

Pensieve header: A determinant bug in mathematica version 9. (Fixed in 9.0.1)

**\$Version**

9.0 for Microsoft Windows (64-bit) (November 20, 2012)

mat is a 2x2 matrix with entries rational functions in x, y, z.

```
{a, b}, {c, d} =
mat = { { -1 - (z (1 - 2 x + x^2 - y + 3 x y - 2 x^2 y - x y^2 + x^2 y^2 - z + 2 x z - x^2 z + y z -
5 x y z + 3 x^2 y z + 2 x y^2 z - 2 x^2 y^2 z + x y z^2 - x^2 y z^2 - x y^2 z^2 + x^2 y^2 z^2)) /
(1 - 2 x + x^2 - 2 y + 4 x y - 2 x^2 y + y^2 - 2 x y^2 + x^2 y^2 - 2 z + 4 x z - 2 x^2 z + 4 y z -
10 x y z + 6 x^2 y z - 2 y^2 z + 8 x y^2 z - 5 x^2 y^2 z - x y^3 z + x^2 y^3 z + z^2 - 2 x z^2 +
x^2 z^2 - 2 y z^2 + 8 x y z^2 - 5 x^2 y z^2 + y^2 z^2 - 8 x y^2 z^2 + 6 x^2 y^2 z^2 + 2 x y^3 z^2 -
2 x^2 y^3 z^2 - x y z^3 + x^2 y z^3 + 2 x y^2 z^3 - 2 x^2 y^2 z^3 - x y^3 z^3 + x^2 y^3 z^3) ,
(y (-1 + z) (1 - 2 x + x^2 + x y - x^2 y + x z - x^2 z - 3 x y z + 2 x^2 y z + x y^2 z -
x^2 y^2 z + x y z^2 - x^2 y z^2 - x y^2 z^2 + x^2 y^2 z^2)) /
(1 - 2 x + x^2 - 2 y + 4 x y - 2 x^2 y + y^2 - 2 x y^2 + x^2 y^2 - 2 z + 4 x z - 2 x^2 z + 4 y z -
10 x y z + 6 x^2 y z - 2 y^2 z + 8 x y^2 z - 5 x^2 y^2 z - x y^3 z + x^2 y^3 z + z^2 - 2 x z^2 +
x^2 z^2 - 2 y z^2 + 8 x y z^2 - 5 x^2 y z^2 + y^2 z^2 - 8 x y^2 z^2 + 6 x^2 y^2 z^2 + 2 x y^3 z^2 -
2 x^2 y^3 z^2 - x y z^3 + x^2 y z^3 + 2 x y^2 z^3 - 2 x^2 y^2 z^3 - x y^3 z^3 + x^2 y^3 z^3) } ,
{ ((-1 + y) z (1 - 2 x + x^2 - y + 2 x y - x^2 y - z + 2 x z - x^2 z + y z - 5 x y z +
3 x^2 y z + x y^2 z - x^2 y^2 z + x y z^2 - x^2 y z^2 - x y^2 z^2 + x^2 y^2 z^2)) /
(1 - 2 x + x^2 - 2 y + 4 x y - 2 x^2 y + y^2 - 2 x y^2 + x^2 y^2 - 2 z + 4 x z - 2 x^2 z + 4 y z -
10 x y z + 6 x^2 y z - 2 y^2 z + 8 x y^2 z - 5 x^2 y^2 z - x y^3 z + x^2 y^3 z + z^2 - 2 x z^2 +
x^2 z^2 - 2 y z^2 + 8 x y z^2 - 5 x^2 y z^2 + y^2 z^2 - 8 x y^2 z^2 + 6 x^2 y^2 z^2 + 2 x y^3 z^2 -
2 x^2 y^3 z^2 - x y z^3 + x^2 y z^3 + 2 x y^2 z^3 - 2 x^2 y^2 z^3 - x y^3 z^3 + x^2 y^3 z^3) ,
-1 - (y (1 - 2 x + x^2 - y + 2 x y - x^2 y - z + 3 x z - 2 x^2 z + y z - 5 x y z + 3 x^2 y z +
x y^2 z - x^2 y^2 z - x z^2 + x^2 z^2 + 2 x y z^2 - 2 x^2 y z^2 - x y^2 z^2 + x^2 y^2 z^2)) /
(1 - 2 x + x^2 - 2 y + 4 x y - 2 x^2 y + y^2 - 2 x y^2 + x^2 y^2 - 2 z + 4 x z - 2 x^2 z + 4 y z -
10 x y z + 6 x^2 y z - 2 y^2 z + 8 x y^2 z - 5 x^2 y^2 z - x y^3 z + x^2 y^3 z + z^2 - 2 x z^2 +
x^2 z^2 - 2 y z^2 + 8 x y z^2 - 5 x^2 y z^2 + y^2 z^2 - 8 x y^2 z^2 + 6 x^2 y^2 z^2 + 2 x y^3 z^2 -
2 x^2 y^3 z^2 - x y z^3 + x^2 y z^3 + 2 x y^2 z^3 - 2 x^2 y^2 z^3 - x y^3 z^3 + x^2 y^3 z^3) } } ;
```

The determinant of mat as computed by Det is not the same as ad-bc:

```
diff = Simplify[a * d - b * c - Det[mat]]
```

$$\begin{aligned}
 & - \left( (-1+x)^2 (1+yz) \right. \\
 & \quad \left( x^4 (-1+y)^2 (-1+z)^2 (-1+z-y^2 (-1+z) z + y (1-3z+z^2))^2 + (-1+y) (-1+z) \right. \\
 & \quad \left( 3y (-1+z)^3 - 3y^2 (-1+z)^3 + y^3 (-1+z)^3 - z (3-3z+z^2) \right) - 2x (-1+y)^2 (-1+z)^2 \\
 & \quad \left( 2 (-1+z)^2 + y^3 (-1+z)^2 z + y (-4+10z-8z^2+z^3) - 2y^2 (-1+4z-4z^2+z^3) \right) - \\
 & \quad 2x^3 (-1+y) (-1+z) \left( -2 (-1+z)^3 + y^5 (-1+z)^3 z^2 - 3y^4 (-1+z)^2 z (1-3z+z^2) + \right. \\
 & \quad \left. y (-6+24z-34z^2+19z^3-3z^4) - y^2 (-6+34z-64z^2+51z^3-15z^4+z^5) + \right. \\
 & \quad \left. y^3 (-2+19z-51z^2+55z^3-24z^4+3z^5) \right) + \\
 & \quad x^2 \left( 6 (-1+z)^4 + y^6 (-1+z)^4 z^2 - 2y^5 (-1+z)^3 z (3-7z+2z^2) + \right. \\
 & \quad \left. 2y (-1+z)^2 (-12+30z-23z^2+3z^3) + 2y^4 (-1+z)^2 (3-23z+42z^2-24z^3+3z^4) + \right. \\
 & \quad \left. y^2 (36-190z+390z^2-386z^3+182z^4-32z^5+z^6) - \right. \\
 & \quad \left. 2y^3 (12-79z+193z^2-227z^3+131z^4-32z^5+2z^6) \right) \left. \right) / \\
 & \quad \left( (-1+y)^2 (-1+z)^2 + x^2 (-1+y) (-1+z) (1-z+y^2 (-1+z) z - y (1-3z+z^2)) - \right. \\
 & \quad \left. x \left( 2 (-1+z)^2 + y^3 (-1+z)^2 z + y (-4+10z-8z^2+z^3) - 2y^2 (-1+4z-4z^2+z^3) \right) \right)
 \end{aligned}$$

And the difference is not merely a failure of Simplify; indeed the difference diff is non-zero even when specialized to numerical values of x, y, z:

```
vals = Thread[{x, y, z} -> N[{sqrt[2], pi, E}]]
```

```
{x -> 1.41421, y -> 3.14159, z -> 2.71828}
```

```
diff /. vals
```

```
-91.7266
```

```
(a * d - b * c /. vals) - Det[mat /. vals]
```

```
1.249 x 10^-16
```