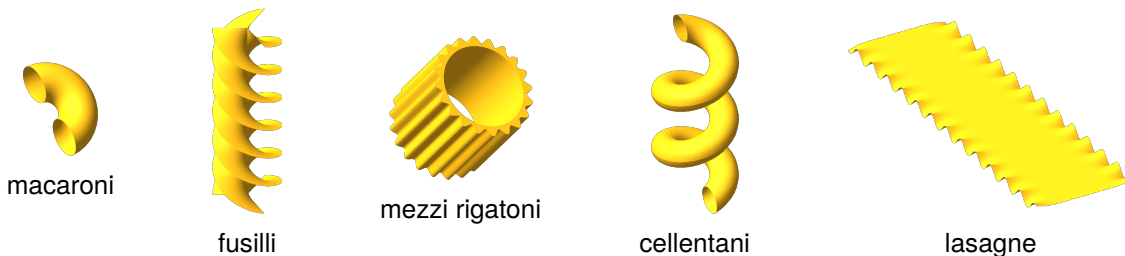


5. (expires 2/15) Consider the planar curve  $\gamma$  defined by  $x^2y^3 + y^2 + y - 2e^x = 0$ . Using **only** Maple, find the slope of the tangent line to the curve at  $(0, 1)$ . Then plot the curve and the tangent line on the same graph.  
*Hint: you might want to use `implicitplot` and `display` from the `plots` library. You might find `implicitdiff` helpful, too.*
6. (expires 2/15) Define a Maple function  $g$  that, given a positive integer  $k$  yields the sum of the first  $k$  primes. What is  $k$  such that  $g(k) \leq 100,000$  but  $g(k + 1) > 100,000$ ?  
*You might find `ithprime` helpful, and probably `add` (rather than `sum`).*
7. (expires 2/15) Write a function that, when given a positive integer  $n$  as input, will return the  $n^{\text{th}}$  digit of  $e$  (where 2 is the  $0^{\text{th}}$  digit of  $e$ , and 1 is the  $2^{\text{nd}}$  digit). What is the  $2024^{\text{th}}$  digit of  $e$ ?  
*Using `floor` might be helpful, but you could have other ideas.*
8. (expires 2/15) Use Maple to make pictures of the following pasta.



Here are some relevant equations, in no particular order.

$$z = \sin(2y) \left(1 - e^{-(x/6)^8}\right) \quad -6 \leq x \leq 6, \quad -20 \leq y \leq 20$$

$$\tau = 1 \quad 0 \leq \phi \leq \pi, \quad -\pi \leq \sigma \leq \pi \quad (\text{toroidal coordinates})$$

$$x = \left(1 + \frac{\cos(s)}{2}\right) \cos(t) \quad y = \left(1 + \frac{\cos(s)}{2}\right) \sin(t) \quad z = 0.4t + \frac{\sin(s)}{2} \quad \begin{matrix} 0 \leq s \leq 2\pi \\ \frac{\pi}{2} \leq t \leq \frac{11\pi}{2} \end{matrix}$$

$$\left. \begin{matrix} x = r \sin(t) & y = r \cos(t) & z = t/2 \\ x = r \sin\left(t + \frac{2\pi}{3}\right) & y = r \cos\left(t + \frac{2\pi}{3}\right) & z = t/2 \\ x = r \sin\left(t - \frac{2\pi}{3}\right) & y = r \cos\left(t - \frac{2\pi}{3}\right) & z = t/2 \end{matrix} \right\} \begin{matrix} 0 \leq r \leq 1 \\ 0 \leq t \leq 4\pi \end{matrix}$$

$$6 \leq r \leq 7 + \sin(20\theta)/2, \quad 0 \leq \theta \leq 2\pi, \quad 0 \leq z \leq 14 \quad (\text{cylindrical coordinates})$$

To help you get started, the Maple worksheet called [pasta.mw](#) draws Mezzi Rigatoni. For full credit, your pasta should look like pasta, with appropriate coloring, viewpoint, smoothness, and lighting. Sauce is optional. See also [some recipes](#).