6.4 Curves of Best Fit

curve of best fit: a curved line that best approximates the trend in a scatter plot

EXAMPLE 1 Using technology to solve a quadratic problem

Audrey is interested in how speed plays a role in car accidents. She knows that there is a relationship between the speed of a car and the distance needed to stop. She has found the following experimental data on a reputable website, and she would like to write a summary for the graduation class website.

x y

Speed (km/h)	Distance (m)	Speed (km/h)	Distance (m)	Speed (km/h)	Distance (m)
90	94.4	38	21	83	130.4
36	17	92	111	50	29.1
65	49.2	22	5.6	48	37
56	50.3	31	16.8	45	20.7
65	43.1	50	40	81	86
24	10.9	52	51.2	42	20.6
35	14.2	33	15.9	31	14
55	57.3	27	7.4	38	21
81	76.5	33	20.7	29	11
83	100.3	32	17.9	77	112.3
25	9.1	47	41.9	76	84.1
25	10	95	105.2	55	35.3
77	77.8	24	6.7	79	81.8
32	14.9	23	6.9	23	6.2
76	67.3	79	63.6	49	35

x_{min} x_{max} y_{min} y_{max}

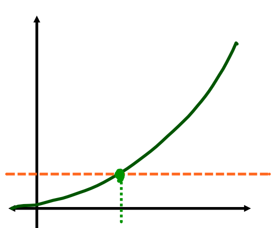
a) Plot the data on a scatter plot. Determine the equation of a quadratic regression function that models the data. $y = 0.00828x^2 + 0.53987x - 10.44948$

b) Use your equation to compare the stopping distance at 30 km/h with the stopping distance at 50 km/h, to the nearest tenth of a metre. $d = 13.2\,m$

c) Determine the maximum speed that a car should be travelling in order to stop within 4 m, the average length of a car. $d = 37.24$

$y = 4\,m$

$x = 20.4$ km/h



→ 2nd $\boxed{\text{calc}}$

→ 5: intersect

→ enter ×3

let's say we need to stop within 50 m to avoid a moose

→ $y_2 = 50 \Rightarrow x = 58.9$ km/hr

EXAMPLE 2 Solving a problem with a cubic regression function

The following table shows the average retail price of gasoline, per litre, for a selection of years in a 30-year period beginning in 1979.

x y

Years after 1979	Price of Gas (¢/L)	Years after 1979	Price of Gas (¢/L)
0	21.98	17	58.52
1	26.18	20	59.43
2	35.63	22	70.56
3	43.26	23	70.00
4	45.92	24	74.48
7	45.78	25	82.32
8	47.95	26	92.82
9	47.53	27	97.86
12	57.05	28	102.27
14	54.18	29	115.29

Xmin Ymin Xmax Ymax

Statistics Canada

a) Use technology to graph the data as a scatter plot. What polynomial function could be used to model the data? Explain.

looks cubic ... looks like 2 turning points

$y = 0.01228x^3 - 0.46451x^2 + 6.29563x + 23.45162$

b) Determine the cubic regression equation that models the data. Use your equation to estimate the average price of gas in 1984 and 1985.

c) Estimate the year in which the average price of gas was 56.0¢/L.

1984 − 1979 $\Rightarrow x = 5$

$y = 44.85$

$\boxed{\text{calc}}$ $\boxed{\text{value}}$

1985: $x = 6$ $y = 47.15$ ¢/L

$y_2 = 56.0 \rightarrow$ find point of intersection (POI)

2^{nd} $\boxed{\text{calc}} \rightarrow \boxed{5} \rightarrow$ enter 3x

$\boxed{X = 16.5} + 1979 = \boxed{1995.5}$

Your Turn

The actual average prices of gas in 1984, 1989, and 1995 were 69.4¢/L, 72.1¢/L, and 80.1¢/L, respectively. Add these data points to the table, and use interpolation to determine a new average price of gas in 1985.

Homefun: Pg. 419 # 2, 3, 4, 7, 8, 10