MASTERING THE AP PHYSICS FORMULA SHEET

A Tactical User's Manual

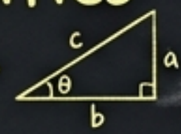
ANATOMY • MECHANICS • STRATEGY

THE SAFETY NET (INCLUDED)

- Kinematics (1D & 2D)
- Newton's Laws
- Work, Energy, Power
- Momentum & Impulse
- Circular Motion & Rotation
- Oscillations & Waves
- Electrostatics & Circuits (AP2)
- Fluids & Thermo (AP2)

THE GAPS (MISSING)

⚠ Trigonometric Identities



$\sin(\theta) = \frac{b}{c}$

$\cos(\theta) = \frac{a}{c}$

$\tan(\theta) = \frac{b}{a}$

⚠ Specific Physical Constants

$g \approx 9.8\ m/s^2$

$G \approx 6.67 \times 10^{-11}\ N \cdot m^2/kg^2$

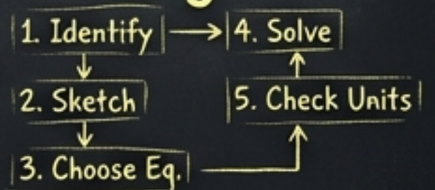
$c \approx 3.00 \times 10^9\ m/s$

⚠ Derived Formulas (Range, Banking Angle)

$R = \frac{v_0^2 \sin(2\theta)}{g}$

$\tan(\theta) = \frac{v^2}{rg}$

⚠ Problem-Solving Strategies



The sheet provides the alphabet.
You must write the sentences.

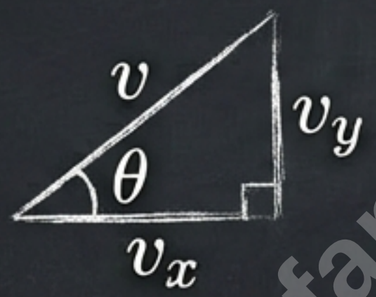
THE INVISIBLE INK

Formulas the College Board Assumes You Own

Vectors

$$v_x = v\cos\theta$$

$$v_y = v\sin\theta$$



Power

$$P = W/t$$

$$P = Fv$$

Linking Variables

$$v = r\omega$$

$$a = r\alpha$$

Don't get caught searching for what isn't there.

MECHANICS: KINEMATICS

$$v_x = v_{x0} + a_x t$$

$$x = x_0 + v_{x0} t + \frac{1}{2} a_x t^2$$

$$v_x^2 = v_{x0}^2 + 2 a_x (x - x_0)$$

CRITICAL: ACCELERATION MUST BE CONSTANT.

If "a" changes, these break. Use Calculus or Energy.

Tactical Tip:
Missing time (t)? Use Eq #3.
Missing distance (x)? Use Eq #1.

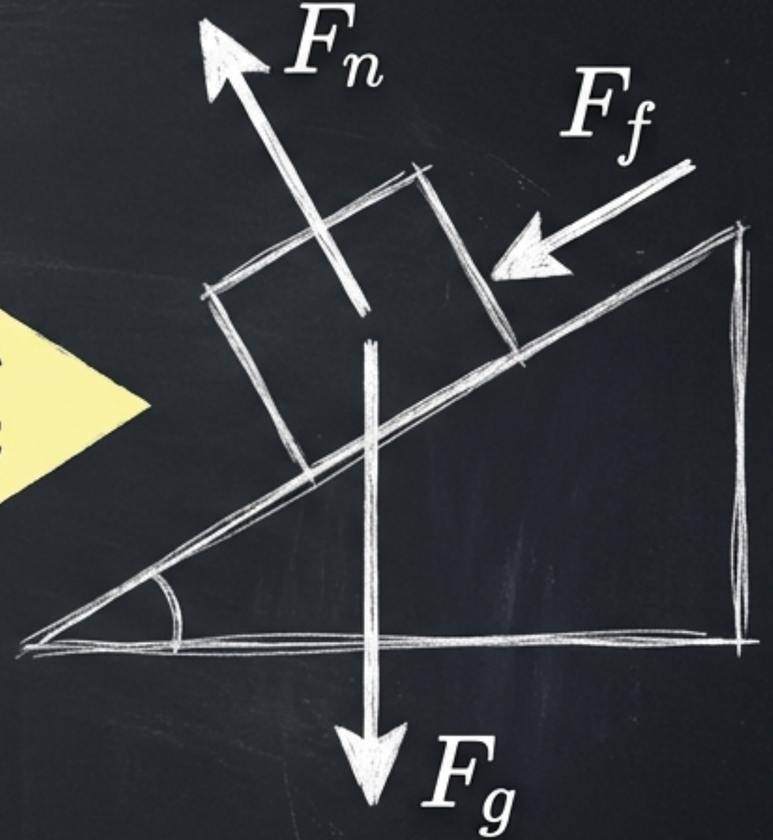
MECHANICS: FORCES

$$F_g = mg$$
Gravity

$$F_f \leq \mu F_n$$
Friction

$$\sum F = ma$$

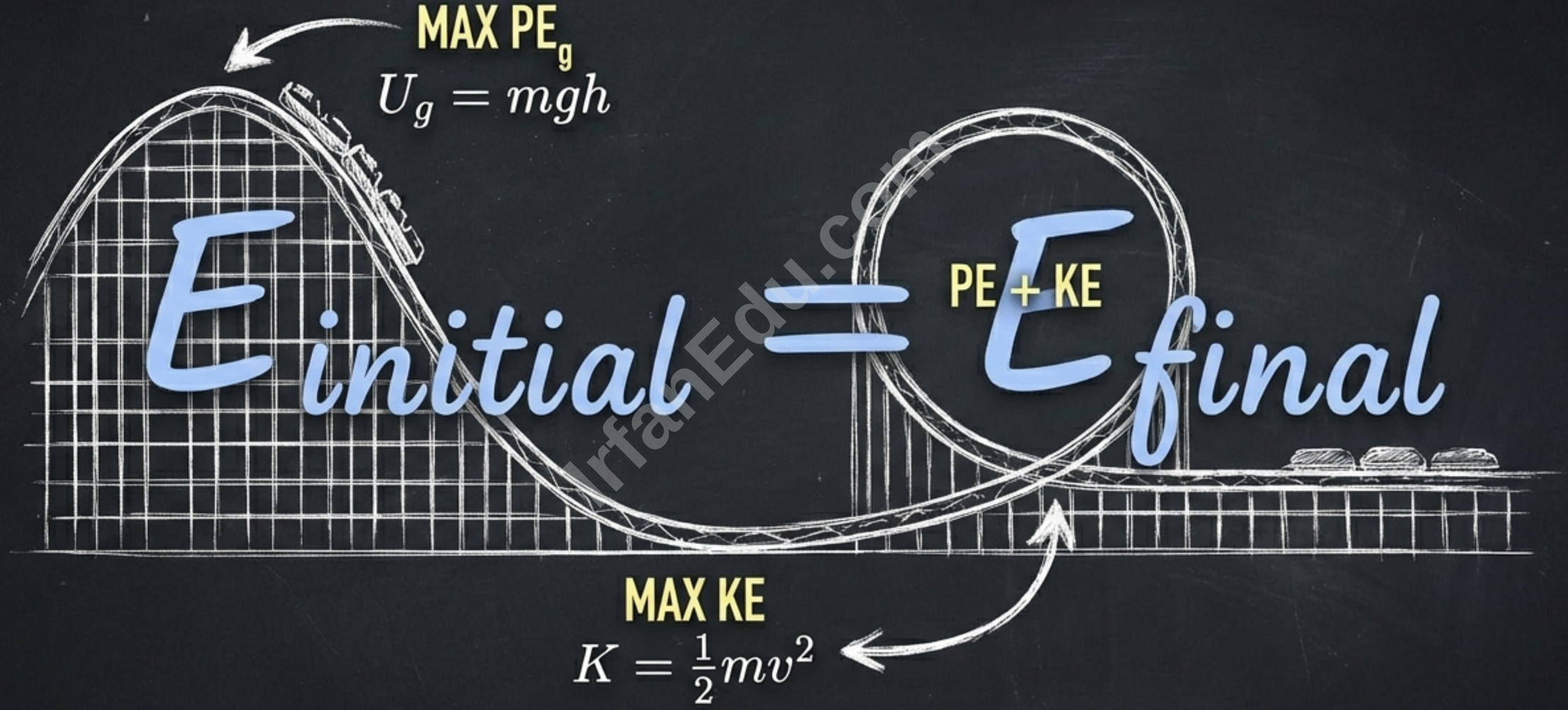
START HERE.
Identify forces,
THEN select
the math.



$$F_c = \frac{mv^2}{r}$$
Centripetal

$$F_g = \frac{Gm_1m_2}{r^2}$$
Universal Gravity

MECHANICS: ENERGY TRANSFER



Energy is a currency that changes forms. If no friction acts, the bank balance never changes.

MECHANICS: MOMENTUM vs. KINETIC ENERGY

$$p = mv$$

$$J = F\Delta t = \Delta p$$

System Type	Momentum (p)	Kinetic Energy (K)
Isolated System	CONSERVED (Always)	Depends on Collision Type
Elastic Collision	Conserved	CONSERVED
Inelastic Collision	Conserved	LOST (to heat/sound)

Momentum is King. It is rarely lost. Energy is picky.

ROTATION: THE MIRROR WORLD

Linear		Angular
Mass (m)	→	Moment of Inertia (I) [Note: Depends on shape!]
Force (F)	→	Torque (τ)
Velocity (v)	→	Angular Velocity (ω)

$$F = ma \qquad \tau = I\alpha$$

Don't fear rotation. It's just linear motion in a circle.

FOUR DANGEROUS MISCONCEPTIONS

Myth: No need to memorize.

False. You have no time to search.

Myth: Formulas work everywhere.

False. Check conditions (e.g. constant acceleration).

Myth: I can skip derivations.

False. The exam tests CREATING formulas.

Myth: The sheet has everything.

False. Vectors & Power are missing.

THE SELECTION ALGORITHM

Identify Knowns & Unknowns

↓

Diagnose Concept

Forces?
Energy?
Momentum?

↓

Select Formula

↓

CHECK CONDITIONS

↓

Solve & Verify

Stop searching blindly. Diagnose the problem before you prescribe the math

THE SECRET WEAPON: UNIT ANALYSIS

$$[m/s]^2 = [m/s^2] \cdot [m]$$

Checking Velocity^2

Checking Acceleration x Distance

$$[m^2/s^2] = [m^2/s^2]$$

Units Match!
Calculation is dimensionally consistent.

The formula sheet doesn't convert units—you do.
If you're solving for velocity but get meters/second^2, the math is wrong.
Use this as your final safety check.

THE STUDY TIMELINE

Weeks 8–10

ORGANIZE

(Group by concept)

Weeks 4–6

MIXED SETS

(Practice switching topics)

Weeks 2–4

SPEED TRAINING

(Locate formula < 10s)

Weeks 0–2

ACTIVE RECALL

(Solve without sheet, then check)

Don’t just solve problems. Train your navigation speed.

HOW TO PRACTICE: THE ANNOTATED SHEET

$$v = v_0 + at$$

$$x = x_0 + v_0 t + \frac{1}{2}at^2$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

Constant "a" only!!

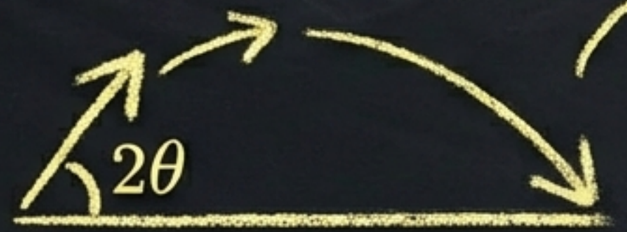
$$F = m\vec{a}$$

Don't forget Direction!

Check Units!

Write all over your practice sheet. Mark the traps. Build the mental map you'll rely on when the clean sheet is in front of you.

Range Formula



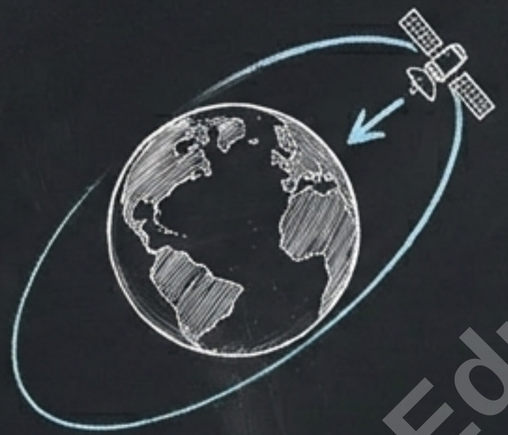
$$R = \frac{v_0^2 \sin(2\theta)}{g}$$

$$= \frac{v_0^2 \sin(2\theta)}{g}$$

WHY WE LEARN THIS

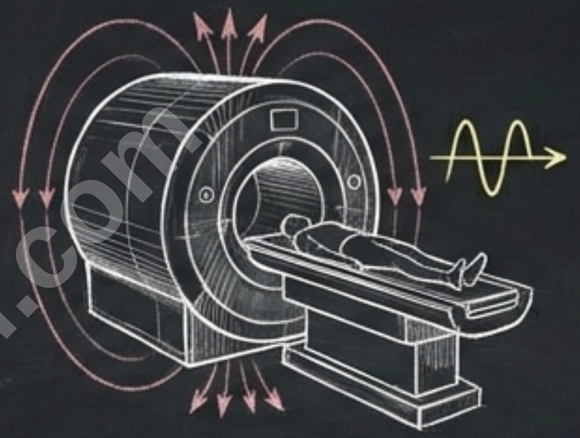
Statics & Forces

Balanced Tensions
Equilibrium
Forces add to zero



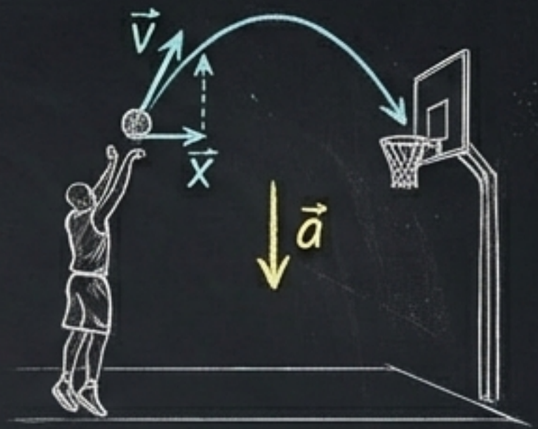
Gravitation

Universal Law
Orbital Mechanics
Kepler's Laws



Magnetism/Waves

Resonance
Spin Flip
Imaging



Projectile Motion

Parabola
Separation of x & y
Range & Height

From bridges to space travel, these equations are the operating system of the physical universe.

1. Know the sheet before you need it.

2. Understand the conditions,
   not just the math.

3. Trust your training.

READY.