

## Problem 3: The Sage Zone

UW Student who knows SageTeX!

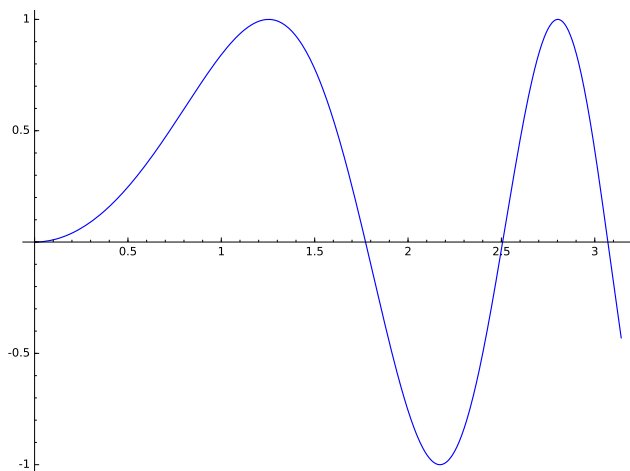
2016-04-22

### 1 Factoring Years

Sage says<sup>1</sup> that  $2016 = 2^5 \cdot 3^2 \cdot 7$  and  $2017 = 2017$ .

### 2 Plotting a Function

Here is a plot of  $\sin(x^2)$  made using `sagetex`. Your plot should be about this size (not enormous).



### 3 Deriving a Formula

Sage can find a formula for  $f(n) = \sin(1) + \sin(2) + \dots + \sin(n)$ . Just enter this code into Sage (in `sagetex` use the `sageblock` environment):

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<sup>1</sup>These factorization are computed using `sagetex`!

```

var('k, n')
f = sum(sin(k), k, 1, n)

```

and find that

$$f = \frac{\cos\left(n \arctan\left(\frac{\sin(1)}{\cos(1)}\right) + \arctan\left(\frac{\sin(1)}{\cos(1)}\right)\right) \sin(1) - (\cos(1) - 1) \sin\left(n \arctan\left(\frac{\sin(1)}{\cos(1)}\right) + \arctan\left(\frac{\sin(1)}{\cos(1)}\right)\right) - \sin(1)}{2(\cos(1) - 1)}$$

Here is a plot of the formula above from 0 to 100:

