

1

(1)

```
> restart;  
eq1:=arctan(1/sqrt(2)*tan(x/2));  
diff(eq1,x);  
simplify(diff(eq1,x));
```

$$eq1 := \arctan\left(\frac{1}{2}\sqrt{2}\tan\left(\frac{1}{2}x\right)\right)$$
$$\frac{\frac{1}{2}\sqrt{2}\left(\frac{1}{2} + \frac{1}{2}\tan\left(\frac{1}{2}x\right)^2\right)}{1 + \frac{1}{2}\tan\left(\frac{1}{2}x\right)^2}$$
$$\frac{\sqrt{2}}{\cos(x) + 3} \quad (1.1)$$

(2)

```
> int(sin(x)/(1+sin(x)),x);
```

$$\frac{2}{\tan\left(\frac{1}{2}x\right) + 1} + x \quad (1.2)$$

(3)

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

$$A := \begin{bmatrix} 1 & 2 & 2 \\ 0 & 1 & 2 \\ 1 & 1 & 0 \end{bmatrix} \quad (1.3)$$

```
> Eigenvectors(A);
```

$$\begin{bmatrix} 0 \\ 3 \\ -1 \end{bmatrix}, \begin{bmatrix} 2 & 2 & 0 \\ -2 & 1 & -1 \\ 1 & 1 & 1 \end{bmatrix} \quad (1.4)$$

2

(1)

```
> f:=(x,y)->x^2+y^2;
```

$$f := (x, y) \rightarrow y^2 + x^2 \quad (2.1.1)$$

```
> fx:=unapply(diff(f(x,y),x),(x,y));
```

```
fy:=unapply(diff(f(x,y),y),(x,y));
```

$$fx := (x, y) \rightarrow 2x$$

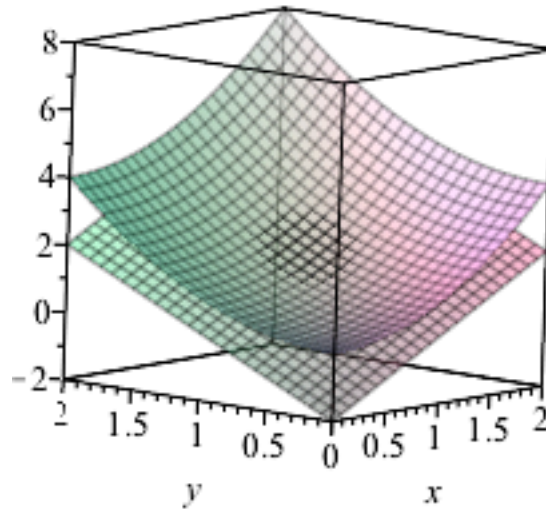
$$fy := (x, y) \rightarrow 2y \quad (2.1.2)$$

```
> z:=unapply(fx(1,1)*(x-1)+fy(1,1)*(y-1)+f(1,1),(x,y));
```

$$z := (x, y) \rightarrow 2x - 2 + 2y$$

(2.1.3)

```
> plot3d([f(x,y),z(x,y)],x=0..2,y=0..2,transparency=0.5);
```



(2)

```
> x1:=Vector([1,1,0]):
```

```
  x2:=Vector([0,1,0]):
```

```
  x3:=Vector([0,-1,1]):
```

```
> y1:=x1:
```

```
  a1:=y1/sqrt(x1.x1);
```

$$a1 := \begin{bmatrix} \frac{1}{2}\sqrt{2} \\ \frac{1}{2}\sqrt{2} \\ 0 \end{bmatrix}$$

(2.2.1)

```
> y2:=x2-(x2.a1).a1;
```

```
  a2:=y2/sqrt(y2.y2);
```

$$y2 := \begin{bmatrix} -\frac{1}{2} \\ \frac{1}{2} \\ 0 \end{bmatrix}$$

(2.2.2)

$$a2 := \begin{bmatrix} -\frac{1}{2}\sqrt{2} \\ \frac{1}{2}\sqrt{2} \\ 0 \end{bmatrix} \quad (2.2.2)$$

```
> y3:=x3-(x3.a1).a1-(x3.a2).a2;
a3:=y3/sqrt(y3.y3);
```

$$y3 := \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

$$a3 := \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad (2.2.3)$$

3

原

```
> restart;
g1:=x->a*x^2+b*x+c;
```

$$g1 := x \rightarrow ax^2 + bx + c \quad (3.1.1)$$

```
> g2:=x->-a*x^2+b*x+d;
```

$$g2 := x \rightarrow -ax^2 + bx + d \quad (3.1.2)$$

```
> s1:=c=solve(g1(2)=1,c);
```

$$s1 := c = 1 - 4a - 2b \quad (3.1.3)$$

```
> s2:=d=solve(g2(-3)=1,d);
```

$$s2 := d = 1 + 9a + 3b \quad (3.1.4)$$

```
> x1:=solve(diff(subs(s1,g1(x)),x)=0,x);
```

$$x1 := -\frac{1}{2} \frac{b}{a} \quad (3.1.5)$$

```
> x2:=solve(diff(subs(s2,g2(x)),x)=0,x);
```

$$x2 := \frac{1}{2} \frac{b}{a} \quad (3.1.6)$$

```
> s3:=b=solve(subs(s1,g1(x1))=-subs(s2,g2(x2)),b);
```

$$s3 := b = -2 - 5a \quad (3.1.7)$$

```
> p:=expand(subs(s3,x1));
```

$$p := \frac{1}{a} + \frac{5}{2} \quad (3.1.8)$$

```
> q:=expand(subs(s3,subs(s1,g1(p))));
```

$$q := -\frac{1}{a} - \frac{1}{4} a \quad (3.1.9)$$

> p+q;

$$\frac{5}{2} - \frac{1}{4} a \quad (3.1.10)$$

> s4:=a=solve(q=-p+2,a);

$$s4 := a = 2 \quad (3.1.11)$$

> g22:=unapply(subs(s4,subs(s3,subs(s2,g2(x))))),x);

$$g22 := x \rightarrow -2x^2 - 12x - 17 \quad (3.1.12)$$

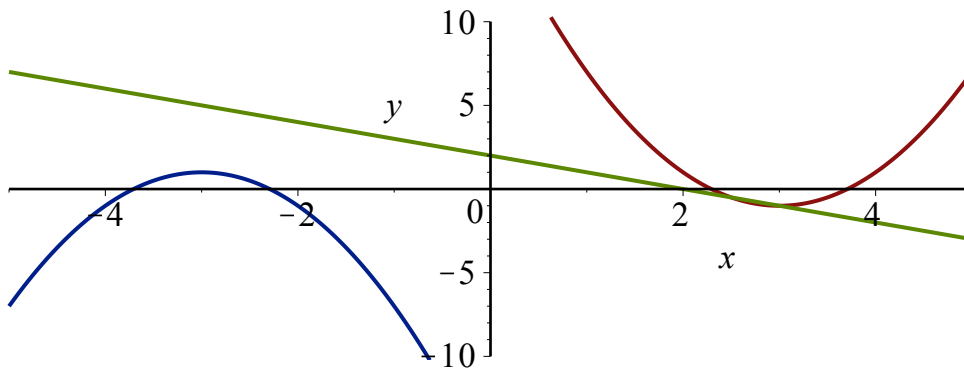
> g22(subs(s4,-p));

$$1 \quad (3.1.13)$$

> g12:=unapply(subs(s4,subs(s3,subs(s1,g1(x))))),x);

$$g12 := x \rightarrow 2x^2 - 12x + 17 \quad (3.1.14)$$

> plot([g12(x),g22(x),-x+2],x=-5..5,y=-10..10);



改

> restart;

g1:=x->a*x^2+b*x+c;

$$g1 := x \rightarrow ax^2 + bx + c \quad (3.2.1)$$

> g2:=x->-a*x^2+b*x+d;

$$g2 := x \rightarrow -ax^2 + bx + d \quad (3.2.2)$$

> s1:=c=solve(g1(2)=0,c);

$$s1 := c = -4a - 2b \quad (3.2.3)$$

> s2:=d=solve(g2(-3)=1,d);

$$s2 := d = 1 + 9a + 3b \quad (3.2.4)$$

> x1:=solve(diff(subs(s1,g1(x)),x)=0,x);

$$x1 := -\frac{1}{2} \frac{b}{a} \quad (3.2.5)$$

> x2:=solve(diff(subs(s2,g2(x)),x)=0,x);

$$x2 := \frac{1}{2} \frac{b}{a} \quad (3.2.6)$$

```
> s3:=b=solve(subs(s1,g1(x1))=-subs(s2,g2(x2)),b);
```

$$s3 := b = -5a - 1 \quad (3.2.7)$$

```
> p:=expand(subs(s3,x1));
```

$$p := \frac{5}{2} + \frac{1}{2a} \quad (3.2.8)$$

```
> q:=expand(subs(s3,subs(s1,g1(p))));
```

$$q := -\frac{1}{4}a - \frac{1}{2} - \frac{1}{4a} \quad (3.2.9)$$

```
> p+q;
```

$$2 + \frac{1}{4a} - \frac{1}{4}a \quad (3.2.10)$$

```
> s4:=a=solve(q=-p+2,a)[1];
```

$$s4 := a = -1 \quad (3.2.11)$$

```
> g22:=unapply(subs(s4,subs(s3,subs(s2,g2(x))))),x);
```

$$g22 := x \rightarrow x^2 + 4x + 4 \quad (3.2.12)$$

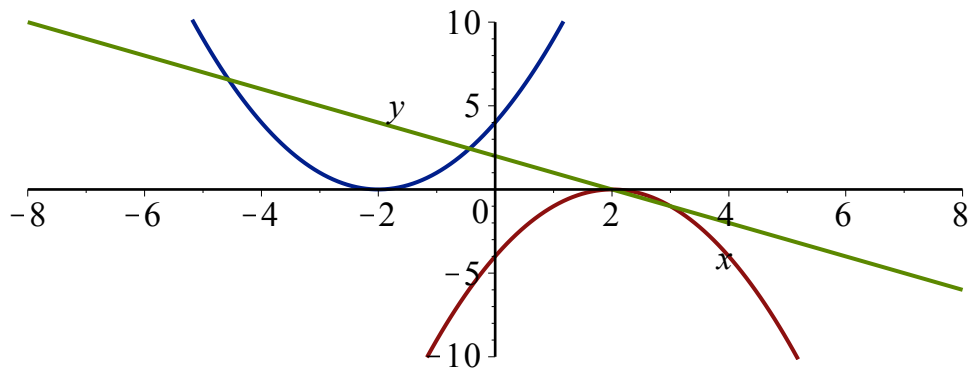
```
> g22(subs(s4,-p));
```

$$0 \quad (3.2.13)$$

```
> g12:=unapply(subs(s4,subs(s3,subs(s1,g1(x))))),x);
```

$$g12 := x \rightarrow -x^2 + 4x - 4 \quad (3.2.14)$$

```
> plot([g12(x),g22(x),-x+2],x=-8..8,y=-10..10);
```



```
> g12(subs(s4,p));
```

$$0 \quad (3.2.15)$$