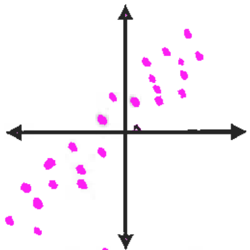
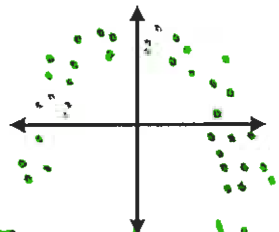
6.4 – Modelling Data with a Curve of Best Fit

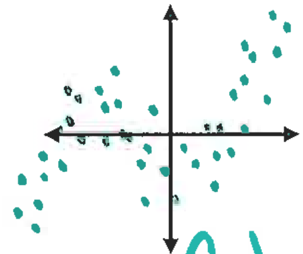
You can use a scatter graph to identify the type of curve that best fits the data



Linear



Quadratic



Cubic

Example 1: (Pg. 414) 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.

Make Scatter Plot on Calc to choose best fit curve.

STAT Edit (enter Data L_1, L_2)

STAT PLOT ENTER ON

2nd Y=

X list : L_1

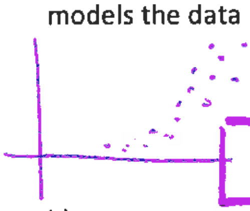
Y list : L_2

GRAPH

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

a) Graph the data on a scatter plot and determine the equation of the regression function (best fit) that models the data

Not quite a straight line. More like Quadratic. So STAT → CALC 5:QuadReg



$$\boxed{y = 0.008x^2 + 0.54x - 10.45}$$

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

30 km/h

$y = 0.008(30)^2 + 0.54(30) - 10.45$

$y = 12.95\text{m}$

$= 13.0$

Almost 3 times bigger at 50 km/h

50 km/h

$y = 0.008(50)^2 + 0.54(50) - 10.45$

$y = 36.55\text{ m}$

$= 36.6$

c) Determine the maximum speed that a car should be travelling in order to stop within 4 m, the average length of a car. (find x when $y = 4$)

$4 = 0.008x^2 + 0.54x - 10.45$

$-4 \qquad\qquad\qquad -4$

$0 = 0.008x^2 + 0.54x - 14.45$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \dfrac{-0.54 \pm \sqrt{0.54^2 - 4(0.008)(-14.45)}}{2(0.008)}$

$x = \dfrac{-0.54 \pm \sqrt{0.754}}{0.016}$

$\boxed{x = 20.5\text{ km/h}}$ OR -88 km/h Reject

Example 2: (Pg. 416) 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.

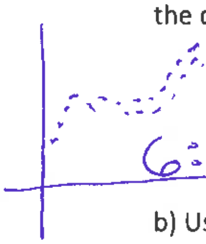
x = years (after 1979)

y = Price ¢/L

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

Statistics Canada

a) Use technology to graph the data as a scatter plot. What polynomial function could be used to model the data? Determine the regression equation (best fit) that models the data.



6:CubicReg

$y = 0.012x^3 - 0.465x^2 + 6.3x + 23.45$

b) Use your equation to estimate the average price of gas in 1984 and 1985.

1984 (5 years after 1979)

$y = 0.012(5)^3 - 0.465(5)^2 + 6.3(5) + 23.45$

$y = 44.83$ ¢/L

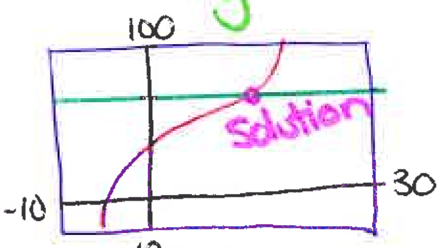
1985 ($x = 6$)

$y = 0.012(6)^3 - 0.465(6)^2 + 6.3(6) + 23.45$

$y = 47.10$ ¢/L.

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

Use your Calculator $Y_1 = 0.012x^3 - 0.465x^2 + 6.3x + 23.45$ and $Y_2 = 56.0$ Then find Intersect



$\boxed{\text{CALC}}$ 5: intersect

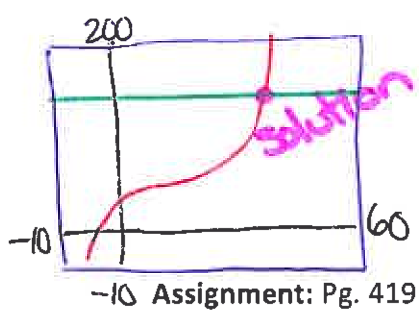
2nd Trace

$x = 17.85$ (18)

year = 1979 + 18 = $\boxed{1997}$

d) Estimate in which year the average price of gas will be \$1.60/L

↳ $y = 160$ ¢/L



$Y_1 = 0.012x^3 - 0.465x^2 + 6.3x + 23.45$

$Y_2 = 160$

$\boxed{\text{CALC}}$ 5: intersect

$x = 33.25$

(33)

year = 1979 + 33 = $\boxed{2012}$

Assignment: Pg. 419 #1 – 7