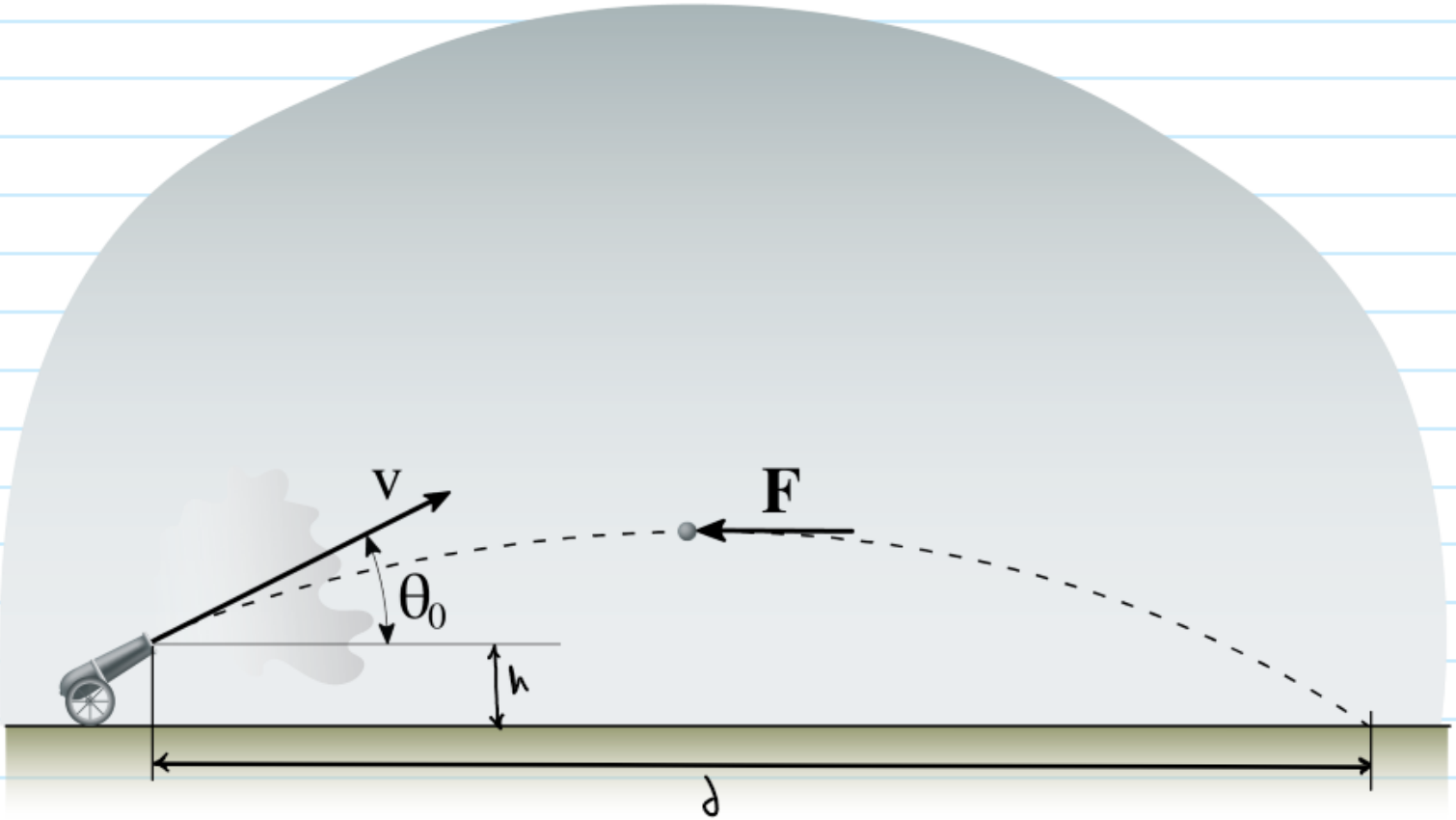
21-P-FA-GD-004

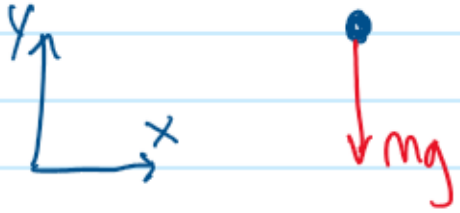


A m cannonball is fired across a field with an initial velocity of v, at an angle of θ above the horizontal. The cannon barrel is at height h. Determine the distance travelled by the cannonball when:

a) There is no external force applied (besides gravity).

b) There is an easterly wind applying a force of F N.

a) FBD



initial velocity

$V_x = V\cos\theta$

$V_y = V\sin\theta$

given V, m, θ, h, g

find d

x

no acceleration in x dir

$V_{xi} = V_{xf}$

Knowing time to impact, find distance travelled...

$d = 0 + V\cos\theta\, t$

y

$0 = h + V\sin\theta\, t - \frac{1}{2}gt^2$

$t = \frac{-V\sin\theta \pm \sqrt{V^2\sin^2\theta + 2gh}}{-g}$ ← simplified quadratic formula

$t = \frac{V\sin\theta \pm \sqrt{V^2\sin^2\theta + 2gh}}{g}$

time until impact (use positive!)

b) FBD

same initial velocity and same impact time as part a).

given v, θ, m, h, g, F, t

find d

x

$$\Sigma F_x = ma_x = -F$$

$$a_x = -F/m$$

$$d = 0 + V\cos\theta\, t - \frac{1}{2} a_x t^2$$