100, 200, and 400m Sprint Time Estimates by C. D. Chester

Brian Mackenzie[1] is a sports coach with a specialty in endurance and conditioning. His website https://www.brianmac.co.uk holds many of his views/guidelines. His view on predicting track and field athlete's sprint times is the purpose of this article. Brian has set up two distinct online calculators to estimate an athlete's performance. One predicts 30m to 250m times[2] and the other 150m to 600m[3].

Both calculators are modeled off Frank W. Dick's data in *Sprints and Relays* (fifth edition)[4]. First, using the 30m to 250m calculator, I entered in 11 distinct 100m times and noted their supposed 200m estimation.[5] It yielded this formula[6]:

$$\mathbf{200m \approx -\left(\frac{32}{825}\right)[(100m)^2] + \left(\frac{2239}{750}\right)(100m) - \left(\frac{6603}{1100}\right); 10 \leq 100m \leq 15}$$

Using the 150m to 600m calculator, I then tested using distinct values for the 200m.[7] It yielded:

$$\mathbf{400m \approx -(0.0444225)[(200m)^2] + (4.7667)(200m) - (34.544); 44 \leq 400m \leq 66}$$

The ranges of applicable 100m and 400m are from Brian's calculators if you were wondering.

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[1] *About* https://www.facebook.com/pg/Anaerobic/about/?ref=page_internal
[2] *30m to 250m time Predictions* https://www.brianmac.co.uk/sprints/pred250.htm
[3] *150m to 600m time Predictions* https://www.brianmac.co.uk/sprints/pred600.htm
[4] DICK, F. (1987) Sprints and Relays. 5th ed. London: BAAB. p. 22-23
[5] Refer to Figure 1 to see all the data used for the regression.
[6] Note that the decimals repeat so I turned them into their fraction equivalents.
[7] Refer to Figure 2 to see all the data used for the regression.

Throughout the different regression types quadratics easily won, thus the relationships[8] are not linear as you can observe from Figure 1 and 2. A very accurate r correlation is reached; most times the quadratic regression has several extra 9's in comparison to the other regression formats. One last thing to note is that when using these predictions round to the nearest hundredth.

So how did the formulas hold up? Well I tried it for myself[9] and these were my results with the amount of error:

100m	Est. 100m-2	Est. 100m-4	Avg. Error	200m	Est. 200m-1	Est. 200m-4	Avg. Error	400m	Est. 400m-1	Est. 400m-2	Avg. Error
11.66	11.64	11.5	0.77%	23.49	23.53	23.2	0.7%	52.12	53.02	52.92	3.26%

Thus, to generalize, the formulas predict the 100m and 200m within 1% and the 400m within 5%. You can try this for other real-world PR's and the numbers will however around the same percent errors. So, to fix the formulas, to add the uncertainty error:

$$\therefore \mathbf{200m \pm 1\% \approx -\left(\frac{32}{825}\right)[(100m)^2] + \left(\frac{2239}{750}\right)(100m) - \left(\frac{6603}{1100}\right); 10 \leq 100m \leq 15}$$

$$\therefore \mathbf{400m \pm 5\% \approx -(0.0444225)\left[(200m)^2\right] + (4.7667)(200m) - (34.544); 44 \leq 400m \leq 66}$$

Note that you can use these two formulas to get any of the three estimates using just one value (100m, 200m, or 400m); hence, the double estimates in the table.

[8] Relationship between the 100m and 200m and 200m to 400m.
[9] I used my personal FAT bests in the 100m, 200m, and 400m.

data

No.	x	y
1	10	19.97
2	10.5	21.07
3	11	22.14
4	11.5	23.2
5	12	24.24
6	12.5	25.25
7	13	26.25
8	13.5	27.23
9	14	28.19
10	14.5	29.13
11	15	30.05

(Inc/Dec of the row)

select: Quadratic regression $y=A+Bx+Cx^2$

Execute Clear Store/Read Print 10dgt

function	value
mean of x	12.5
mean of y	25.15636364
correlation coefficient r	0.9999997669
A	-6.00273
B	2.985333
C	-0.0387879

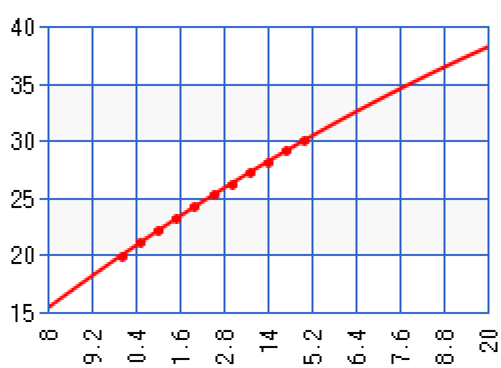

Figure 1

(input by clicking each cell in the table below)

data

No.	x	y
1	20.33	44
2	20.67	45
3	21.01	46
4	21.36	47
5	21.71	48
6	22.06	49
7	22.42	50
8	22.78	51
9	23.15	52
10	23.52	53
11	23.9	54
12	24.28	55
13	24.67	56
14	25.06	57
15	25.45	58
16	25.85	59
17	26.26	60

(Inc/Dec of the row)

select: Quadratic regression $y=A+Bx+Cx^2$

Execute Clear Store/Read Print 14dgt

function	value
mean of x	23.204705882353
mean of y	52
correlation coefficient r	0.99999898573173
A	-34.544015346
B	4.7667012668
C	-0.04442251036

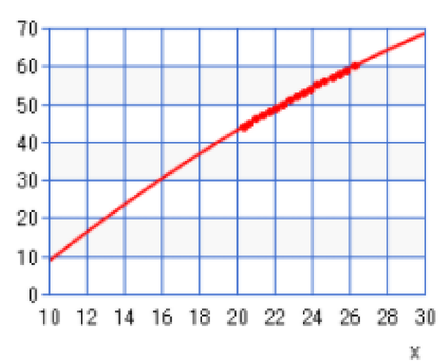

Figure 2