

- Topic: Applied optimization

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- **Homework:** Watch videos 6.11 - 6.16 for Tuesday.  
No videos for Wednesday.

- 1 Construct a polynomial  $P$  such that

$$\lim_{x \rightarrow 1} \frac{P(x)}{e^x - e \cdot x} = \frac{1}{e}$$

- 2 Find  $a \in \mathbb{R}$  and  $n \in \mathbb{N}$  such that the limit

$$\lim_{x \rightarrow 0} \frac{\sin x - ax^n}{x^3}$$

exists. What is the value of the limit?

## Maggie's farm

You're working on Maggie's farm. Maggie has 300m of fencing and needs you to fence off a rectangular field and add an extra fence that divides the rectangular area in two equal parts down the middle. What is the largest area that the field can have?

Find the point on the parabola  $y^2 = 2x$  that is closest to the point  $(1, 4)$ .

# Fire

You hear a scream. You turn around and you see that Qin is on fire. Literally.

At first, you think maybe you should just let Qin burn - perhaps they'd give a day of mourning and cancel the test. After a moment, your pesky conscience sets in.

Luckily, you are next to a river.

Qin is 10 meters away from the river and you are 5 meters away from the point  $P$  on the river closest to Qin. You are carrying an empty bucket. You can run twice as fast with an empty bucket as you can run with a full bucket. How far from the point  $P$  should you fill your bucket in order to get to Qin with a bucket full of water as fast as possible?