

1(1)

```
> restart;
t:=unapply((4+5*cos(x))/(5+4*cos(x)),x);
simplify(diff(t(x),x));
```

$$t := x \rightarrow \frac{4 + 5 \cos(x)}{5 + 4 \cos(x)}$$

$$-\frac{9 \sin(x)}{16 \cos(x)^2 + 40 \cos(x) + 25}$$

(1.1)

```
> simplify(diff(arccos(t(x)),x));
```

$$\frac{3 \sin(x)}{\sqrt{-\frac{\cos(x)^2 - 1}{(5 + 4 \cos(x))^2} (16 \cos(x)^2 + 40 \cos(x) + 25)}}$$

(1.2)

1(2)

```
> restart;
x:=t->3*t/(1+t^3);
y:=t->3*t^2/(1+t^3);
```

$$x := t \rightarrow \frac{3t}{1 + t^3}$$

$$y := t \rightarrow \frac{3t^2}{1 + t^3}$$

(2.1)

```
> dxdt:=diff(x(t),t);
dydt:=diff(y(t),t);
```

$$dxdt := \frac{3}{t^3 + 1} - \frac{9t^3}{(t^3 + 1)^2}$$

(2.2)

$$dydt := \frac{6t}{t^3 + 1} - \frac{9t^4}{(t^3 + 1)^2}$$

```
> simplify(dydt/dxdt);
```

$$\frac{t(t^3 - 2)}{2t^3 - 1}$$

(2.3)

2(1)

```
> restart;
eq1:=(1-2*cos(x))/(5-4*cos(x));
```

$$eq1 := \frac{1 - 2 \cos(x)}{5 - 4 \cos(x)}$$

(3.1)

```
> int(eq1,x);
```

$$-\arctan\left(3 \tan\left(\frac{1}{2}x\right)\right) + \frac{1}{2}x$$

(3.2)

2(2)

```
> restart;
eq2:=1/(x+y)^(3/2);
```

$$eq2 := \frac{1}{(x + y)^{3/2}}$$

(4.1)

```
> eq3:=int(int(eq2,x=1/n..1),y=1/n..1);
```

[Warning, unable to determine if -y is between 1/n and 1; try to use assumptions or use the AllSolutions option](#)

$$eq3 := -4\sqrt{2} \sqrt{\frac{1}{n}} + 8 \sqrt{\frac{n+1}{n}} - 4\sqrt{2}$$

(4.2)

```
> limit(eq3,n=infinity);
```

$$8 - 4\sqrt{2}$$

(4.3)

3(1)

```
> restart;
with(LinearAlgebra);
> A:=Matrix([[2,1,1],[1,2,1],[0,0,1]]);
```

$$A := \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

(5.1)

```
> I,P:=Eigenvectors(A);
```

$$I, P := \begin{bmatrix} 3 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 & -1 & -1 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

(5.2)

```
> MatrixInverse(P).A.P;
```

$$\begin{bmatrix} 3 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

(5.3)

3(2)

```
> restart;
with(LinearAlgebra);
> A:=Matrix([[0,c,b],[c,0,a],[b,a,0]]);
```

```

A := 
$$\begin{bmatrix} 0 & c & b \\ c & 0 & a \\ b & a & 0 \end{bmatrix}$$

> B:=Matrix([[1,-1,1],[1,-1,1],[1,1,-1]]);
B := 
$$\begin{bmatrix} -1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{bmatrix}$$

> A.B;

$$\begin{bmatrix} c+b & -c+b & c-b \\ -c+a & c+a & c-a \\ -b+a & b-a & b+a \end{bmatrix}$$

> Determinant(A.B);

$$8abc$$


```

(6.1)

(6.2)

(6.3)

(6.4)

4 (2014-I.A 追試no.2)

```

> restart;
f:=x->a*x^2+b*x+c;
f := 
$$x \rightarrow ax^2 + bx + c$$

> eqs:={f(-1)=4,f(2)=7};
#eqs:={f(-1)=4,f(2)=6.5};
eqs :=  $\{a - b + c = 4, 4a + 2b + c = 7\}$ 
> aa:=solve(eqs,{b,c});#ア-オ
aa :=  $\{b = -a + 1, c = -2a + 5\}$ 
> sort(subs(aa,f(x)),x);

$$ax^2 + (-a + 1)x - 2a + 5$$

> eq2:=diff(subs(aa,f(x)),x);
eq2 :=  $2ax - a + 1$ 
> pp:=solve(eq2=0,x);#カ, キ
pp :=  $\frac{1}{2} \frac{a-1}{a}$ 
> qq:=simplify(subs(aa,subs(x=pp,f(x))));#ク-ス
qq :=  $-\frac{1}{4} \frac{9a^2 - 22a + 1}{a}$ 
> -subs(a=2,pp);
-subs(a=2,qq);#セ-テ

$$-\frac{1}{4}$$


```

(7.1)

(7.2)

(7.3)

(7.4)

(7.5)

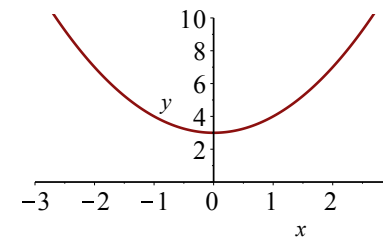
(7.6)

(7.7)

```

-7/8 (7.8)
> a0:=solve(pp=0,a);
a0 := 1 (7.9)
> plot(subs(a=a0,subs(aa,f(x))),x=-3..3,y=0..10);#ハ

```



```

> subs(a=a0,qq);#ト
3 (7.10)
> solve(qq=0,a);#ナ-ノ

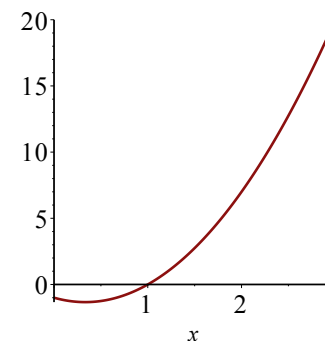
```

$\frac{11}{9} - \frac{4}{9}\sqrt{7}, \frac{11}{9} + \frac{4}{9}\sqrt{7}$ (7.11)

```

> a2:=solve(subs(x=1,subs(a=a1,subs(aa,f(x)))),a1);#ハ
a2 := 3 (7.12)
> plot(subs(a=a2,subs(aa,f(x))),x=0..3);#ハ

```



```

5
> restart;
f:=x->a*x^2+b*x+c;
f := 
$$x \rightarrow ax^2 + bx + c$$

> #eqs:={f(-1)=4,f(2)=7};
(8.1)

```

```
eqs:={f(-1)=4,f(2)=6.5};
      eqs := {a - b + c = 4, 4 a + 2 b + c = 6.5} (8.2)
```

```
> aa:=solve(eqs,{b,c});#ア-オ
      aa := {b = -1. a + 0.8333333333, c = -2. a + 4.8333333333} (8.3)
```

```
> sort(subs(aa,f(x)),x);
      a x2 + (-1. a + 0.8333333333) x - 2. a + 4.8333333333 (8.4)
```

```
> eq2:=diff(subs(aa,f(x)),x);
      eq2 := 2 a x - 1. a + 0.8333333333 (8.5)
```

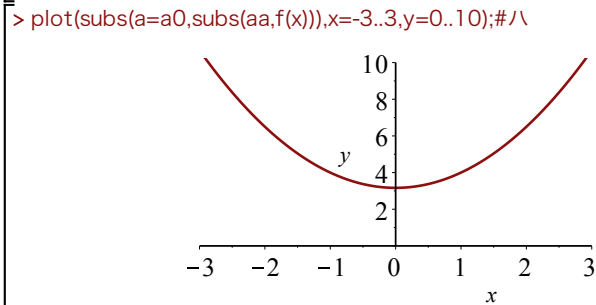
```
> pp:=solve(eq2=0,x);#カ, キ
      pp :=  $\frac{5.000000000 \cdot 10^{-11} (-8.333333333 \cdot 10^9 + 1.000000000 \cdot 10^{10} a)}{a}$  (8.6)
```

```
> expand(pp);
      -  $\frac{0.4166666666}{a}$  + 0.5000000000 (8.7)
```

```
> qq:=simplify(subs(aa,subs(x=pp,f(x))));#ク-ス
      qq :=  $\frac{-0.1736111111 + 5.25 a - 2.25 a^2}{a}$  (8.8)
```

```
> -subs(a=2,pp);
      -0.2916666668
      -subs(a=2,qq);#セ-テ
      -0.6631944450 (8.9)
```

```
> a0:=solve(pp=0,a);
      a0 := 0.8333333333 (8.10)
```



```
> subs(a=a0,qq);#ト
      3.166666667 (8.11)
```

```
> solve(qq=0,a);#ナ-ノ
      0.03355121920, 2.299782114 (8.12)
```

```
> a2:=solve(subs(x=1,subs(a=a1,subs(aa,f(x))),a1);#ハ
      a2 := 2.833333333 (8.13)
```

