

# Partial Product

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MATH 361B

February 11, 2019

The partial product terms that I created are:

$$p_n = \prod_{i=1}^n \frac{\sin(i)}{i^2 \cos(i)}$$

Convergence or divergence of the infinite product:

1.

$$p_n = \prod_{i=2}^n \frac{i^3 - 1}{i^3 + 1}$$

When looking at the terms of this partial product sequence with different values for  $n$ , it seems that the last 15 terms are always approximately 0.666667. Also, as  $i$  gets larger, the  $-1$  in the numerator and the  $+1$  in the denominator will become negligible, so eventually each term will be multiplied by  $\approx 1$ , which means that the product would remain about the same at that point. This, combined with the output I received from my code, leads me to believe that this product will converge to  $\approx 0.666667$ .

2.

$$q_n = \prod_{i=1}^n \frac{e^{i/100}}{i^{10}}$$

For relatively large  $n$ , the last 15 terms of the partial product sequence are 0. I found this to be true for  $n = 1000$ ,  $n = 5000$ , and  $n = 10000$ , so I assume that the terms will remain at 0 as  $n$  continues to increase. Therefore, I would conclude that this product will converge to 0.

3.

$$p_n = \prod_{i=1}^n \frac{\sin(i)}{i^2 \cos(i)}$$

Just like in the last product, the last 15 terms of this sequence are 0 for large  $n$ , including  $n = 1000$ ,  $n = 5000$ , and  $n = 10000$ . I assume that these terms will remain at 0 as  $n$  continues to increase, so I think that this product will also converge to 0.