

Worksheet 1

Math 607, Homological Algebra

Monday, March 30, 2020

1. Let R be a commutative ring and $I, J \subset R$ two ideals.
Show that $R/I \otimes R/J \cong R/(I + J)$.
2. For next time, download and install Macaulay2:
<https://faculty.math.illinois.edu/Macaulay2/>
Email me if you have trouble.

Try to run the following code. The double dashes are comments.

```
R = QQ[x,y,z] -- 3-space
I = ideal(y-x^2,z) -- a parabola in the xy-plane
J = ideal(x) -- the yz-plane
J' = ideal(y) -- the xz-plane
K = ideal(x,y) -- the z-axis

length prune Tor_0(R^1/I, R^1/J)
-- R^1/I makes an R-module, R/I makes a new ring
-- prune is just to keep it from doing something stupid.
length prune Tor_1(R^1/I, R^1/J)

length prune Tor_0(R^1/I, R^1/J')
length prune Tor_1(R^1/I, R^1/J')

length prune Tor_0(R^1/I, R^1/K)
length prune Tor_1(R^1/I, R^1/K)
length prune Tor_2(R^1/I, R^1/K)

R^1/K -- see what R/K looks like
prune Tor_0(R^1/K, R^1/K)
prune Tor_1(R^1/K, R^1/K)
prune Tor_2(R^1/K, R^1/K)
prune Tor_3(R^1/K, R^1/K)
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Maybe also try it with Ext^0 , Ext^1 , Ext^2 ...