1

a 大学院への数学p.105, 4.1-prob5(東大院)

```
> Int(1/(2+cos(t)),t=0..2*Pi);
```

$$\int_0^{2\pi} \frac{1}{2+\cos(t)}\,dt \tag{1.1.1}$$

```
> int(1/(2+cos(t)),t=0..2*Pi);
```

$$\frac{2}{3}\pi\sqrt{3} \tag{1.1.2}$$

b

```
> f1:=unapply(convert(series(sqrt(1+x),x,2),polynom),
  x);
  f2:=unapply(convert(series(sqrt(1+x),x,3),polynom),
  x);
```

$$f1 := x \to 1 + \frac{1}{2}x$$

$$f2 := x \to 1 + \frac{1}{2}x - \frac{1}{8}x^2 \tag{1.2.1}$$

```
> f1(0.1);
  f2(0.1);
```

$$1.050000000$$
$$1.048750000 \tag{1.2.2}$$

```
> f1(0.01);
  f2(0.01);
```

$$1.005000000$$
$$1.004987500 \tag{1.2.3}$$

2

a

テラダ本，線形代数p.74

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

$$A := \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \tag{2.1.1}$$

```
> A^2;
```

$$\begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix} \tag{2.1.2}$$

```
> A^3;
```

$$\begin{bmatrix} 1 & 0 & 0 \\ 2 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix} \tag{2.1.3}$$

```
> A^98;
```

$$\begin{bmatrix} 1 & 0 & 0 \\ 49 & 1 & 0 \\ 49 & 0 & 1 \end{bmatrix} \tag{2.1.4}$$

```
> A^99;
```

$$\begin{bmatrix} 1 & 0 & 0 \\ 50 & 0 & 1 \\ 49 & 1 & 0 \end{bmatrix} \tag{2.1.5}$$

```
> A^100;
```

$$\begin{bmatrix} 1 & 0 & 0 \\ 50 & 1 & 0 \\ 50 & 0 & 1 \end{bmatrix} \tag{2.1.6}$$

b

```
> A:=Matrix([[-1,3,0,2],[1,7,2,12],[2,-1,1,3]]);
  #A:=Matrix([[1,0,-1,-2],[-1,1,2,3],[2,1,-1,-3]]);
```

$$A := \begin{bmatrix} -1 & 3 & 0 & 2 \\ 1 & 7 & 2 & 12 \\ 2 & -1 & 1 & 3 \end{bmatrix} \tag{2.2.1}$$

```
> P,L,U:=LUDecomposition(A);
```

$$P, L, U := \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ -2 & \frac{1}{2} & 1 \end{bmatrix}, \begin{bmatrix} -1 & 3 & 0 & 2 \\ 0 & 10 & 2 & 14 \\ 0 & 0 & 0 & 0 \end{bmatrix} \tag{2.2.2}$$

```
> eq2:=GenerateEquations(U,[x,y,z,u]);
```

$$eq2 := [-x + 3y + 2u = 0, 10y + 2z + 14u = 0, 0 = 0] \tag{2.2.3}$$

```
> solve(eq2,[x,y,z,u]);
```

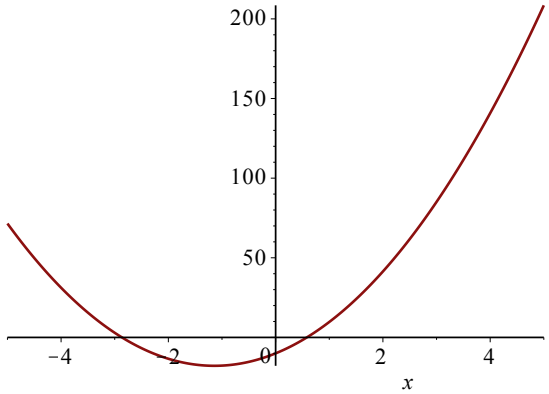
$$[[x = 3y + 2u, y = y, z = -5y - 7u, u = u]] \tag{2.2.4}$$

3.a

```
> y1:=x->6*x^2+13.7*x-10;
```

$$y1 := x \to 6\,x^2 + 13.7\,x - 10 \quad \textbf{(3.1)}$$

```
> plot(y1(x),x=-5..5);
```




```
> solve(y1(x)=0,x);
```

$$0.5817222751,\ -2.865055608 \quad \textbf{(3.2)}$$

```
> y2:=x->y1(x-a)+b;
```

$$y2 := x \to y1\,(x - a) + b \quad \textbf{(3.3)}$$

```
> s1:=solve(y2(0)=0,b);
```

$$s1 := 10. - 6.\,a^2 + 13.70000000\,a \quad \textbf{(3.4)}$$

```
> collect(subs(b=s1,y2(x)),x);
```

$$6\,x^2 + (-12.\,a + 13.7)\,x \quad \textbf{(3.5)}$$

3.b

```
> s2:=solve(y2(-2)=y2(3),a);
```

$$s2 := 1.641666667 \quad \textbf{(4.1)}$$

```
> y30:=subs(b=s1,y2(x));
  y31:=subs(a=s2,y30);
```

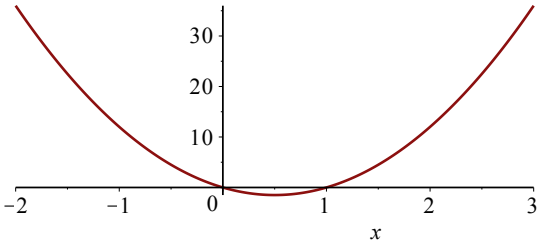
$$y30 := 6\,(x - a)^2 + 13.7\,x - 6.\,a^2$$

$$y31 := 6\,(x - 1.641666667)^2 + 13.7\,x - 16.17041668 \quad \textbf{(4.2)}$$

```
> y3:=unapply(y31,x);
```

$$y3 := x \to 6\,(x - 1.641666667)^2 + 13.7\,x - 16.17041668 \quad \textbf{(4.3)}$$

```
> plot(y3(x),x=-2..3);
```




```
> y3(-2);
```

$$35.99999998 \quad \textbf{(4.4)}$$

```
> s4:=solve(diff(y3(x),x),x);
```

$$s4 := 0.5000000000 \quad \textbf{(4.5)}$$

```
> y3(1/2);
```

$$-1.50000001 \quad \textbf{(4.6)}$$