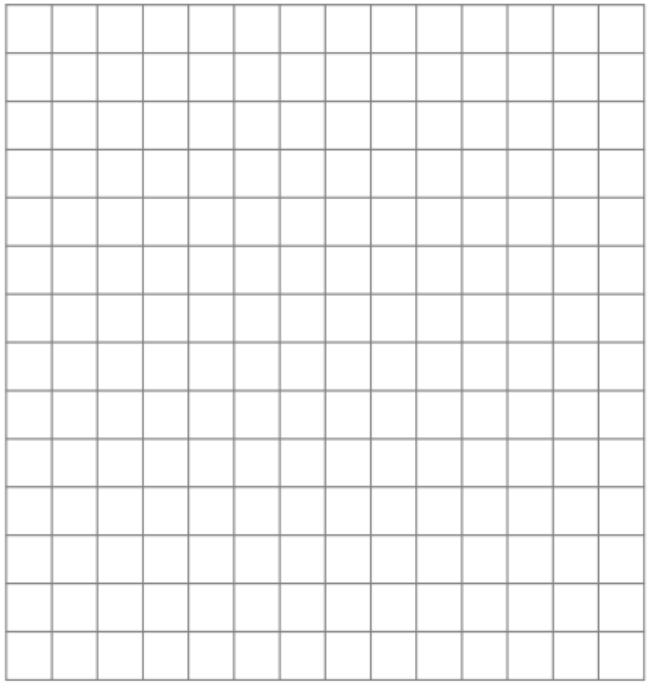
40 Meter Sprint

Back in 2009, Jamaican sprinter Usain Bolt ran the 100-meter dash in a record setting time of 9.58 seconds. A recent study highlights the astounding physics behind this unprecedented human achievement. An interesting thing about Bolt is that he's 6ft 5in tall. That means he needs to expend a bit more energy than the average sprinter in order to overcome the drag caused by wind resistance; he's actually not very aerodynamic relative to other runners. But that said, his record was the biggest increase since timing was introduced in 1968. He's truly a freak of nature. According to a mathematical model that now appears in the European Journal of Physics, Bolt's maximum power occurred when he was less than one second into the race — but while he was running at only half his eventual maximum speed, which registered at the jaw-dropping rate of 12.2 meters per second (40 feet/second), or 43.92 km/h (27 mph). His acceleration out of the starting blocks clocked in at 9.5 meters per second squared, (31.2 ft/s2, which is almost 0.97 g (the acceleration due to Earth's gravity), and he generated an incredible 2.6 kilowatts of power (3.5 horsepower) less than a second later. The study also showed that less than 8% of the energy his muscles generated was used for motion, the rest absorbed by drag. The physicists suspect that Bolt makes up for his large frame and slow reaction-time by virtue of his tremendous stride and fast twitch muscle fibers. Interestingly, Bolt ran the 100-meters with a slight wind at his back. But even without that assist, calculations showed he would have finished the race only 0.1 second slower — which would still have still resulted in a world record.

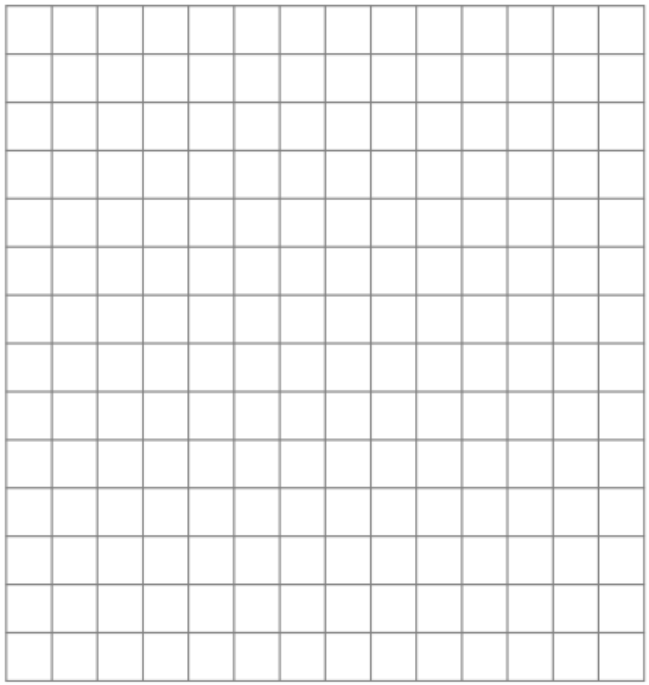
https://gizmodo.com/the-physics-of-usain-bolts-world-record-100-meter-dash-924744818

	Time (seconds)		**Velocities (m/s)**		**Acceleration (m/s2)**	
Distance (m)	Bolt	You	Bolt	You	Bolt	You
0m	0 s					
10m	1.85 s					
20m	2.89 s					
30m	3.78 s					
40m	4.64 s					

Position (m) vs Time (s)



Acceleration (m/s2) vs Time (s)



Velocity (m/s) vs Time (s)