Physics and Math in a Golf Swing

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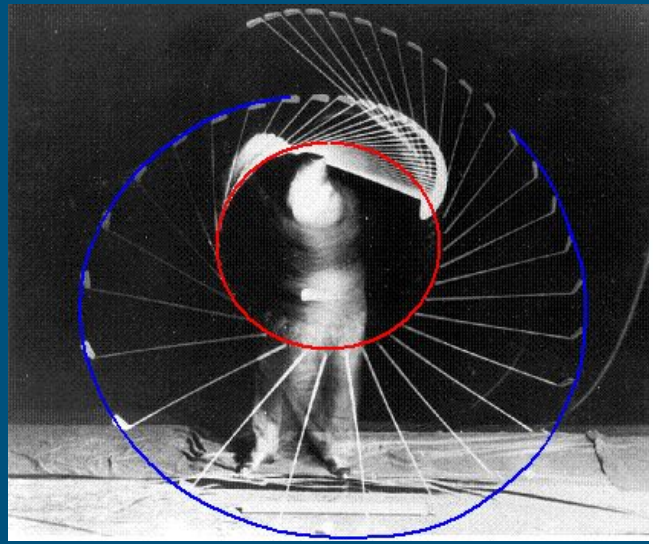
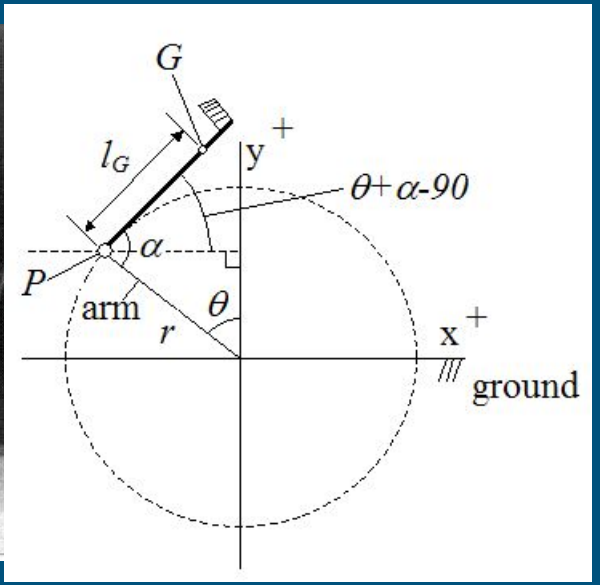
Golf Basics

- Hitting a “plastic” ball a long distance
- Maximum of 14 clubs in a bag
  - Driver, irons, putter
- Least amount of strokes
  - ie. lower scores win
- Scores with weird names
  - Bogey, birdie, par, eagle, albatross

Complicated Sport

- Lots of physics
  - Rotation and torque
  - Energy transfer
  - Pendulum like motion
  - Club material
  - Ball specifications
- Physical challenges
  - Body timing
  - Age





Swing Aspects

- Swing speed
- Club head speed
- Ball speed
- Angle of Attack (AoA)
- Launch angle
- Spin rate
- Loft angle

Optimal Swing (irons)

- Center of club face
- Negative AoA
  - Lowers spin rate
  - “Piercing“ ball flight

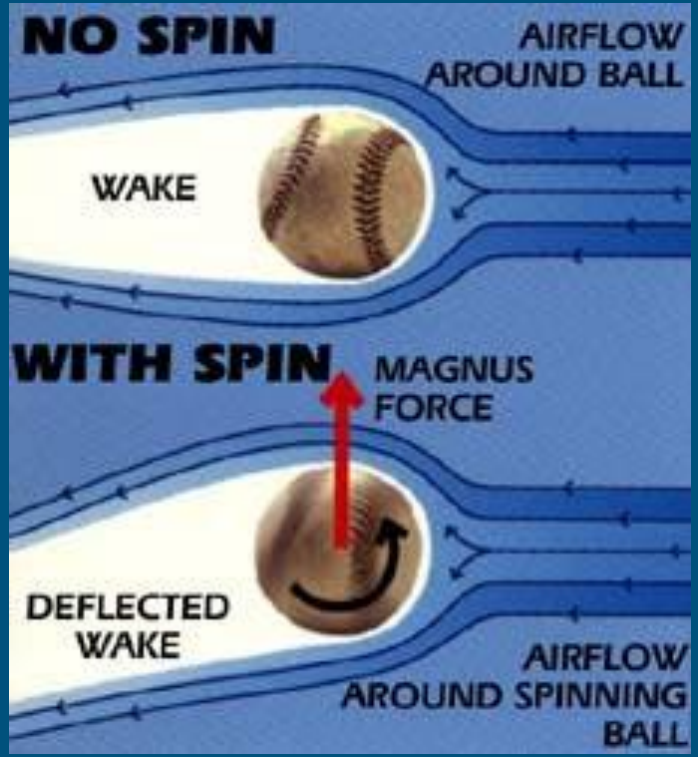
https://www.youtube.com/watch?v=AEkLBC6A7rg

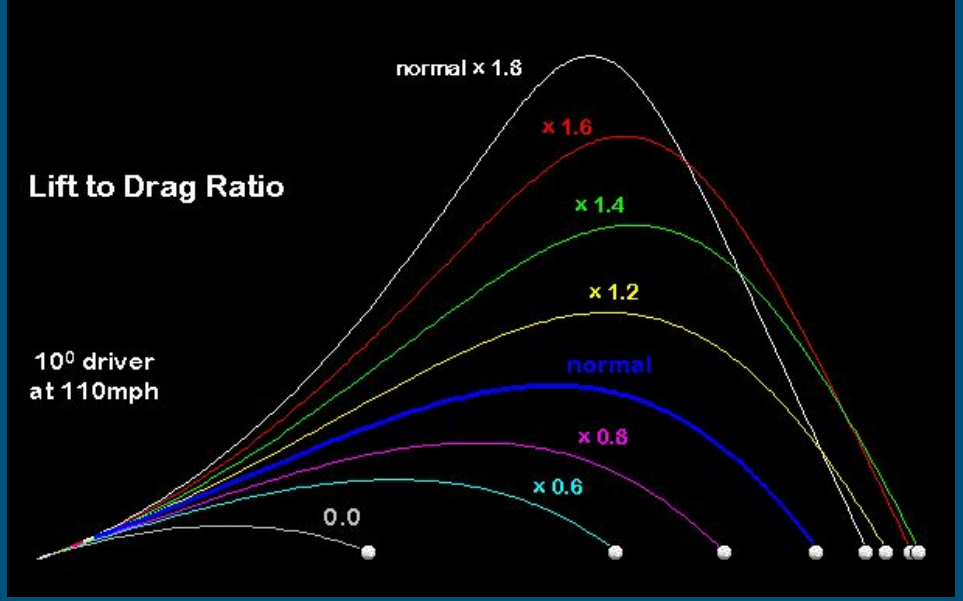
Why lower spin?

Magnus Effect

- Spin causes air to push
  - Curved flight path

https://www.youtube.com/watch?v=2OSrvzNW9FE





Optimal Launch and Spin

Optimal Launch and Spin

Driver Ball Speed	-10°	-8°	-6°	-4°	-2°	0°	2°	4°	6°	8°	10°
180mph • 290km/h	3.6° 3450	4.9° 3250	6.2° 3050	7.5° 2850	9.0 2700	10.4 2550	11.9° 2400	13.3° 2200	14.8° 2050	16.4° 1950	17.9° 1800
170mph • 274km/h	4.3° 3500	5.7° 3300	6.9° 3100	8.2° 2900	9.6° 2750	11° 2550	12.4° 2400	13.9° 2250	15.3° 2100	16.8° 1950	18.2° 1800
160mph • 257km/h	5.2° 3500	6.5° 3300	7.7° 3100	9° 2950	10.3° 2750	11.7° 2600	13° 2400	14.4° 2300	15.9° 2100	17.3° 1950	18.7° 1800
150mph • 241km/h	6.2° 3500	7.4° 3350	8.6° 3150	9.8° 2950	11.1° 2750	12.4° 2600	13.7° 2450	15.1° 2300	16.4° 2150	17.9° 2000	19.3° 1850
140mph • 225km/h	7.3° 3550	8.3° 3300	9.5° 3150	10.7° 2950	12° 2800	13.2° 2600	14.5° 2450	15.8° 2300	17.2° 2150	18.5° 2000	19.9° 1850
130mph • 209km/h	8.4° 3500	9.4° 3300	10.6° 3150	11.7° 2950	12.8° 2750	14.1° 2600	15.3° 2450	16.6° 2300	17.9° 2150	19.2° 2000	20.6° 1850
120mph • 193km/h	9.6° 3450	10.6° 3250	11.6° 3100	12.7° 2900	13.8° 2750	15° 2600	16.2° 2450	17.4° 2300	18.7° 2150	19.9° 2000	21.2° 1850
110mph • 177km/h	10.9° 3400	11.8° 3200	12.7° 3000	13.9° 2850	14.9° 2700	15.9° 2550	17.1° 2400	18.2° 2250	19.5° 2100	20.7° 1950	21.9° 1850
100mph • 161km/h	11.9° 3250	12.9° 3100	13.9° 2950	14.9° 2800	15.9° 2600	16.9° 2450	18° 2300	19.1° 2150	20.3° 2050	21.4° 1900	22.6° 1750
90mph • 145km/h	12.7° 3050	13.9° 2950	15° 2800	15.9° 2650	16.9° 2500	18° 2350	19° 2200	20° 2100	21.1° 1950	22.2° 1850	23.3° 1700
80mph • 129km/h	13.8° 2800	14.5° 2650	15.8° 2600	16.9° 2450	17.8° 2350	18.8° 2200	19.9° 2100	20.8° 1950	21.8° 1800	22.9° 1700	24° 1600

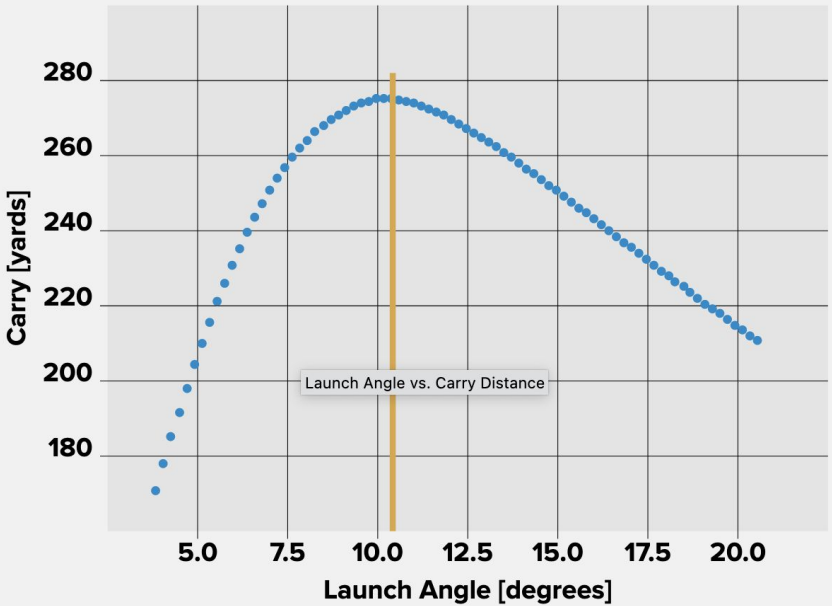
Angle of Attack

Legend

- 325y 297m
- 300y 274m
- 275y 251m
- 250y 229m
- 225y 206m
- 200y 183m
- 175y 160m
- 150y 137m
- 125y 114m

Chat

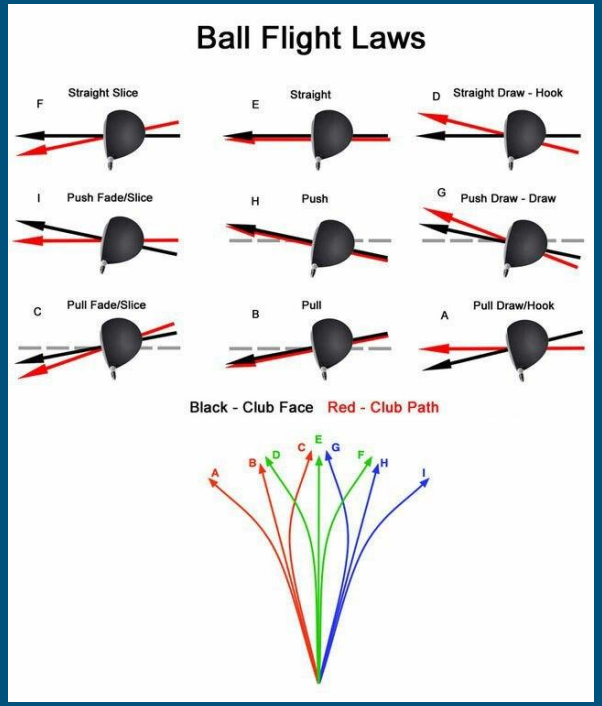
Launch Angle vs. Carry Distance



Launch angle vs. carry for simulated drives with 113 mph club speed and -1.5 angle of attack

Complicated Sport

- More than just the swing
  - Shot shapes
  - Ball flights
  - Equipment differences
- External factors
  - Weather
  - Course location
  - Temperature
  - Ball lie



Other Sports?

- Football
- Basketball
- Soccer

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