

```

> restart:with(Student[VectorCalculus]):with(plots):with(student):
Warning, the assigned names <,> and <|> now have a global binding

Warning, these protected names have been redefined and unprotected: *, +, -, ., D,
Vector, diff, int, limit, series

Warning, the name changecoords has been redefined

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assigned

```

```

> # Ex 1 a

```

```

>

```

```

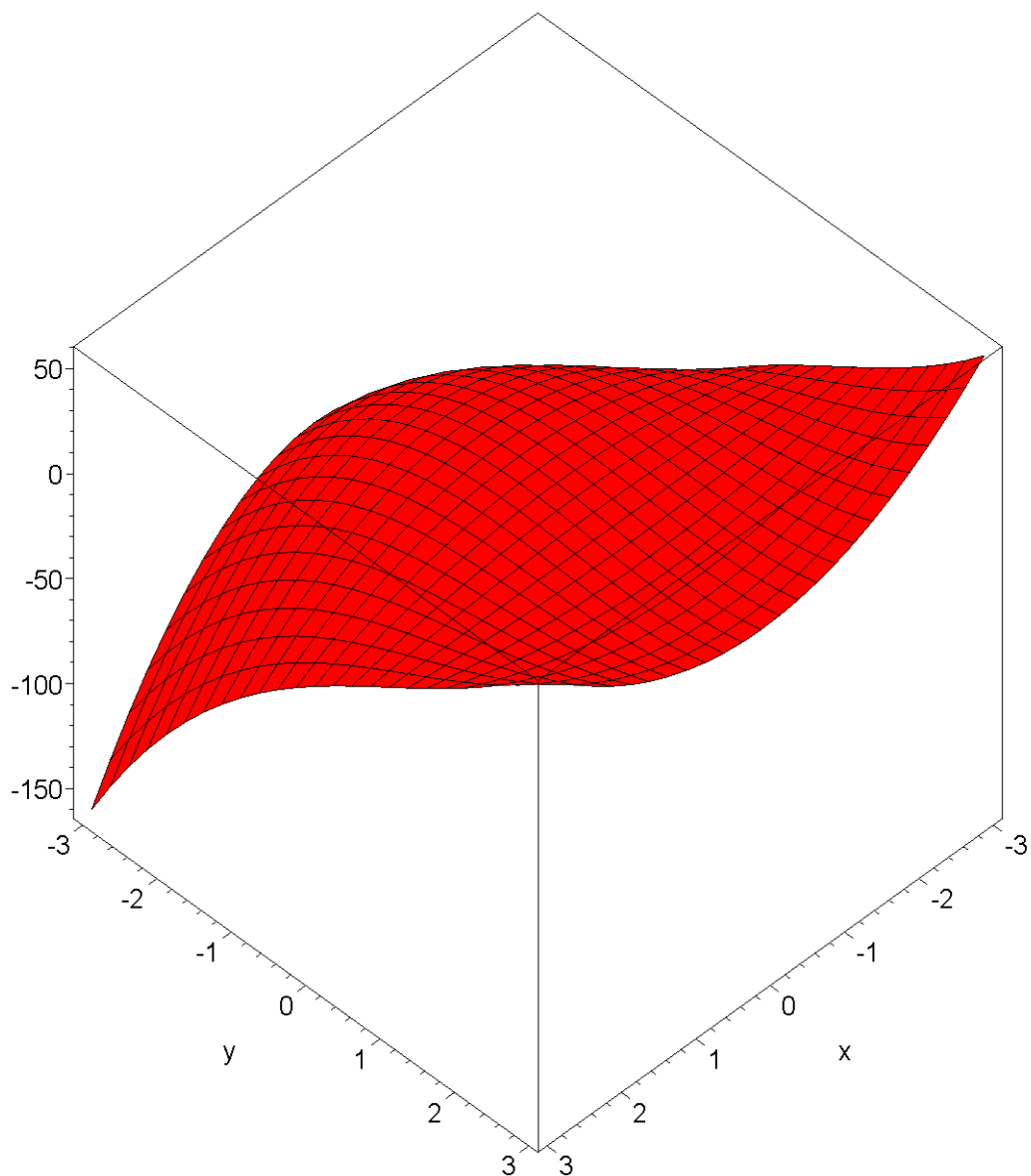
> f := (x,y) -> 3*x^2*y+y^3-3*x^2-3*y^2+2;plot3d(f(x,y), x =
-3..3,y=-3 .. 3,
color=red,axes=boxed);fxx:=diff(3*x^2*y+y^3-3*x^2-3*y^2+2,x,x);H:=
diff(3*x^2*y+y^3-3*x^2-3*y^2+2,x,x)*diff(3*x^2*y+y^3-3*x^2-3*y^2+2
,y,y)-
diff(3*x^2*y+y^3-3*x^2-3*y^2+2,x,y)*diff(3*x^2*y+y^3-3*x^2-3*y^2+2
,x,y);

```

```

f := (x, y) → Student:-VectorCalculus:-`+`(Student:-VectorCalculus:-`+`(
Student:-VectorCalculus:-`+`(Student:-VectorCalculus:-`+`(
Student:-VectorCalculus:-`*(Student:-VectorCalculus:-`*(3, x2), y), y3),
Student:-VectorCalculus:-`-(Student:-VectorCalculus:-`*(3, x2))),
Student:-VectorCalculus:-`-(Student:-VectorCalculus:-`*(3, y2))), 2)

```



$$f_{xx} := 6y - 6$$

$$H := (6y - 6)^2 - 36x^2$$

the next step is to find the roots of some hande calcaulations

```
> fx:=diff(3*x^2*y+y^3-3*x^2-3*y^2+2,x);fy:=diff(3*x^2*y+y^3-3*x^2-3*y^2+2,y);
```

$$fx := 6xy - 6x$$

$$fy := 3x^2 + 3y^2 - 6y$$

their are 4 roots set them up with rx and ry

```
> rx := array(1..4):ry := array(1..4):
```

```
rx:=[0,0,1,-1];ry:=[0,2,1,1];
```

```
rx := [0, 0, 1, -1]
```

```
ry := [0, 2, 1, 1]
```

```
> for i from 1 to 4 do
```

```
h:=subs(x=rx[i],y=ry[i],H);valfxx:=subs(x=rx[i],y=ry[i],fxx);print  
(i,rx[i],ry[i],valfxx,h); end do:
```

```
1, 0, 0, -6, 36
```

```
2, 0, 2, 6, 36
```

```
3, 1, 1, 0, -36
```

```
4, -1, 1, 0, -36
```

```
>
```

```
>
```

```
> s4:=SpaceCurve( <rx[4],ry[4],t>, t=-2..50,color=blue,axes=boxed  
):
```

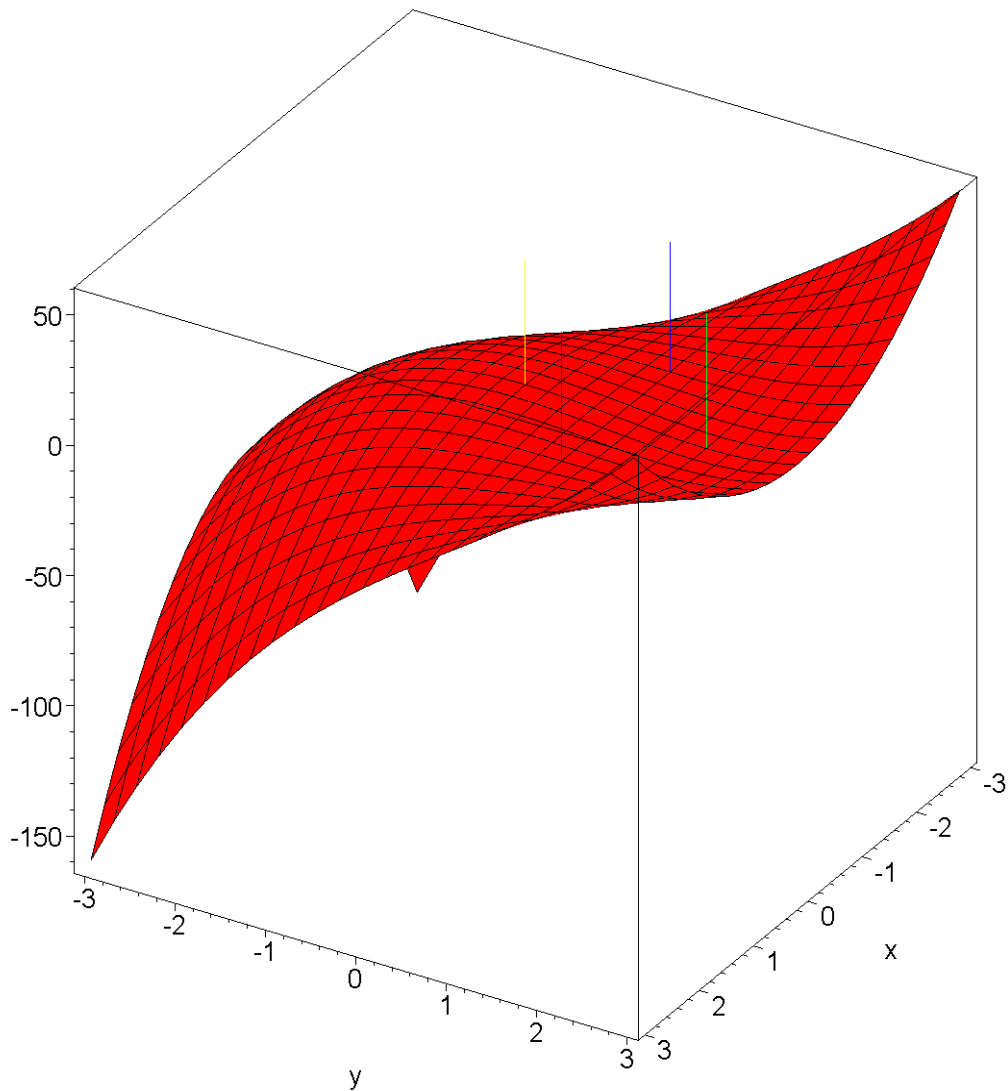
```
> s1:=SpaceCurve( <rx[1],ry[1],t>, t=-10..50,color=  
yellow,axes=boxed ):
```

```
s2:=SpaceCurve( <rx[2],ry[2],t>, t=-5..50,color=green,axes=boxed  
):
```

```
s3:=SpaceCurve( <rx[3],ry[3],t>, t=-2..50,color=blue,axes=boxed  
):
```

```
s0:=plot3d(f(x,y), x = -3..3,y=-3 .. 3, color=red,axes=boxed):
```

```
> display3d(s0,s1,s2,s3,s4);
```



```
> #ex 1 b
```

```
> restart:with(Student[VectorCalculus]):with(plots):with(student):
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```

```
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```

```
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```

```
Warning, the protected name D has had its previous binding removed and has been
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```

```
> f:= (x,y) -> x^4-5*x^2+y^2+3*x+2;plot3d(f(x,y), x = -3..3,y=-3 ..
```

```

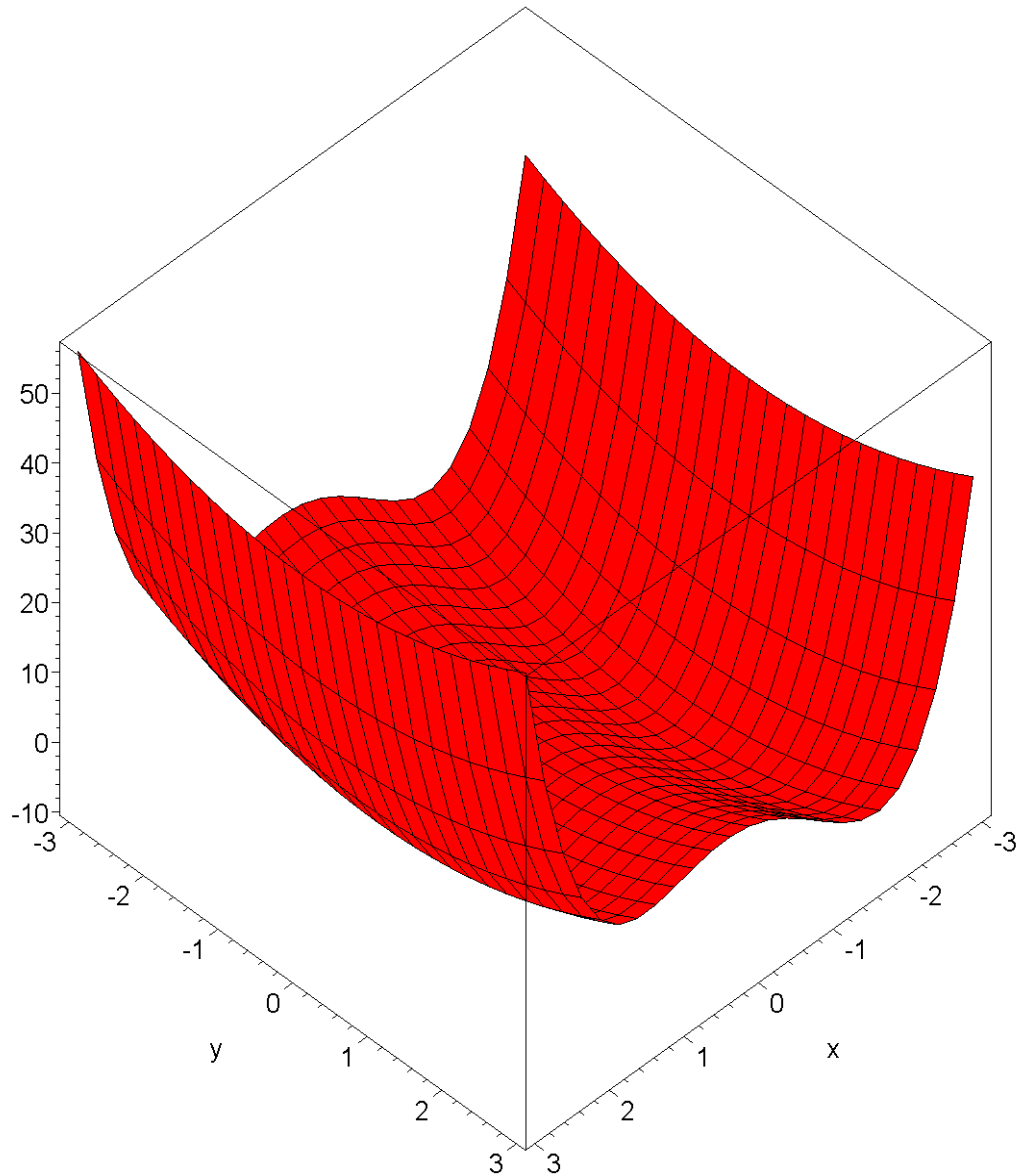
3, color=red, axes=boxed); fxx:=diff(x^4-5*x^2+y^2+3*x+2,x,x); H:=
diff(x^4-5*x^2+y^2+3*x+2,x,x)*diff(x^4-5*x^2+y^2+3*x+2,y,y)-
diff(x^4-5*x^2+y^2+3*x+2,x,y)*diff(x^4-5*x^2+y^2+3*x+2,x,y);

```

```

f := (x, y) → Student:-VectorCalculus:-`+`(Student:-VectorCalculus:-`+`(
Student:-VectorCalculus:-`+`(Student:-VectorCalculus:-`+`(x^4,
Student:-VectorCalculus:-`-`(Student:-VectorCalculus:-`*(5, x^2))), y^2),
Student:-VectorCalculus:-`*(3, x)), 2)

```

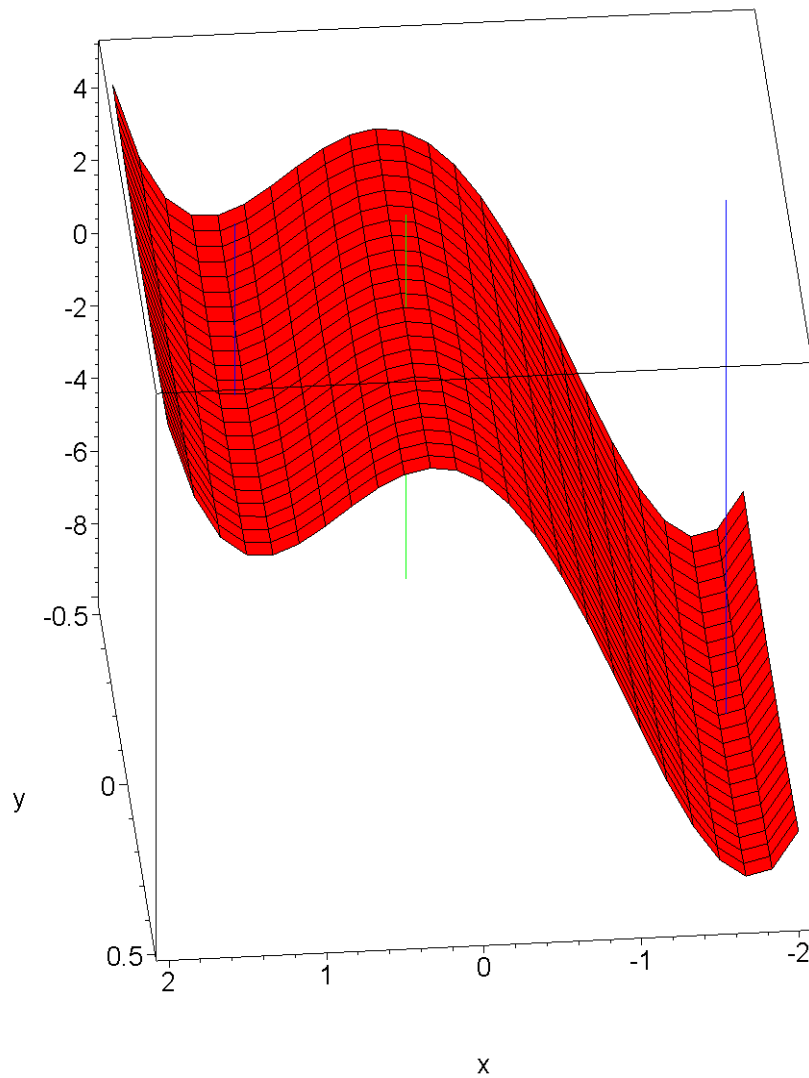


$$f_{xx} := 12x^2 - 10$$

$$H := 24x^2 - 20$$

the next step is to find the roots of some hande calculaations

```
> fx:=diff(x^4-5*x^2+y^2+3*x+2,x);fy:=diff(x^4-5*x^2+y^2+3*x+2,y);  
      fx := 4 x3 - 10 x + 3  
      fy := 2 y  
> rx:=fsolve( fx=0 );# the corresponding x-values  
      rx := -1.713939436, 0.3121681883, 1.401771248  
> for i from 1 to 3 do  
  h:=subs(x=rx[i],y=0,H);valfxx:=subs(x=rx[i],y=0,fxx);print(i,rx[i]  
  ,0,valfxx,h); end do:  
      1, -1.713939436, 0, 25.25106068, 50.50212136  
      2, 0.3121681883, 0, -8.830612267, -17.66122453  
      3, 1.401771248, 0, 13.57955158, 27.15910317  
>  
>  
>  
> s1:=SpaceCurve( <rx[1],0,t>, t=-10..5,color= blue,axes=boxed ):  
  s2:=SpaceCurve( <rx[2],0,t>, t=-5..5,color=green,axes=boxed ):  
  s3:=SpaceCurve( <rx[3],0,t>, t=-2..5,color=blue,axes=boxed ):  
  s4:=plot3d(f(x,y), x = -2..2,y=-.5 .. .5, color=red,axes=boxed):  
> display3d(s1,s2,s3,s4);
```



```

> # ex 2a
>
> restart:with(Student[VectorCalculus]):with( plots): with(student):
> f:= (x,y) -> sin(x+y);plot3d(f(x,y), x = 0.. Pi,y= 0 .. Pi,
color=red,axes=boxed);fxx:=diff(sin(x+y),x,x);H:=
diff(sin(x+y),x,x)*diff(sin(x+y),y,y)-
diff(sin(x+y),x,y)*diff(sin(x+y),x,y);
Warning, the assigned names <, > and <|> now have a global binding

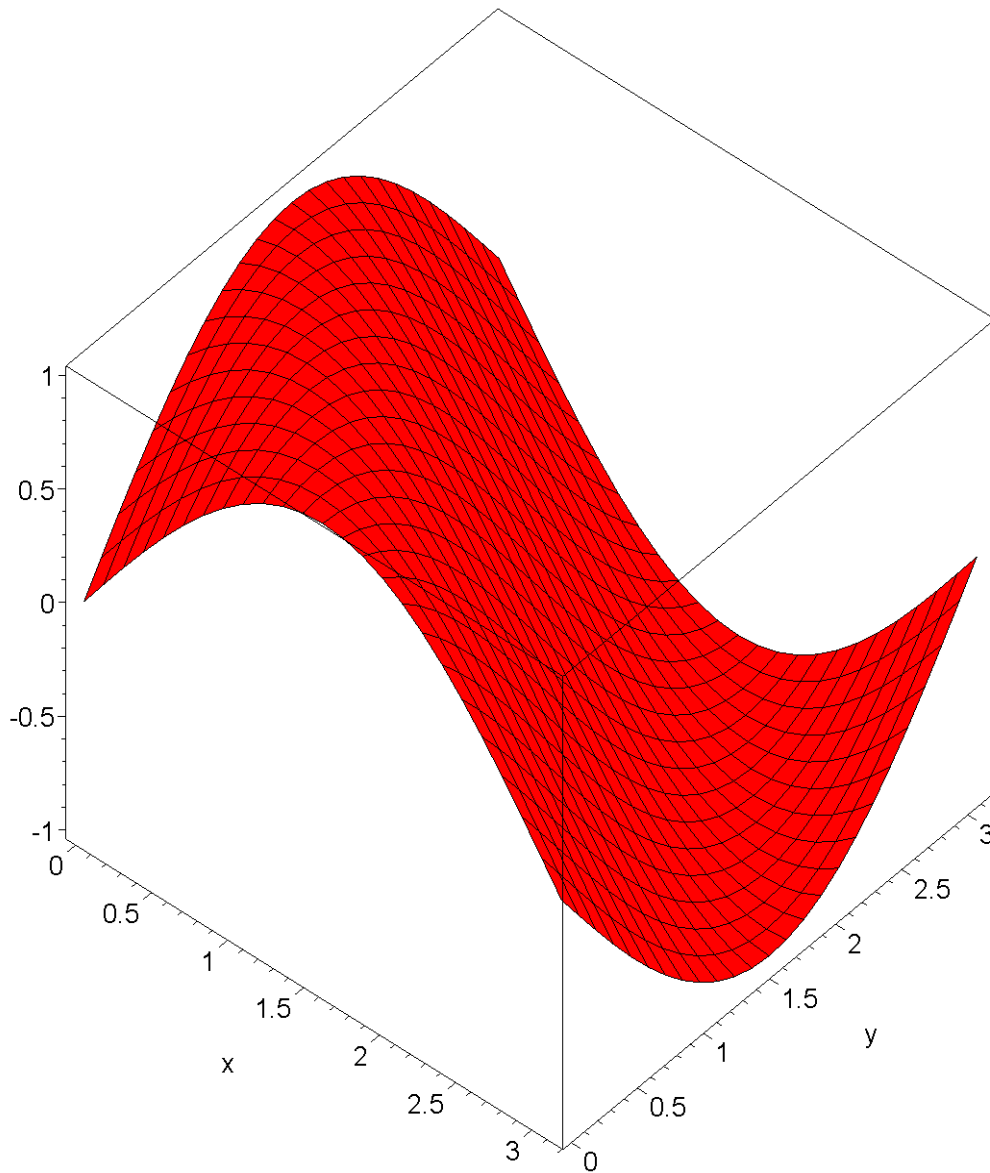
Warning, these protected names have been redefined and unprotected: *, +, -, ., D,
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```

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```
f := (x, y) → sin(Student:-VectorCalculus:-`(x, y))
```



```
fx := -sin(x + y)
```

```
H := 0
```

```
> fx:=diff(sin(x+y),x);fy:=diff(sin(x+y),y);# is zero when x+y =  
Pi/2
```

```
fx := cos(x + y)
```

```
fy := cos(x + y)
```



```

[ >
> restart:with(Student[VectorCalculus]):with(plots): with(student):
  f1:=(x,y,z) -> x^2*y*z +1 =10;
Warning, the assigned names <,> and <|> now have a global binding

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Vector, diff, int, limit, series

Warning, the name changecoords has been redefined

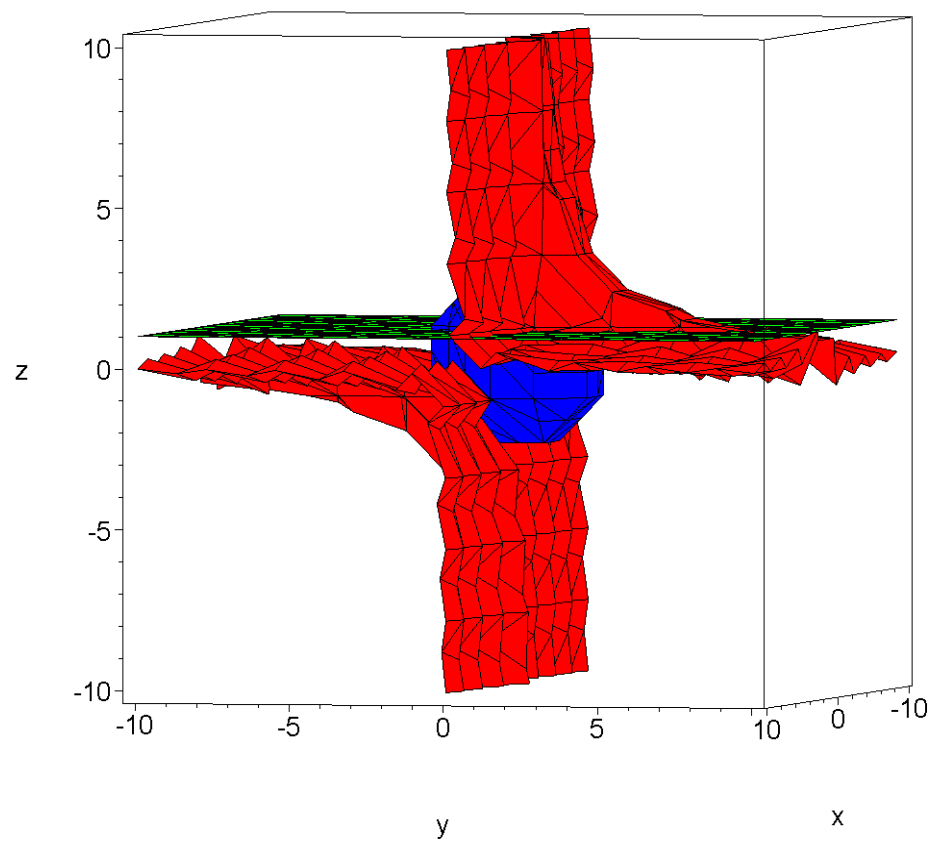
Warning, the protected name D has had its previous binding removed and has been
assigned

f1 := (x, y, z) → Student:-VectorCalculus:-`+`(
  Student:-VectorCalculus:-`*(Student:-VectorCalculus:-`(x^2, y), z), 1) = 10
> f2:=(x,y,z) -> x^2 +y^2+z^2=10;

  f2 := (x, y, z) → Student:-VectorCalculus:-`+`(Student:-VectorCalculus:-`(x^2, y^2), z^2) = 10
> f3:=(x,y,z) -> z=1;

  f3 := (x, y, z) → z = 1
> R1:=implicitplot3d(x^2*y*z=9, x=-10 .. 10, y=-10 .. 10, z=-10..
  10,axes=boxed,color=red):
> R2:=implicitplot3d(x^2+y^2+z^2 =10, x=-10 .. 10, y=-10 .. 10,
  z=-10.. 10,axes=boxed,color=blue):
> R3:=implicitplot3d(z=1, x=-10 .. 10, y=-10 .. 10, z=-10..
  10,axes=boxed,color=green):
> display3d(R1,R2,R3);

```



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