. Todo’s

TODO 3

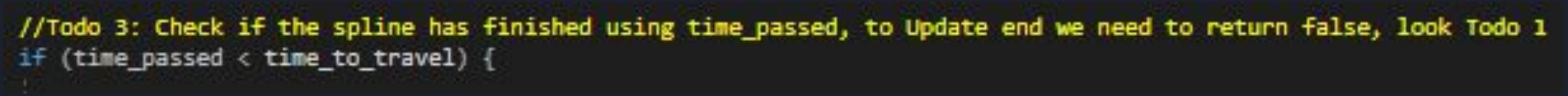
Check if the spline has finished using time_passed, to Update end we need to return false, look Todo 1



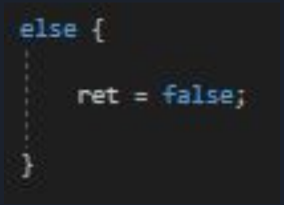
```
//Todo 3: Check if the spline has finished using time_passed, to Update end we need to return false, look Todo 1
```

7. Todo’s

TODO 3: Solution



```
//Todo 3: Check if the spline has finished using time_passed, to Update end we need to return false, look Todo 1
if (time_passed < time_to_travel) {
```

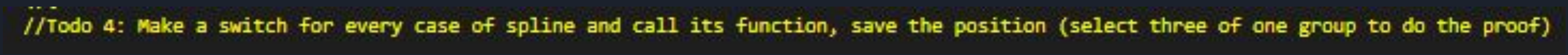


```
else {

    ret = false;

}
```

7. Todo’s

TODO 4

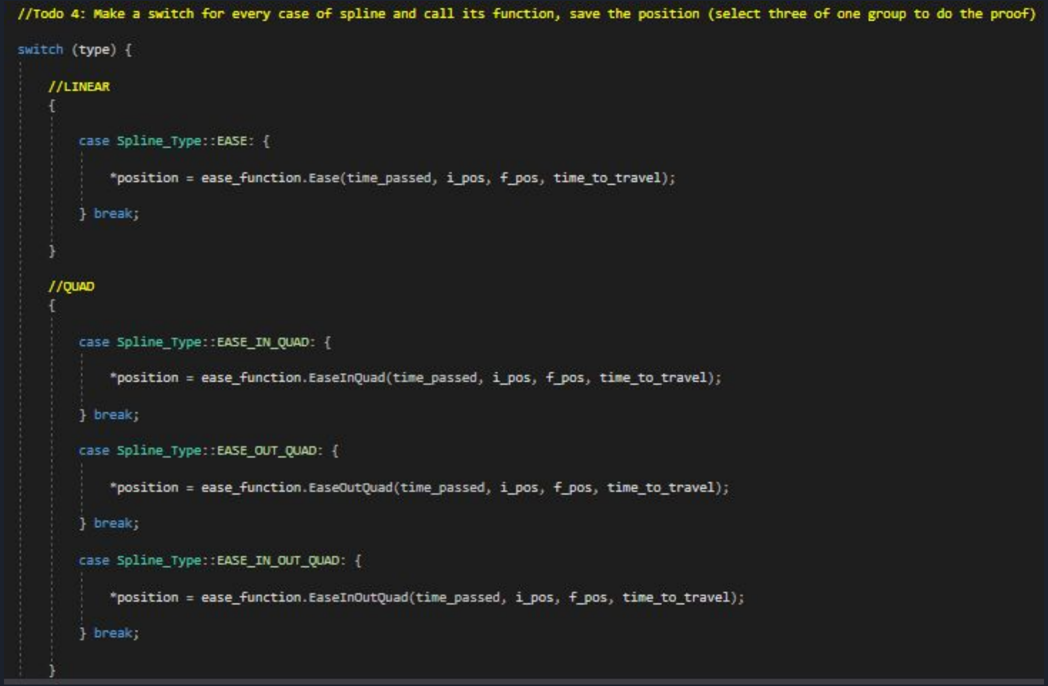
Make a switch for every case of spline and call its function, save the position (select three of one group to do the proof)



```
//Todo 4: Make a switch for every case of spline and call its function, save the position (select three of one group to do the proof)
```

7. Todo’s

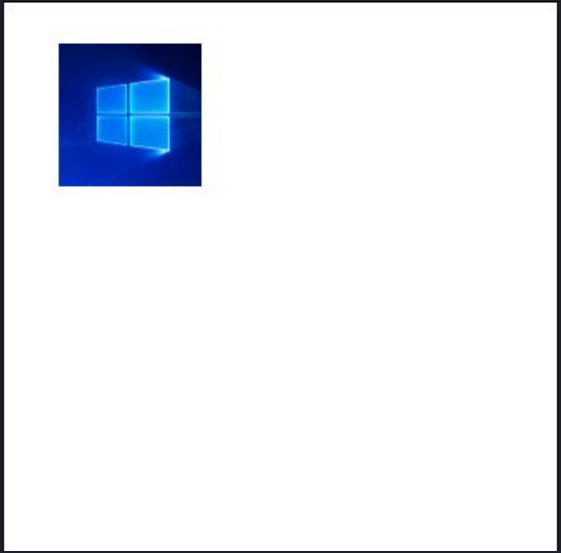
TODO 4: Solution



```
//Todo 4: Make a switch for every case of spline and call its function, save the position (select three of one group to do the proof)

switch (type) {

    //LINEAR
    {

        case Spline_Type::EASE: {

            *position = ease_function.Ease(time_passed, i_pos, f_pos, time_to_travel);

        } break;

    }

    //QUAD
    {

        case Spline_Type::EASE_IN_QUAD: {

            *position = ease_function.EaseInQuad(time_passed, i_pos, f_pos, time_to_travel);

        } break;

        case Spline_Type::EASE_OUT_QUAD: {

            *position = ease_function.EaseOutQuad(time_passed, i_pos, f_pos, time_to_travel);

        } break;

        case Spline_Type::EASE_IN_OUT_QUAD: {

            *position = ease_function.EaseInOutQuad(time_passed, i_pos, f_pos, time_to_travel);

        } break;

    }
```

8. Homework

1. Adapt code to can work with X axis and Y axis simultaneously
2. Adapt code to can work with the scale



9. References

Easing https://github.com/Michaelangel007/easing/

Visual Easing Equations by Robert Penner http://www.gizma.com/easing/#quint1

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Animating with Robert Penner's Easing Functions https://www.kirupa.com/html5/animating_with_easing_functions_in_javascript.htm

AHEasing Warrenm https://github.com/warrenm/AHEasing