MAT137 - Week 10, Lecture 1

- **Reminder:** Problem Set 4 is due **Thursday 21 November, by 11:59pm**.
- **Reminder:** Test 2 is scheduled for Friday 29 November.
- Today's lecture will assume you have watched up to and including video 5.4.

  For Thursday's lecture, watch videos 5.5 and 5.6.

Derivative of arctan

Recall that we defined the arctan function as follows:

If $x, y \in \mathbb{R}$, then

$$\arctan(y) = x \quad \Longleftrightarrow \quad \begin{cases} x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right) \\ \tan x = y \end{cases}$$

Problem. Derive a formula for the derivative of arctan.

Hint: Start with the fact that

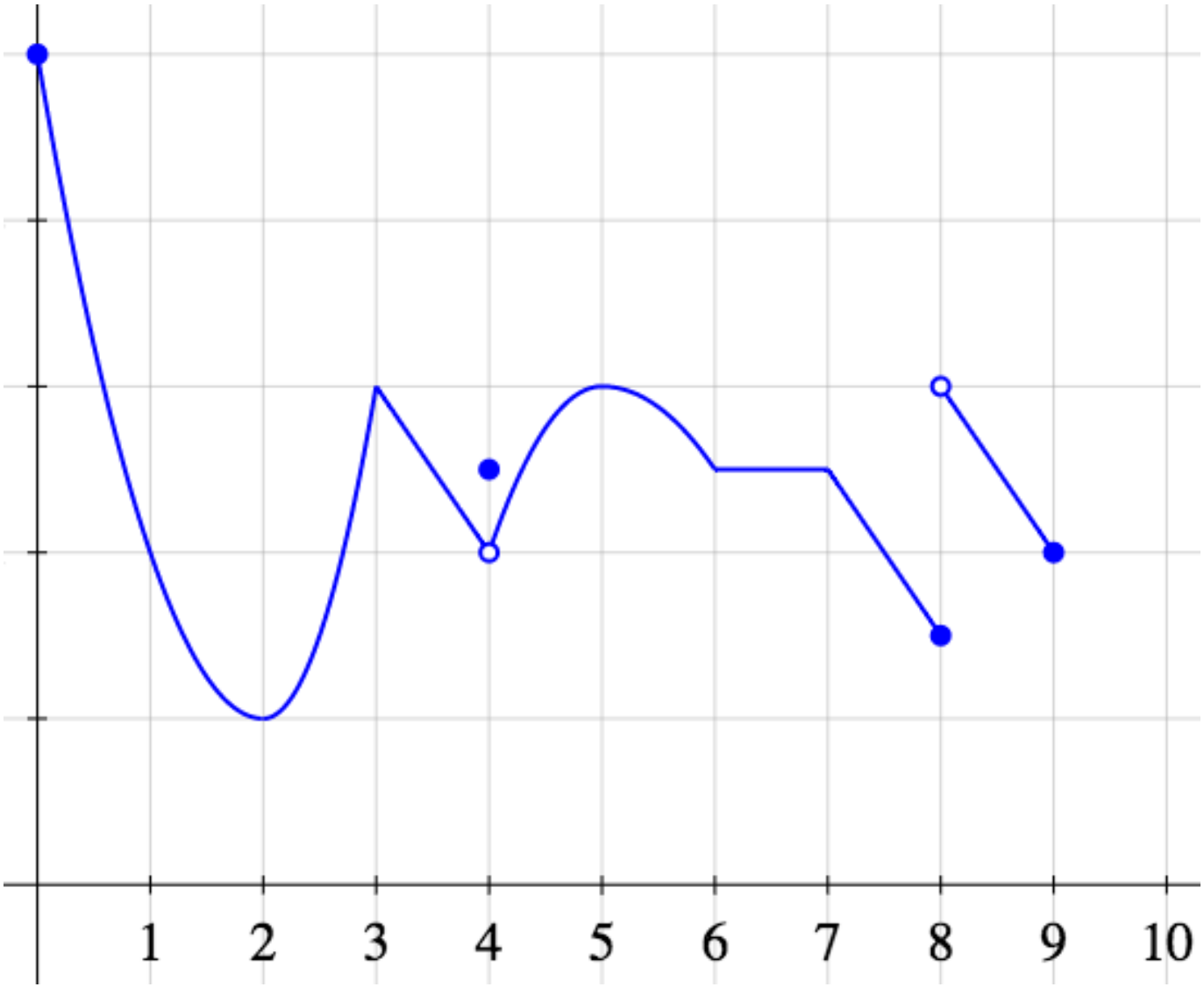
$$\text{for any } x \in \mathbb{R}, \ \tan\left(\arctan(x)\right) = x,$$

and differentate both sides with respect to x.

The process should be quite similar to the derivation of a formula for the derivative of arcsin that you saw in video 4.7.

Definition of local/global extremum

Find local and global extrema of the function with this graph:



Common misconceptions

Suppose we know the following information about the function h:

- The domain of h is $(-4, 4)$.
- h is continuous at every point in its domain.
- h is differentiable on its entire domain, except at 0.
- $h'(x) = 0 \quad \iff \quad x = -1$ or 1.

Problem. What can you conclude about the maximum of h?

1. h has a maximum at $x = -1$, or 1.
2. h has a maximum at $x = -1, 0$, or 1.
3. h has a maximum at $x = -4, -1, 0, 1$, or 4.
4. None of the above.