Kinematics → $\vec{r}, \vec{v}, \vec{a}$ — no forces

Kinetics → $\vec{F} = m\vec{a}$

Statics

$\sum \vec{F} = 0$

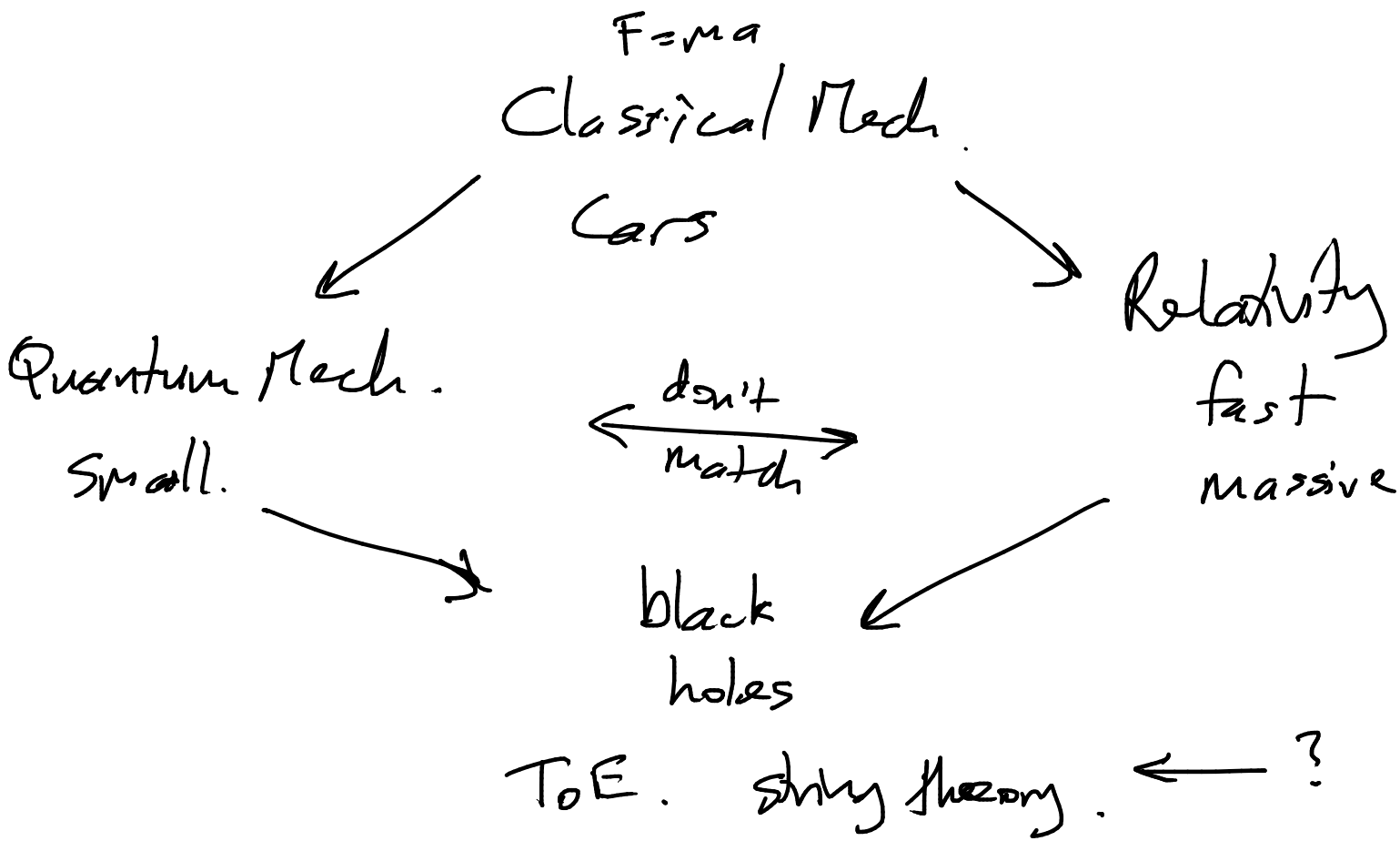
Kinematics

$\vec{a}$

$\sum \vec{F} = m\vec{a}$

Classical mechanics → models of reality.

George Box: "All models are wrong.
Some models are useful."



Classical Mech $\vec{F} = m\vec{a}$

simulation

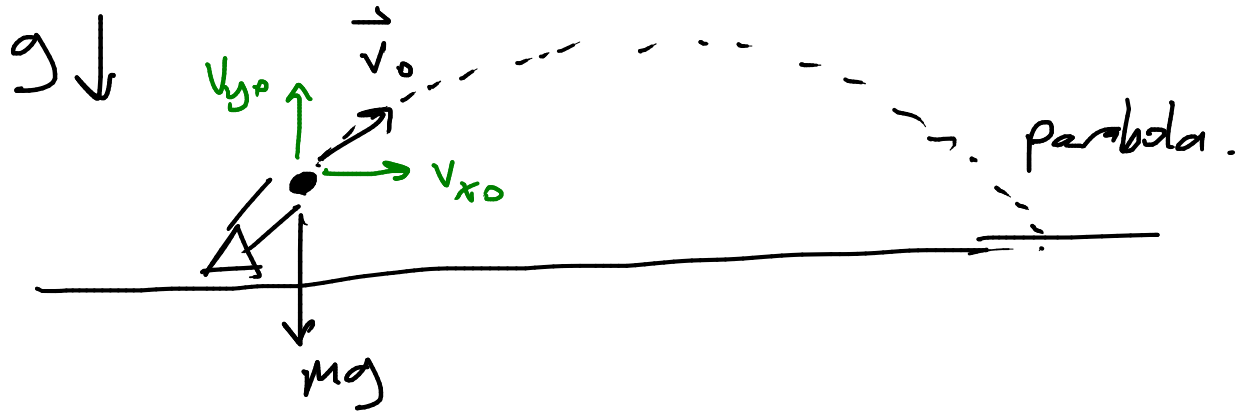
① Method of assumed forces $\vec{F} \rightarrow \vec{a}$

② Method of assumed motion. $\vec{a} \rightarrow \vec{F}$

measurement

Ex assumed forces.

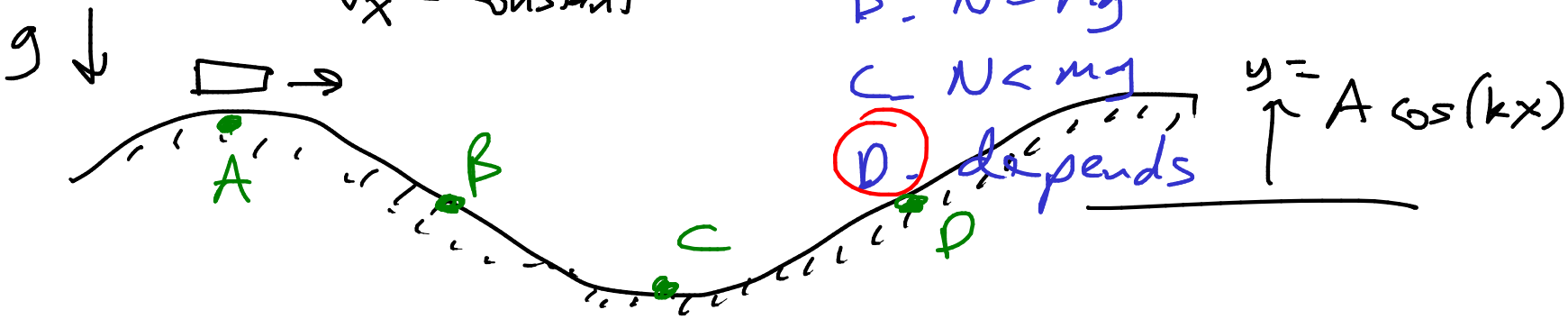
$\vec{F} = m\vec{a}$



N = force of road on car

Ex assumed motion

v_x = constant



A. $N > mg$

B. $N = mg$

C. $N < mg$

D. depends

use $\vec{F} = m\vec{a}$ to compute $\vec{F}$

when does $N = mg$

① FBD

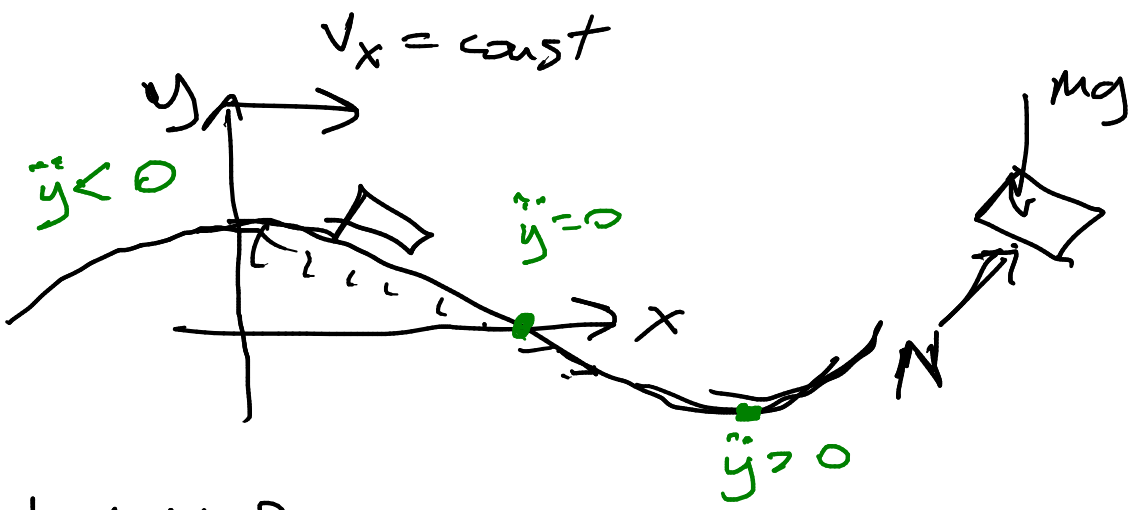
② kinematics → $\vec{a}$

③ Newton: $\vec{F} = m\vec{a}$

④ Algebra: solve for $\vec{F}$

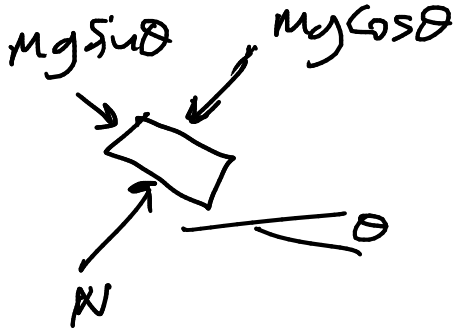
or solve for $\vec{a}$

Ex



$N = mg\cos\theta$

① FBD

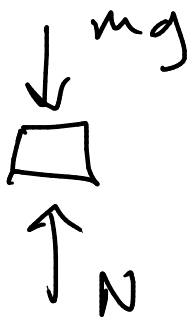


kinematics ②

$y = A\cos kx$

$\dot{y} = -Ak\sin kx\ \dot{x}$ if $\ddot{x} = 0$

$\ddot{y} = -Ak^2\cos kx\ \dot{x}^2$



$\sum \vec{F} = m\vec{a}$

vertical: $N - mg = m\ddot{y}$

(3) Newton

use $F = ma$ to find F

$\ddot{y} < 0$

$N - mg < 0$

$N < mg$

feel light

(4) algebra.

$\ddot{y} > 0$

$N - mg > 0$

$N > mg$

feel heavy.

Method of assumed

A forces

B. motion