

NEWTON'S 2nd Law

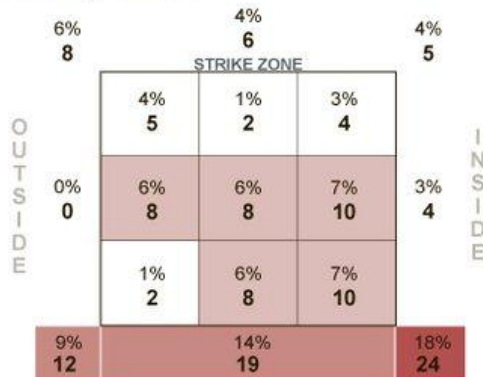
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Santana's Mastery, Pitch by Pitch

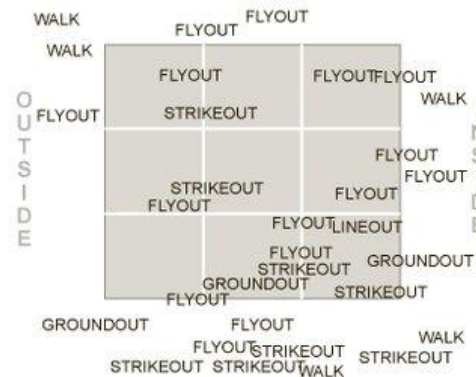
	Pitch Velocity			Avg. Velocity by Pitch Count								
	AVG.	LOW	HIGH	1-15	16-30	31-45	46-60	61-75	76-90	91-105	106-120	121+
FASTBALL	88	85	90	89	88	88	88	88	88	88	88	88
SLIDER	80	77	84	83	83	80	81	80	80	78	80	—
CHANGEUP	77	74	82	79	77	77	77	78	78	77	76	77

Pitches by Location



Source: Inside Edge

Results by Pitch Location



METS 8, CARDINALS 0

Santana, Pushing Past Pitch Count, Throws Mets' First No-Hitter

What stood between the [Mets](#) and the first no-hitter in their 51-season history was a matter of inches, Carlos Beltran and one deceiving baseball. [Johan Santana](#) was supposed to have a pitch count, but his left shoulder was not supposed to be this healthy, and for how well he danced with fate all night, it would not have mattered how many pitches he threw.



Johan Santana threw 134 pitches with 8 strikeouts against the Cardinals.

INTRODUCTON: Santan's pitch starts from rest and his throw is 7 feet from start of throw(see picture at left) to when the ball(5 1/8 oz) in his hand is released at 88 mph(mi/hr). So, $V_{\text{initial}} = 0$, $V_{\text{final}} = 88$ mph(fastball), $X = 7$ ft.

QUESTIONS: (a) Find weight of ball in pounds? (b) Find mass of ball in slugs? (c) Convert 88 mph to ft/s? (d) Find acceleration $a = ?$ (ft/s²) of ball during the throwing process?(e) Find force on ball during the 7 ft throwing process?

HINTS: 16 oz/pound, $W = mg$, $g=32$ ft/s², 88 ft/s = 60 mph, $F = ma$

ANSWERS: (a) .33 lb., (b) 0.0103 slugs, (c) 129.1 ft/s., (d) 1190.5 ft/s², (e) ~ 12.2 lb.

But in the sixth inning, on his way **to throwing a no-hitter** against the [St. Louis Cardinals](#) on Friday at Citi Field, Santana left a pitch where Beltran could pull it down the left-field line. It appeared to be a fair ball, what would have been a double, what would have ended the no-hitter. But the third-base umpire, Adrian Johnson, [called it foul](#), and Beltran then grounded out.