Graphing Calculator Finanical Program Note

December 18, 2020 1:00 PM

FOM12
Ch1 Notes: Using the TVM Solver Home = 2nd Quit

N = # of payments (years * PY)
I = Interest rate as % (don't need to convert to a decimal)
(-) One Time **PV = present value** (will be negative for money going into the bank)
(-) Reg Payment **PMT = amount of a recurring payment or investment** (negative for $ going in, zero if none)
(+) **FV = future value** (will be positive for money coming out of the bank)
P/Y = # of payments per year (how often I put $ in, default=1 even if no payments are made)
C/Y = # of compounding periods per year (how often bank pays me, type this after P/Y)
BEGIN/END = when payments are made (usually BEGIN for investments, but not always)
BEGIN for One Time (PV)
End for Reg Payment. (PMT)

One Time

Ex1. Find the end value of $700 invested @ 6% compounded quarterly for 3 years

N	I (%)	PV	~~PMT~~	FV *	P/Y	C/Y	PMT
3yrs	6%	-700	∅		1	4	Begin.

1) $836.93

One Time

Ex2. How much money must be invested today, at 3% compounded semi-annually, for the accumulated amount to be $5000 after 10 years?

N	I (%)	PV *	~~PMT~~	FV	P/Y	C/Y	PMT
10 yr	3%		∅	5000	1	2	Begin

2) $3712.35

One Time

Ex3. A sum of $350 is invested for 7 years, and compounded semi-annually. At the end of 7 years the investment is worth $500. What was the rate of interest?

N	I (%) *	PV	PMT	FV	P/Y	C/Y	PMT
7yr.		-350	∅	500	1	2	Beg.

3) 5.167%

Try

One Time

Ex4. How many years would it take a lump sum payment of $500 invested at 19.2%, compounded monthly to grow to $850?

(year)

* N	I (%)	PV	~~PMT~~	FV	~~P/Y~~	C/Y	PMT
	19.2	-500	Ø	850	1	12	Begin

4) 2.79 years.

Reg Payment

Ex5. Terra invests $100 **each month** into an investment that earns 7% compounded monthly. How much will she have accumulated in 5 years?

Payment

N	I (%)	~~PV~~	PMT	* FV	P/Y	C/Y	PMT
60	7%	Ø	-100		12	12	End.

5yr × 12/yr.

5) $7159.29

Ex6. Danielle needs $6000 for tuition. If she has two years to save up, and she can earn 6.5% compounded annually, how much must she put aside **every month**?

N	I (%)	~~PV~~	* PMT	FV	P/Y	C/Y	PMT
24	6.5%	Ø		6000	12	1	End.

2yr × 12

6) $235.20

Try

Ex7. Brock invests $50 **every week** into an investment that earns 6% compounded quarterly. How many payments must he make to accumulate $3000? How many years is this?

* N	I (%)	PV	PMT	FV	P/Y	C/Y	PMT
Solve	6%	Ø	-50	3000	52	4	End

58 weeks ÷ 52 weeks/yr

7) 1.1 yr

6.1 – EXPLORING THE GRAPHS OF POLYNOMIAL FUNCTIONS

A polynomial function consist of one or more terms, which are separated by + or – signs.

> The degree of a polynomial function is the value of the highest exponent in the function. If a polynomial function includes a term with no variable, this term is called a constant term.

Determine the Degree and the Constant

Example 1: Determine the degree and the constant of each polynomial function.

a. $f(x) = x^2 + 4x - 5$

b. $g(x) = 3x - 7$

c. $h(x) = 8$

> A number that multiplies the variable in a polynomial is called a coefficient. The leading coefficient is the number that multiplies the term with the highest power.

Determine the Leading Coefficient

Example 2: Determine the leading coefficient of each polynomial function.

a. $f(x) = x^2 + 4x - 5$

b. $g(x) = 3x - 7$

> The terms in a polynomial function are normally written so that the powers are in descending order.
>
> For example, $f(x) = 2x^3 + 3x^2 - 2x + 5$

Example 3: Write a polynomial function in descending order that satisfies the following conditions.

a. degree 2, leading coefficient –3

b. degree 2, leading coefficient 7, two terms

c. degree 1, leading coefficient 1

d. degree 0

e. degree 3, constant term –8

f.

Domain

The domain is the set of all possible ***x*-values** which will make the function "work" and will output real *y*-values.

Range

The range of a function is the complete set of all possible **resulting *y*-values** of the dependent variable.

End behaviour

The end behaviour of a polynomial is the description of the shape of the graph, from left to right, on the coordinate plane.

Turning Point

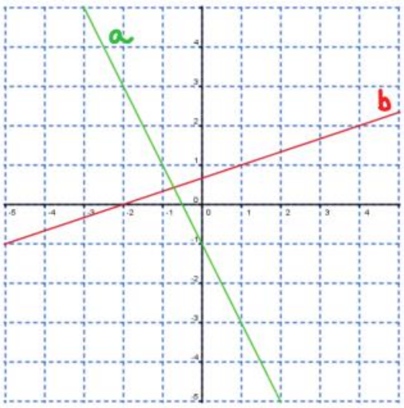
A turning point is any point where the graph of a function changes from increasing to decreasing or from decreasing to increasing.

Polynomial functions are named according to their degree. Polynomial functions of degrees 0, 1, 2, and 3 are called constant, linear, quadratic, and cubic functions, respectively.

Characteristics of Polynomial Functions

Example 4: Determine the type of function, the degree, the x-intercepts, y-intercepts, end behaviour, range and number of turning points for each type of function.

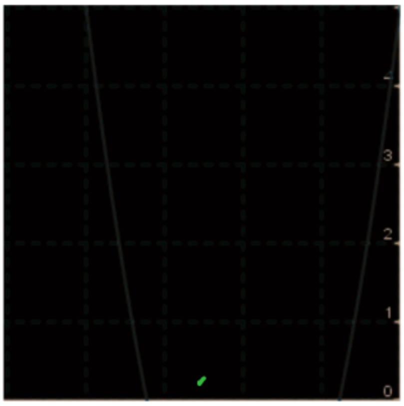
a.



Type of function		
Degree		
Number of *x*-ints		
Number of *y*-ints		
Domain		
Range		

End Behaviour		
Number of Turning Points		

b.



Type of function	
Degree	
Number of x-ints	
Number of y-ints	
Domain	
Range	

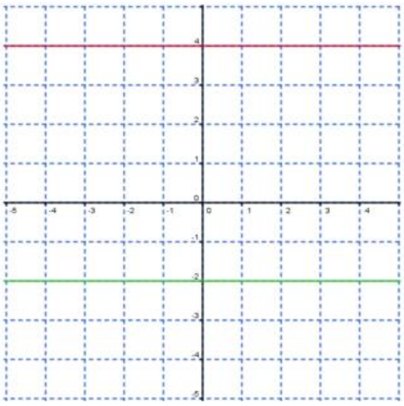
End Behaviour		
Number of Turning Points		

c.

Type of function	
Degree	
Number of x-ints	
Number of y-ints	
Domain	
Range	

End Behaviour		
Number of Turning Points		

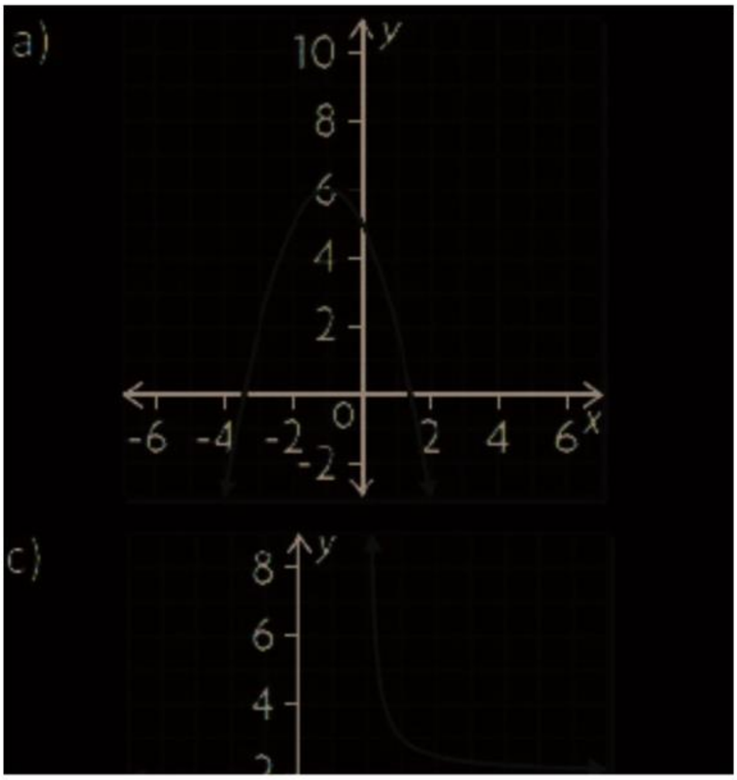
d.



Type of function		
Degree		
Number of x-ints		
Number of y-ints		
Domain		
Range		

End Behaviour		
Number of Turning Points		

Example 5: Which of the following graphs might represent polynomial functions?



Assignment: p. 383 #1 – 4

6.2 – CHARACTERISTICS OF THE EQUATIONS OF POLYNOMIAL FUNCTIONS

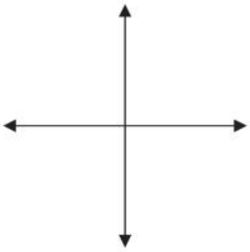
Standard Form: The standard forms for polynomial functions are:

Linear	*Quadratic*	*Cubic*
$f(x)=ax+b$, where $a\neq 0$.	$f(x)=ax^2+bx+c$, where $a\neq 0$.	$f(x)=ax^3+bx^2+cx+d$, where $a\neq 0$.

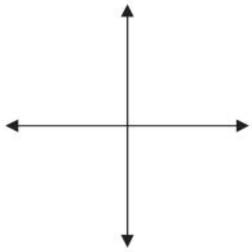
Observe the Characteristics of the Graphs of Polynomial Functions

Example 1: Sketch the graph on the grid using the graphing calculator window *x*: [–8, 8, 2] *y*: [–20, 20, 5]

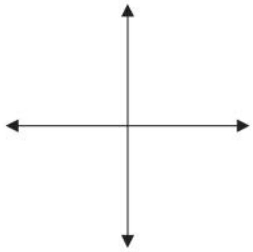
$f(x)=\frac{1}{2}x-6$



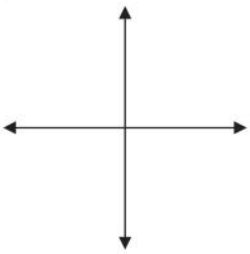
$f(x)=-5x-2$



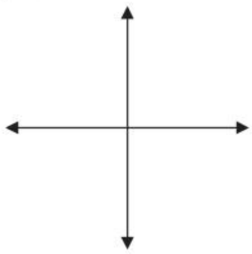
$f(x)=-2x^2+2x+4$



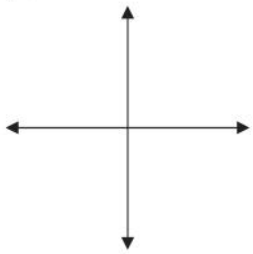
$f(x)=x^2-6x+12$



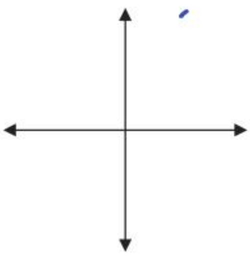
$f(x)=-2x^3+4x^2-3x+1$



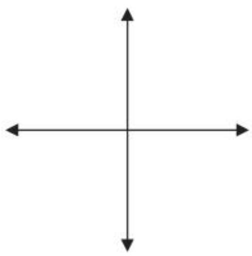
$f(x)=2x^3+4x^2-3x+1$



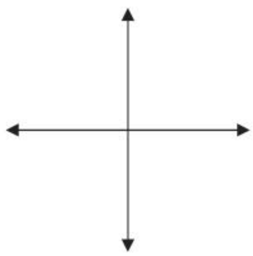
$f(x)=x^3-2x^2-15x+36$



$f(x)=x^3-8$



$f(x)=-x^3+2x^2+15x-10$



a. How is the constant term in a polynomial function related to the y-intercept of the graph of the function?

b. How does the sign of the leading coefficient affect the end behaviour of the graph of each type of polynomial function?

Foundations of Mathematics 12 – 6.2

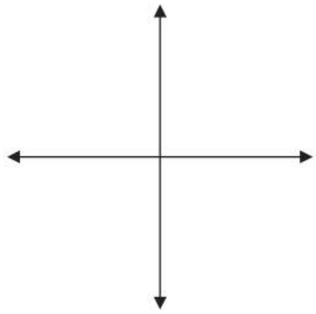
The *degree* of a polynomial function determines the *shape of the function*. The graphs of polynomial functions of the same degree have common characteristics.

Reason about the Characteristics of the Graph of a Given Polynomial Function Using Its Equation

Example 2: Predict the number of possible x-intercepts, y-intercept, domain, range, end behaviour, number of possible turning points of each function using its equation.

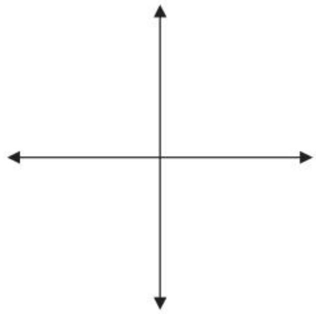
a. $f(x) = 3x - 5$

x-intercepts	
y-intercept	
domain	
range	
end behaviour	
number of turning pts.	



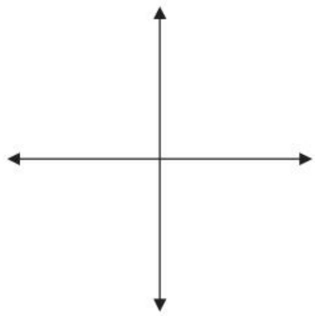
b. $f(x) = -2x^2 - 4x + 8$

x-intercepts	
y-intercept	
domain	
range	
end behaviour	
number of turning pts.	



c. $f(x) = 2x^3 + 10x^2 - 2x - 10$

x-intercepts	
y-intercept	
domain	
range	
end behaviour	
number of turning pts.	

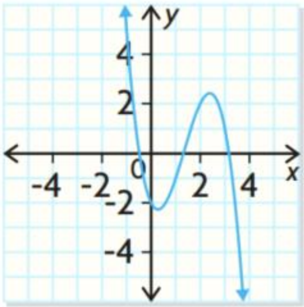


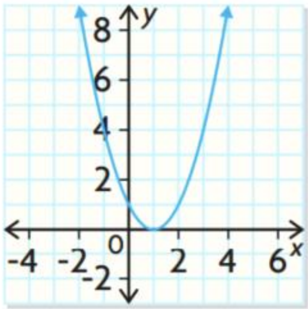
Connect Polynomial Functions to Their Graphs

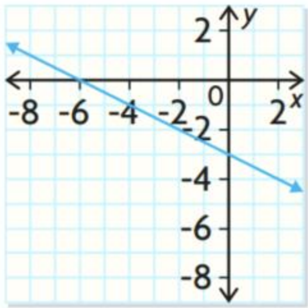
Example 3: Match each graph with the correct polynomial function. Justify your reasoning.

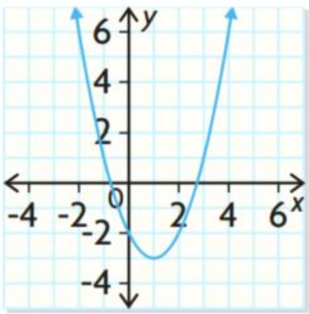
$g(x) = -x^3 + 4x^2 - 2x - 2$ $\quad$ $j(x) = x^2 - 2x - 2$ $\quad$ $p(x) = x^3 - 2x^2 - x - 2$

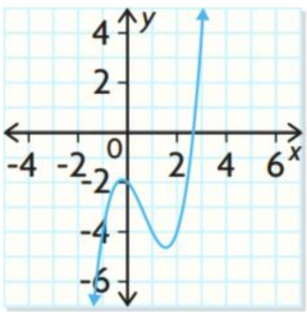
$h(x) = -\frac{1}{2}x - 3$ $\quad$ $k(x) = x^2 - 2x + 1$ $\quad$ $q(x) = -2x - 3$

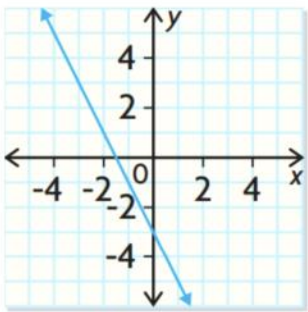










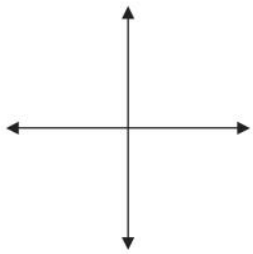


Foundations of Mathematics 12 – 6.2

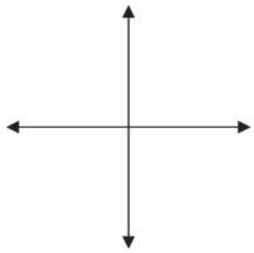
Reason about the Characteristics of the Graphs of Polynomial Functions

Example 4: Sketch the graph of a possible polynomial function for each set of characteristics below.

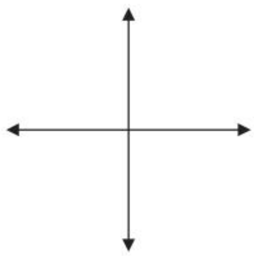
a. Range: $\{y \mid y \geq -2, y \in \mathbb{R}\}$ and y-intercept: 4



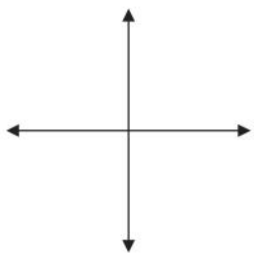
b. Range: $\{y \mid y \in \mathbb{R}\}$ and turning points: one in quadrant III and another in quadrant I



c. Extending from quadrant II to quadrant IV, degree 1, y-intercept of -3



d. Range: $\{y \mid y \leq 6, y \in \mathbb{R}\}$ and x-intercept: 2 and 6



Assignment: p. 393 #4 – 11, 13

6.3 – MODELLING DATA WITH A LINE OF BEST FIT

Interpolation

Interpolation is the process used to estimate a value within the domain of a set of data, based on a trend.

You can graph the scatter plot and interpolate using a graphing calculator.

Step 1. Enter the data

→ Press STAT key → Select EDIT → Clear any numbers that are written in L1, L2

→ Under Column L1, enter the data (x-values)

→ Under Column L2, enter the data (y-values)

Step 2. Choose window

→ Press WINDOW and adjust Xmin, Xmax, Ymin, Ymax

→ Graph

Step 3. Obtain the function

→ Press STAT key → Select CALC → Select #4 LinReg (or #5 QuadReg or #6 CubicReg)

→ Enter L1 , L2 ,

→ VARS → Select Y-VARS → Select #1 Function → Y1

Use Technology to Determine a Linear Model for Continuous Data

Example 1: The one-hour record is the farthest distance travelled by bicycle in 1 h. The table below shows the world-record distances and the dates they were accomplished.

Year	1996	1998	1999	2002	2003	2004	2007	2008	2009
Distance (km)	78.04	79.14	81.16	82.60	83.72	84.22	86.77	87.12	90.60

International Human Powered Vehicle Association

a. Use technology to create a scatter plot and to determine the equation of the line of best fit. Round to three decimal places.

b. Interpolate a possible world-record distance for the year 2006, to the nearest hundredth of a kilometre.

Linear regression results in an equation that balances the points in the scatter plot on both sides of the line. A line of best fit can be used to predict values that are not recorded or plotted. Predictions can be made by reading values from the line of best fit on a scatter plot or by using the equation of the line of best fit.

Foundations of Mathematics 12 – 6.3

Try: Consider the data in the table. Use technology to create a scatter plot and to determine the equation of the line of best fit.

x	0	2	4.5	5.2	9.5	12
y	5.1	6.7	8.2	8.8	11.9	13.4

a. Determine, to the nearest tenth, the value of y when x is 10.6.

b. Determine, to the nearest tenth, the value of x when y is 9.8.

Extrapolation

Extrapolation is the process used to estimate a value outside the domain of a set of data, based on a trend.

Use Linear Regression to Solve a Problem that Involves Discrete Data

Example 2: Matt buys T-shirts for a company that prints art on T-shirts and then resells them. When buying the T-shirts, the price Matt must pay is related to the size of the order. Five of Matt's past orders are listed in the table below.

Number of Shirts	Cost per Shirt ($)
500	3.25
700	1.95
200	5.20
460	3.51
740	1.69

Matt has misplaced the information from his supplier about price discounts on bulk orders. He would like to get the price per shirt below $1.50 on his next order.

a. Use technology to create a scatter plot and determine an equation for the linear regression function that models the data. Round to three decimal places.

b. What do the slope and y-intercept of the equation of the linear regression function represent in this context?

c. Use the linear regression function to extrapolate the size of order necessary to achieve the price of $1.50 per shirt.

Assignment: p. 407 #1 – 11 (odds)

6.4 – MODELLING DATA WITH A CURVE OF BEST FIT

Curve of best fit

Curve of best fit is a curve that best approximates the trend on a scatter plot.

Use Technology to Solve a Quadratic Problem

Example 1: The concentration (in milligrams per litre) of a medication in a patient's blood is measured as time passes. Susan has collected the following data and is attempting to express the concentration as a polynomial function of time.

Time (*T hours*)	0	1.5	3	4.5	6	7.5	9
Concentration (*C* mg/L)	0	26.9	41.2	47.8	46.0	36.8	20.3

a. On a graphing calculator, enter the data in two lists. Time in L_1 and Concentration in L_2. Create a scatter plot of the data and use the quadratic regression feature to determine the polynomial function, $C = aT^2 + bT + c$, that best fits the data. Round the parameters a, b, and c to 2 decimal places.

b. The doctor has decided that the patient needs a second dose of medication when the concentration in the blood is less than 10 mg/L. If the first dose of medication was given at 9:00am, at what time should the second dose be given?

Example 2: Consider the data in the table. Use technology to create a scatter plot and to determine the equation of the line of best fit.

x	0	1.5	3.3	5.1	7.4	8.6	10.0
y	19.5	10.3	3.4	1.6	6.2	16.1	20.3

a. Determine, to the nearest tenth, the value of y when x is 10.6.

b. Determine, to the nearest tenth, the value of x when y is 9.8.

Technology uses polynomial regression to determine the curve of best fit. Polynomial regression results in an equation of a curve that balances the points on both sides of the curve. A curve of best fit can be used to predict values that are not recorded or plotted. Predictions can be made by reading values from the curve of best fit on a scatter plot or by using the equation of the curve of best fit.

Use Technology to Solve a Cubic Regression Function

Example 3: 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.

Years after 1979	Price of Gas (¢/L)
0	21.98
1	26.18
2	35.63
3	43.26
4	45.92

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

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.

5. Consider the data in the table. Create a scatter plot from the data using a graphing calculator.

x	0	5	10	15	20	25	30	35	40	45	50
y	120	102	83	74	67	64	62	54	45	31	10

a. Use the cubic regression feature of a calculator to determine a cubic function that models the data. Round to three decimal places.

b. Use the cubic regression equation to determine the value of x when y = 90.

c. Use the linear regression feature of a calculator to determine a leaner function that models the data. Round to three decimal places.

d. Use the linear regression equation to determine the value of x when y = 90.

e. Which model appears to be the better for the data?