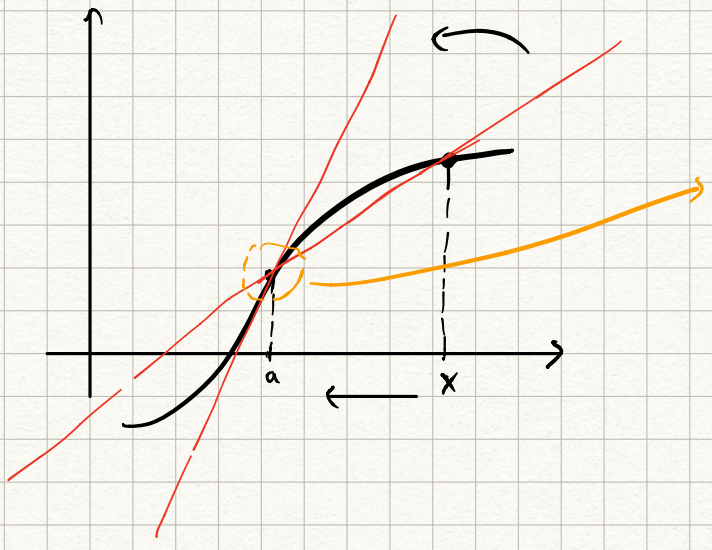
LINEARIZATION

Recall the definition of the derivative!

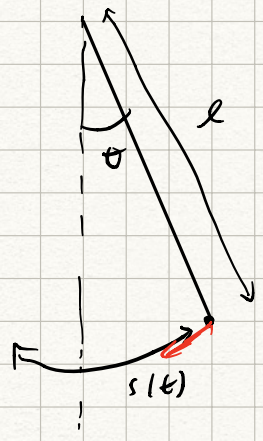


$$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

at values $x \approx a$, the tangent line is a good approx. for $f(x)$.

$$L(x) = f(a) + f'(a)(x - a)$$

ex.



$$m \frac{d^2 s}{dt^2} = -mg \sin\theta$$

$$\frac{d^2\theta}{dt^2} = -\frac{g}{\ell} \sin\theta \qquad [s = \theta \ell)$$

We approximate $\sin\theta = \theta$ for small θ.

$$\frac{d^2\theta}{dt^2} = -\frac{g}{\ell}\theta$$

→ Want function where 2nd deriv. is $-\frac{g}{\ell}$ times itself.

consider $\theta(t) = \cos\left(\sqrt{\frac{g}{\ell}} \cdot t\right)$

$$\theta'(t) = -\sqrt{\frac{g}{\ell}} \sin\left(\sqrt{\frac{g}{\ell}} \cdot t\right)$$

$$\theta''(t) = -\frac{g}{\ell} \cos\left(\sqrt{\frac{g}{\ell}} \cdot t\right) = -\frac{g}{\ell}\theta$$