Multiple Choice Shortcuts
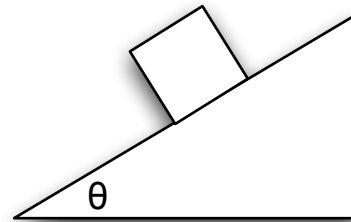## Use g = -10 m/s^2

Free Fall from Rest

Time	Instantaneous velocity	Total Change in position
0	0	0
1 s	-10 m/s	-5 m
2 s	-20 m/s	-20 m
3 s	-30 m/s	-45 m
4 s	-40 m/s	-80 m

Look out for phrases like "falls from rest without air resistance for 45 m".
That means it took 3 s.

Kinematics (constant a)

$$\Delta x = \tfrac{1}{2}(v_0 + v)t$$

Displacement is the average velocity multiplied by time.

"The object goes from rest to 40 m/s in 4 s. How far did it go?"

0 to 40 m/s -> average v = 20 m/s

(20 m/s)(4 s) = 80 m

Frictionless Inclines

If the inclined plane is frictionless, then:
a = g sin θ

Horizontal Projectiles

4 m/s

h = 20 m
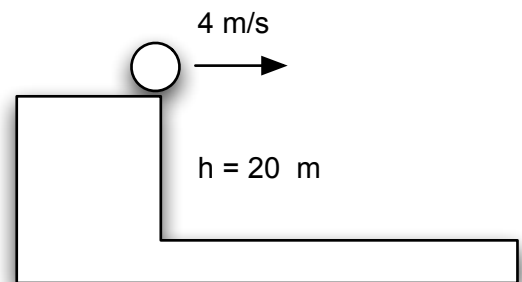
"What distance does the projectile travel in the x-direction?"

If the height is one of the free fall distances, it's quick!

It takes 2 seconds to fall 20 m, and v is constant in the x-direction.

(4 m/s)(2 s) = 8 m

Angled Projectiles that Land at the Same Height

10 m/s

30°
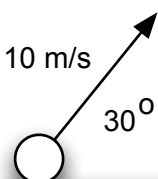
Find Vyo (it's Vo sin θ), then divide by g to get the halfway time.

To get Δx:
Double it to get the whole time
Multiply by Vxo (it's Vo cos θ)

To get Max Height
Find the average Vy (starts at Vyo and ends at 0)
Multiply by the halfway time.

Vyo = 10 sin 30 = 5 m/s

t = 5 m/s / 10 m/s^2 = 0.5 seconds to go halfway.

Vxo = 10 m/s cos 30 = 8.66 m/s
Δx = (8.66 m/s) (1 s) = 8.66 m

average Vy = 1/2(5 m/s + 0) = 2.5 m/s
max height = (2.5 m/s)(0.5 s) = 1.25 m