

EXAM-DAY · 90-MIN REVISION CARD

Motion in a Plane

Print this · Fold it · Carry to the exam-hall gate · Revise once · Then walk in.

FORMULAS & KEY RESULTS

Vector A in 2D: $A = A_x \hat{i} + A_y \hat{j}$.

Magnitude: $|A| = \sqrt{A_x^2 + A_y^2}$.

Direction: $\tan(\theta) = A_y / A_x$
where θ is angle from +x axis.

Resolution: $A_x = A \cos \theta$,
 $A_y = A \sin \theta$.

Triangle law: place tail of B at head of A; R from tail of A to head of B.

Parallelogram law: $R = \sqrt{A^2 + B^2 + 2AB \cos \theta}$.

Angle of R with A: $\tan(\alpha) = B \sin \theta / (A + B \cos \theta)$.

Dot product: $A \cdot B = AB \cos \theta$ (scalar).

Cross product: $A \times B = AB \sin \theta \hat{n}$ (vector, right-hand rule).

Projectile components: $u_x = u \cos \theta$, $u_y = u \sin \theta$.

Time of flight (ground-to-ground): $T = 2u \sin \theta / g$.

Max height: $H = u^2 \sin^2 \theta / (2g)$.

Horizontal range: $R = u^2 \sin(2\theta) / g$; max at $\theta = 45^\circ$, $R_{\max} = u^2/g$.

Trajectory equation: $y = x \tan \theta - (g x^2) / (2 u^2 \cos^2 \theta)$.

Horizontal projectile from height H: $t = \sqrt{2H/g}$, $R = u \sqrt{2H/g}$.

Centripetal acceleration: $a_c = v^2/r = \omega^2 r$, directed toward centre.

Angular velocity: $\omega = v/r = 2\pi / T$.

TOP 5 PYQ PATTERNS

1 Projectile from ground (5 marks)

5 marks · 95% of years
Resolve u into u_x and u_y . Apply T, H, R formulas in that order.

2 Vector addition (3 marks)

3 marks · 80% of years
Use $R = \sqrt{A^2 + B^2 + 2AB \cos \theta}$. State both magnitude AND angle.

3 Vector resolution (2 marks)

2 marks · 78% of years
 $A_x = A \cos \theta$ (along +x), $A_y = A \sin \theta$ (along +y). θ from +x axis.

4 Uniform circular motion (3 marks)

3 marks · 68% of years
 $a_c = v^2/r$. Always toward centre. Speed constant; direction changes.

5 Horizontal projectile (5 marks)

5 marks · 60% of years
Decouple vertical ($u_y=0$, $a=g$) and horizontal ($u_x=u$, $a=0$) motions.

90-MIN REVISION FLOW

0-15 min

Read scalar vs vector definitions. List 5 of each from everyday physics. Define unit vectors $\hat{i}$, $\hat{j}$, $\hat{k}$.

15-30 min

Practice 3 vector-addition problems (parallelogram law). Verify magnitude AND direction in each.

30-50 min

Derive $R = u^2 \sin(2\theta)/g$ and $H = u^2 \sin^2 \theta / (2g)$ from scratch using independent horizontal and vertical motions.

50-70 min

Solve 2 projectile numericals: one ground-to-ground at $\theta = 30^\circ$, one horizontal launch from a height.

70-85 min

Uniform circular motion — calculate a_c for 3 different (v , r) pairs. Sketch direction of a_c each time.

85-90 min

Review topper template (5 question types, 3-5 marks each). Memorise structure, not numbers.

Confidence, not anxiety. You've practised this all year. Trust your steps. Don't change strategy on exam morning.
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