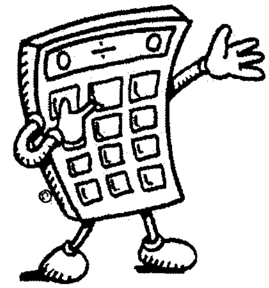
ICM Notes on Applications of Polynomials



reminders about how to use your calculator . . .

Enter Data in List
Press STAT button
Clear your list by highlighting CLRLLIST and ENTER
ClrList appears on your screen enter the list to be cleared separated by a comma then hit ENTER
Press STAT button
Make sure Edit is highlighted and press ENTER
You are now ready to enter your x values in one list and the matching y values in the other list
(remember which list you used to store your data)

To Graph the Data
Press STATPLOT enter 4 to turn off all plots. Hit ENTER
Press STATPLOT and make sure Plot 1 is highlighted press ENTER
Turn on the plot
Select the type of graph
Identify in which list you stored the x values
Identify in which list you stored the y values
Select the style of mark you want placed on the graph.
Press the GRAPH button. You should see discrete marks for each ordered pair of data.

To get the curve of best fit
Make sure that you have no equation in y1
Go to home screen and press CLEAR button
Press the STAT Button
Highlight CALC on the top row
Select the type of regression curve that best fits the contour of the data and ENTER.
Now name the lists that contain your data separated by commas. The values of the constants in the equation will appear on the home screen.

To Graph the curve of best fit on your data
Press Y= button
Make sure your cursor is were you want your equation
Press the VARS button
Go down to #5 Statistics
Highlight EQ on the top row
Make sure #1 RegEQ is highlighted and press ENTER
The equation will appear after y=
Press GRAPH button and the curve will be graphed on your data.

Note: If you want a measure of how well the curve fits the data, go to catalog button and go to "Diagnosis On." ENTER
Now when you do a curve of best fit, you will get a regression coefficient (an "r" value).
The closer this value is to 1 the better the curve fits the data.

Example 1 Perform a linear regression on the data below. Predict the consumption for the year 2015. $x = 35$

The U.S. consumption of aspirin (in billions) is given by the table below.

years after 1980	0	5	10	15	20
aspirin in billions	631.5	615	525	487	480

$y = -8.62x + 633.9$

for 2015: $-8.62(35) + 633.9 = 332.2$

Example 2 The population present in a bacteria culture over 5 days is given in the table below. Perform a cubic regression. Predict the population for day 7,

time (days)	0	1	2	3	4	5
population	30	133	214	337	527	819

$y = 6.435x^3 - 23.603x^2 + 114.858x + 31.230$

1885.9524

$\boxed{1885 \text{ bacteria}}$

Quadratics

Example 3 The number of bacteria in a refrigerated food is given by $n(t) = 20t^2 - 20t + 120$ for $-2 \le t \le 14$ where t is the temperature of the food in degrees Celsius. At what temperature will the number of bacteria be minimal?

$$t = \frac{-b}{2a} = \frac{-(-20)}{2(20)} = \boxed{\frac{1}{2}^\circ C}$$

Example 4 The length of a rectangle is three more than twice the width. Determine the dimensions that will give a total area of 27 m^2.

w = width

$l = 2w + 3$

$A = lw = (2w+3)w = 27$

$2w^2 + 3w - 27 = 0$

$(2w + 9)(w - 3) = 0$

$2w + 9 = 0$ $\quad w - 3 = 0$

$\cancel{w = -\frac{9}{2}}$

$\boxed{w = 3m \quad l = 9m}$

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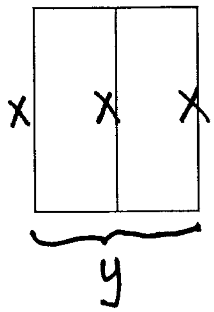
Example 5 Two rectangular corrals are to be made from 100 yds of fencing as seen below. If the rancher wants the total area to be maximum, what dimensions should be used to make the corrals?

perimeter



$$3x+2y=100$$
$$2y=100-3x$$
$$y=\frac{100-3x}{2}=50-\frac{3}{2}x$$

$$A=xy=x\left(50-\frac{3}{2}x\right)$$
$$A=50x-\frac{3}{2}x^2$$

$x=16\frac{2}{3}$ yd Area $=416\frac{2}{3}$ yd^2

$$y=50-\frac{3}{2}\left(\frac{50}{3}\right)=25\text{yd}$$

The formula for a freely falling body ignoring any effects of air resistance is $s(t) = -16t^2 + v_0t + s_0$ feet

- $s(t)$ represents the projectile's height at any time t
- v_0 represents initial velocity
- s_0 represents intial height from which the projectile is released
- t represents time in seconds after the projectile is released

Example 6 A baseball throwing machine is used to train little league players to catch pop-ups. The machine throws baseballs straight upward with an initial velocity of 48 ft/sec from a height of 3.5 feet.

a) Find an equation that models the height of the ball as a function of the ball t seconds after it is thrown. $s(t)=-16t^2+48t+3.5$

b) What is the maximum height the ball will reach? How many seconds will it take to reach this height? $t=1.5$ sec 39.5 ft

c) If the player misses the catch, how long will it take the ball to hit the ground? ht $=0$ $t=3.071$ sec