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7 月 17 日（金）第 12 回数値解析 I 提出課題 19TM054 浅野 駿介

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課題 12-1

<作成プログラム>

```
#include<stdio.h>
```

```
#include<math.h>
```

```
#define G 9.8066;//重力加速度
```

```
//x についての関数
```

```
double syahoux(double x,double vx,double vy) {
```

```
    double p = 1.184, S = 0.00418, C = 0.4,result,M=0.14;
```

```
    result = (-vx / sqrt(vx * vx + vy * vy) * 1 / 2 * p * (vx * vx + vy * vy) * S * C) / M;
```

```
    return(result);
```

```
}
```

```
//y についての関数
```

```
double syahouy( double y, double vx, double vy) {
```

```
    double p = 1.184, S = 0.00418, C = 0.4, result, M = 0.14;
```

```
    result = (-vy / sqrt(vx * vx + vy * vy) * 1 / 2 * p * (vx * vx + vy * vy) * S * C) / M-
```

```
G;
```

```
    return(result);
```

```
}
```

```
double ball(double x_0, double vx_0, double ax_0, double y_0, double vy_0, double ay_0,
```

```
double t_0, double h) {
```

```
    //各値の宣言
```

```
    double x = x_0, vx = vx_0, ax = ax_0;
```

```
    double y = y_0, vy = vy_0, ay = ay_0;
```

```
    double t = t_0, x_new, vx_new, ax_new, y_new, vy_new, ay_new, t_new;
```

```

double vxm=0, vym=0, axm=0, aym=0;

while (y >= 0) {//地面に落ちるまでループを続ける
    if ((int)(t / h) % 5 == 0)//5 回ごとに位置を出力
        printf("%lf      %lf      %lf¥n", t, x,y);

    //シグマの項を計算する
    vxm = vxm + vx;
    vym = vym + vy;
    axm = axm + ax;
    aym = aym + ay;

    t_new = t + h;
    ax_new = syahoux(x, vx, vy);
    ay_new = syahouy(y, vx, vy);
    vx_new = vx_0 + axm * h;
    vy_new = vy_0 + aym * h;
    x_new = x_0 + vxm * h;
    y_new = y_0 + vym * h;

    //値を入れ替える
    t = t_new;
    x = x_new;
    y = y_new;
    vx = vx_new;
    vy = vy_new;
    ax = ax_new;
    ay = ay_new;
}
return(0);
}

void main() {
    //vx_0 と vy_0 は初速に  $\cos 45^\circ$  と  $\sin 45^\circ$  をかけた数値
    double h = 0.01, x_0 = 0.0, vx_0 = 28.284, ax_0 = 0.0, y_0 = 0.0, vy_0 = 28.284,
    ay_0 = -9.8066, t_0 = 0.0;

```

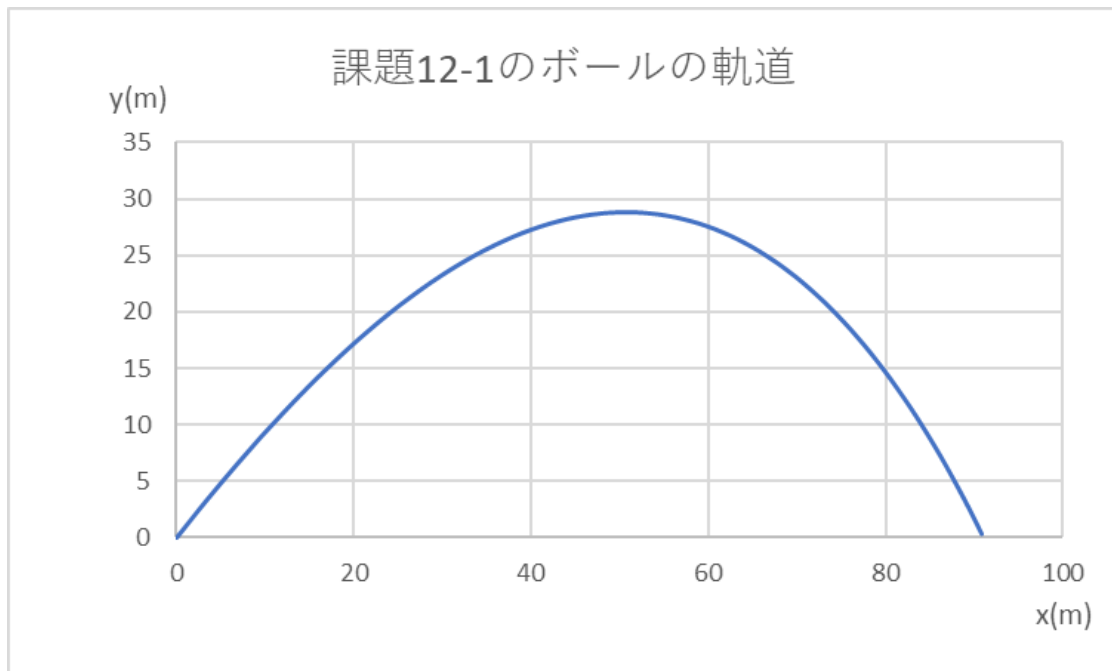
```
ball(x_0, vx_0, ax_0, y_0, vy_0, ay_0, t_0, h);  
}
```

<出力結果>

0.000000	0.000000	0.000000
0.050000	1.409411	1.399615
0.110000	3.075784	3.022174
0.150000	4.171567	4.069576
0.200000	5.524879	5.341119
0.250000	6.860548	6.571631
0.300000	8.179185	7.761998
0.350000	9.481372	8.913059
0.400000	10.767666	10.025614
0.450000	12.038596	11.100421
0.500000	13.294668	12.138203
0.550000	14.536363	13.139645
0.600000	15.764144	14.105403
0.650000	16.978450	15.036098
0.700000	18.179702	15.932324
0.750000	19.368304	16.794646
0.800000	20.544640	17.623603
0.850000	21.709079	18.419708
0.900000	22.861973	19.183452
0.950000	24.003661	19.915302
1.000000	25.134464	20.615705
1.050000	26.254693	21.285087
1.100000	27.364644	21.923855
1.150000	28.464600	22.532399
1.200000	29.554833	23.111089
1.250000	30.635602	23.660281
1.300000	31.707155	24.180316
1.350000	32.769731	24.671517
1.400000	33.823556	25.134197
1.450000	34.868848	25.568653
1.500000	35.905815	25.975171
1.550000	36.934654	26.354024

1.600000	37.955554	26.705475
1.650000	38.968696	27.029776
1.700000	39.974251	27.327167
1.750000	40.972383	27.597883
1.800000	41.963246	27.842146
1.850000	42.946988	28.060172
1.900000	43.923749	28.252168
1.950000	44.893661	28.418336
2.000000	45.856848	28.558870
2.050000	46.813430	28.673956
2.110000	47.952764	28.778726
2.160000	48.895193	28.838463
2.210000	49.831349	28.873318
2.260000	50.761322	28.883458
2.310000	51.685196	28.869048
2.360000	52.603049	28.830247
2.410000	53.514954	28.767213
2.460000	54.420978	28.680100
2.510000	55.321183	28.569061
2.560000	56.215626	28.434248
2.610000	57.104359	28.275811
2.660000	57.987427	28.093898
2.710000	58.864875	27.888658
2.760000	59.736739	27.660238
2.810000	60.603053	27.408788
2.860000	61.463847	27.134454
2.910000	62.319148	26.837386
2.960000	63.168977	26.517733
3.010000	64.013354	26.175646
3.060000	64.852296	25.811277
3.110000	65.685814	25.424778
3.160000	66.513919	25.016305
3.210000	67.336619	24.586014
3.260000	68.153920	24.134062
3.310000	68.965824	23.660611
3.360000	69.772334	23.165822

3.410000	70.573447	22.649860
3.460000	71.369162	22.112891
3.510000	72.159477	21.555084
3.560000	72.944384	20.976611
3.610000	73.723880	20.377644
3.660000	74.497956	19.758359
3.710000	75.266605	19.118933
3.760000	76.029818	18.459548
3.810000	76.787588	17.780386
3.860000	77.539903	17.081630
3.910000	78.286756	16.363468
3.960000	79.028135	15.626089
4.010000	79.764031	14.869684
4.060000	80.494435	14.094444
4.110000	81.219336	13.300565
4.160000	81.938725	12.488244
4.210000	82.652594	11.657678
4.260000	83.360934	10.809067
4.310000	84.063736	9.942612
4.360000	84.760993	9.058516
4.410000	85.452698	8.156982
4.460000	86.138845	7.238217
4.510000	86.819428	6.302425
4.560000	87.494442	5.349813
4.610000	88.163884	4.380591
4.660000	88.827749	3.394966
4.710000	89.486037	2.393147
4.760000	90.138745	1.375345
4.810000	90.785874	0.341770



## 課題 12-2

<作成プログラム>

```
#define _USE_MATH_DEFINES
```

```
#include<stdio.h>
```

```
#include<math.h>
```

```
#define G 9.8066;//重力加速度
```

```
//x についての関数
```

```
double syahoux(double x, double vx, double vy) {
```

```
    double p = 1.184, S = 0.166, C = 0.19, result, M = 1460;
```

```
    result = (-vx / sqrt(vx * vx + vy * vy) * 1 / 2 * p * (vx * vx + vy * vy) * S * C) / M;
```

```
    return(result);
```

```
}
```

//y についての関数

```
double syahouy(double y, double vx, double vy) {  
    double p = 1.184, S = 0.166, C = 0.19, result, M = 1460;  
  
    result = (-vy / sqrt(vx * vx + vy * vy) * 1 / 2 * p * (vx * vx + vy * vy) * S * C) / M -  
    G;  
  
    return(result);  
}
```

```
double ball(double x_0, double vx_0, double ax_0, double y_0, double vy_0, double ay_0,  
double t_0, double h) {
```

//各値の宣言

```
double x = x_0, vx = vx_0, ax = ax_0;
```

```
double y = y_0, vy = vy_0, ay = ay_0;
```

```
double t = t_0, x_new, vx_new, ax_new, y_new, vy_new, ay_new, t_new;
```

```
double vxm = 0, vym = 0, axm = 0, aym = 0;
```

```
while (y >= 0) { //地面に落ちるまでループを続ける
```

//シグマの項を計算する

```
vxm = vxm + vx;
```

```
vym = vym + vy;
```

```
axm = axm + ax;
```

```
aym = aym + ay;
```

```
t_new = t + h;
```

```
ax_new = syahoux(x, vx, vy);
```

```
ay_new = syahouy(y, vx, vy);
```

```
vx_new = vx_0 + axm * h;
```

```
vy_new = vy_0 + aym * h;
```

```
x_new = x_0 + vxm * h;
```

```
y_new = y_0 + vym * h;
```

//値を入れ替える

```
t = t_new;
```

```

        x = x_new;
        y = y_new;
        vx = vx_new;
        vy = vy_new;
        ax = ax_new;
        ay = ay_new;
    }
    return(x);
}

void main() {
    int i;
    double h = 0.1, x_0 = 0.0, vx_0, ax_0 = 0.0, y_0 = 0.0, vy_0, ay_0 = -9.8066, t_0
= 0.0, V=780, K, L=0;

    for(i=0; L<30050; i++){//30050m を超えるまでループ
        K = M_PI / 2 * i / 100;//K は仰角
        vx_0 = V * cos(K);//初速の x 方向成分
        vy_0 = V * sin(K);//初速の y 方向成分
        L = ball(x_0, vx_0, ax_0, y_0, vy_0, ay_0, t_0, h);
    }
    printf("とるべき仰角は%lf¥n", K);
}

```

<出力結果>

とるべき仰角は 0.361283

<理解した内容、感想、注意点など>

- ・課題 12-2 はどこでループさせるかが難しかった。
- ・どちらの課題も変数が多くて大変だった。整理すると分かりやすくなる。
- ・課題 12-2 の作成プログラムについては 12-1 のプログラムに少し改良を加えた。仰角が変数であるため x 方向と y 方向で初速を与えるのに三角関数を使った。