Exercises

1	2	3	4

Surname, First name

General Physics : mechanics (PHYS-101(en))
Final exam - Answer booklet

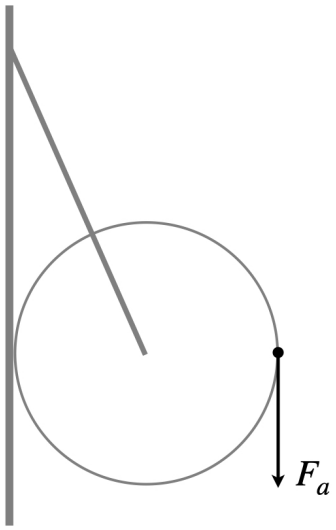
1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9
0	0	0	0	0	0	0

Do not turn the page before the start of the exam. This document is double-sided and has **28** pages, the last ones possibly being blank. Do not unstaple.

- Place your student card on your table.
- A single double-sided sheet of A4 paper (written by you) may be brought to and used during the exam. No other material is permitted.
- Using a calculator or any electronic device is not permitted during the exam.
- Use a black or dark blue pen and clearly erase with correction fluid if necessary.
- If a question is wrong, the teacher may decide to nullify it.

Toilet paper

1a Draw the forces.



1b Determine the torques $\vec{\tau}_g$, $\vec{\tau}_N$, $\vec{\tau}_f$, $\vec{\tau}_T$, and $\vec{\tau}_a$.

$\vec{\tau}_g$ = ...

$\vec{\tau}_N$ = ...

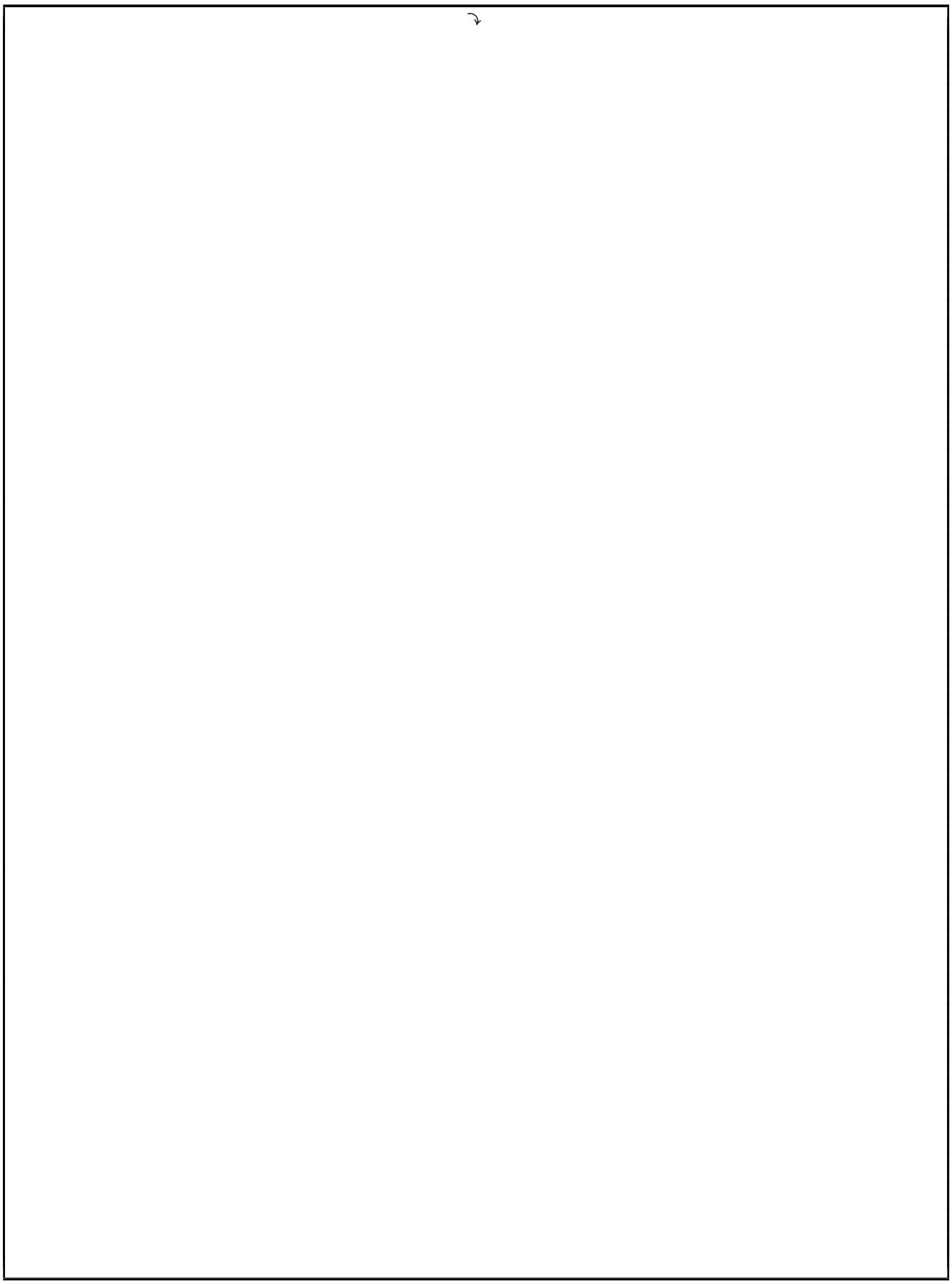
$\vec{\tau}_f$ = ...

$\vec{\tau}_T$ = ...

$\vec{\tau}_a$ = ...

1c Determine the largest value of the force F_a.

F_a = ...



1d Determine the tension $\vec{T}$ and normal $\vec{N}$ forces.

$\vec{T}$ = ...

$\vec{N}$ = ...

1e Determine the angular acceleration α.

α = ...

1f Determine the vertical position $y(t)$.

$y(t)$ = ...

DART mission

2a Determine the orbital velocity $\vec{v}_0$.

$\vec{v}_0$ = ...

2b Determine the mass m_1.

m_1 = ...

↳

2c Determine the mass m_2.

m_2 = ...

2d Determine the velocity $\vec{v}_a$ immediately after the collision.

$\vec{v}_a$ = ...

2e Draw a figure showing the orbits.

2f Determine the velocity $\vec{v}_b$ immediately after the collision.

$\vec{v}_b$ = ...

2g Determine the distance R_2.

R_2 = ...

2h Determine the velocity $\vec{v}_c$ from the new orbit.

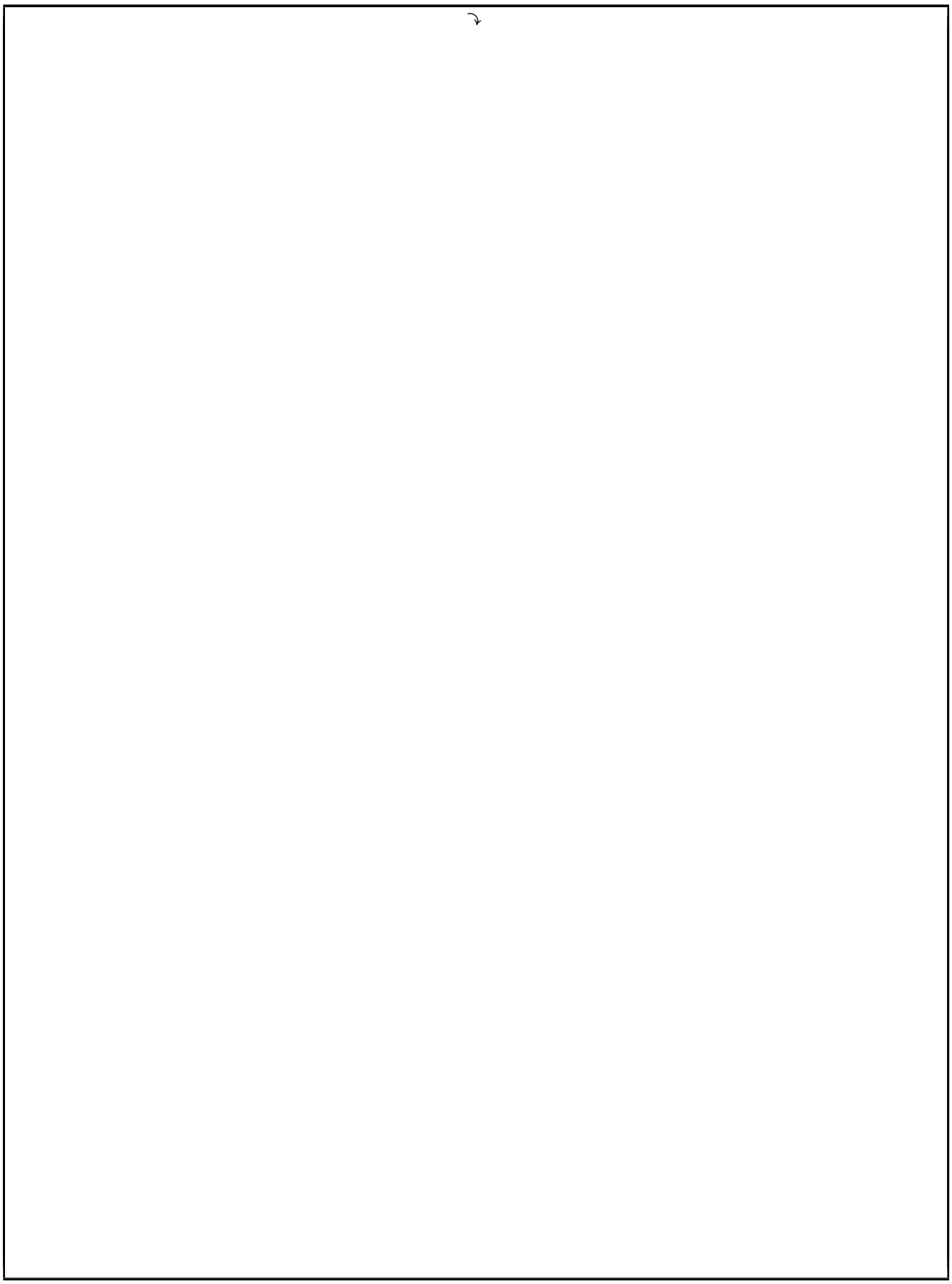
$\vec{v}_c$ = ...

2i Determine the change in velocity $\Delta\vec{v}_s$.

$\Delta\vec{v}_s$ = ...

2j Determine the mass of fuel burnt m_f.

m_f = ...



Tennis serve

3a Determine the speed v_r.

v_r = ...

3b Determine the trajectory of the ball $y(x)$.

$y(x)$ = ...

↳

3c Determine the condition for the ball to pass above the net.

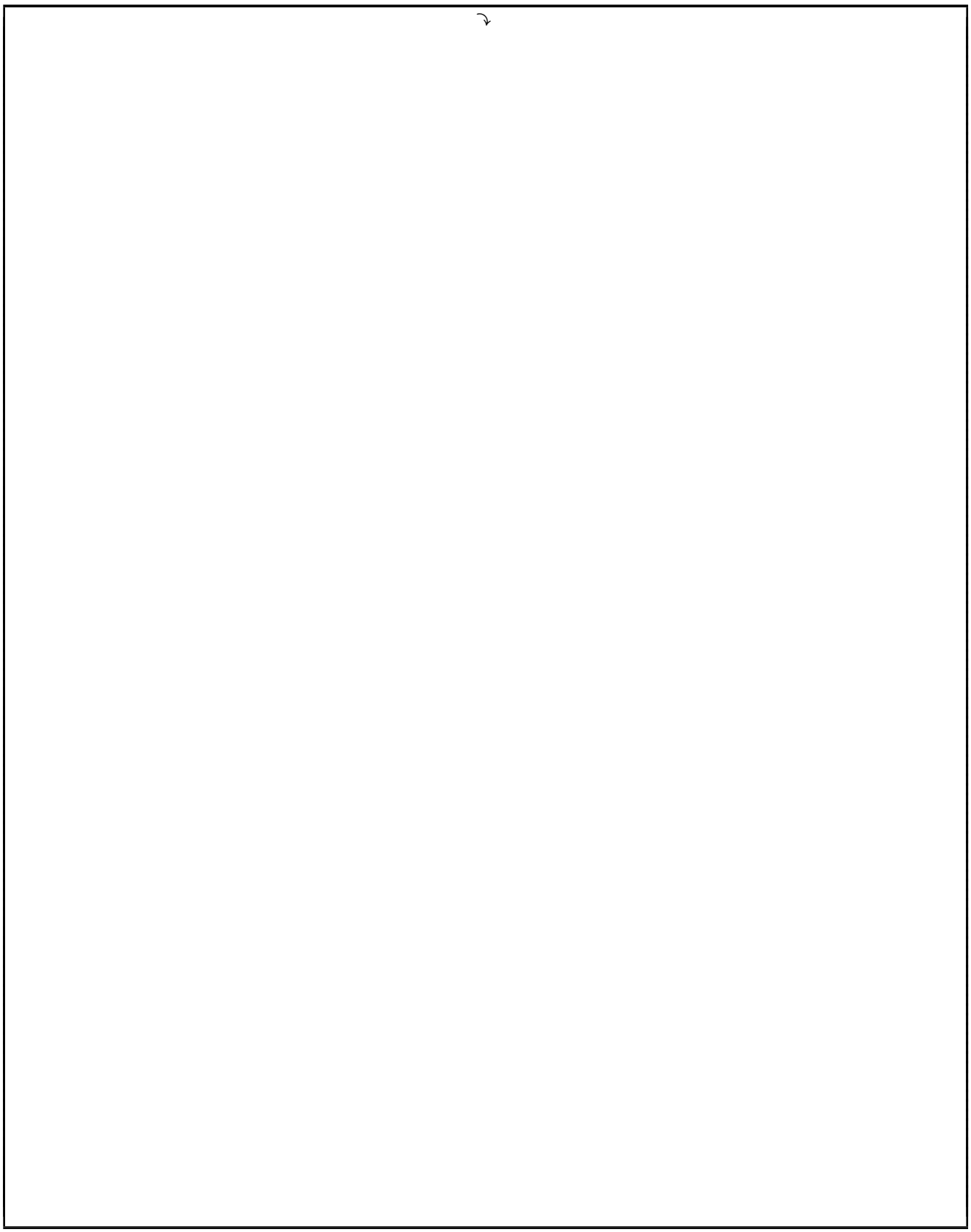
.....

3d Determine the condition for the ball to land before reaching the service line.

.....

3e Determine the minimum height y_0.

y_0 = ...



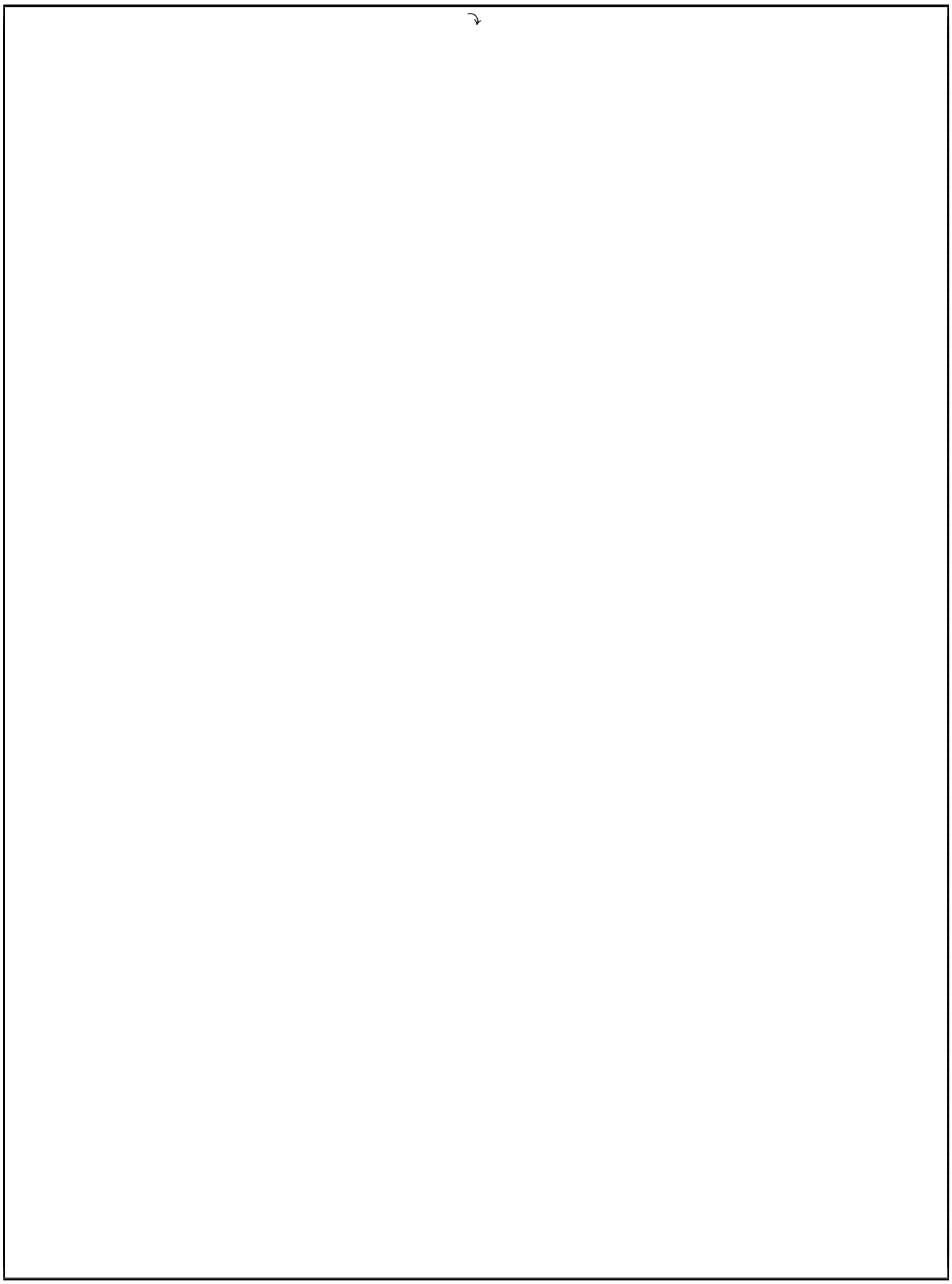
3f Determine the numerical value for the minimum height y_0.

y_0 = ...

3g Determine the trajectory of the ball $y(x)$ with drag.

$y(x)$ = ...

↳



Extra space (if needed)

4a The work below is for part ..... of problem .....

4b The work below is for part ..... of problem .....

4c The work below is for part ..... of problem .....

4d The work below is for part ..... of problem .....

4e The work below is for part ..... of problem .....