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Warm-up

Sunday, March 8, 2015

1. What is the 11th term of the expansion $(3x + y)^{10}$.

2. Expand the expression $(2 + 6i)^2$

2. Find all roots for the function $f(x) = 8x^3 - 27$



10

9

8

7

6

5

4

3

2

1

Objectives

Model Real World Situations with Polynomial Models

Make predictions using Polynomial Models

Homework

Packet Page 17 - 18 all problems

Find all the complex roots of each polynomial.

1. $x^4 - 8x^3 + 11x^2 + 40x - 80$

$4, 4, \sqrt{5}, -\sqrt{5}$

2. $4x^4 - x^3 - 12x^2 + 4x - 16$

$2, -2, \frac{1 + 3i\sqrt{7}}{8}, \frac{1 - 3i\sqrt{7}}{8}$

3. $x^6 + 2x^5 + 7x^4 + 20x^3 - 21x^2 + 18x - 27$

$-3, 1, 3i, -3i, i, -i$

4. $x^3 - 4x^2 + 4x - 16$

$4, 2i, -2i$

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

$1, \frac{1 \pm i\sqrt{11}}{2}$

6. $f(x) = x^3 - 3x^2 - 15x + 125$

$-5, 4 \pm 3i$

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

$\frac{2}{3}, -\sqrt{5}, \sqrt{5}$

8. $f(x) = x^4 - 4x^3 + 8x^2 - 16x + 16$

$2, -2i, 2i$

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

$-1, 1, -\sqrt{2}, \sqrt{2}$

10. $f(x) = x^3 - 2x^2 - 17x - 6$

$-3, \frac{5 \pm \sqrt{33}}{2}$

Write the expansion of each binomial.

$$1. (a + b)^3 \quad a^3 + 3a^2b + 3ab^2 + b^3$$

$$2. (x - y)^4 \quad x^4 - 4x^3y + 6x^2y^2 - 4xy^3 + y^4$$

$$3. (r + 1)^5 \quad r^5 + 5r^4 + 10r^3 + 10r^2 + 5r + 1$$

$$4. (a - b)^6 \quad a^6 - 6a^5b + 15a^4b^2 - 20a^3b^3 + 15a^2b^4 - 6ab^5 + b^6$$

$$8. (x + y)^5 \quad x^5 + 5x^4y + 10x^3y^2 + 10x^2y^3 + 5xy^4 + y^5$$

$$9. (x - y)^5 \quad x^5 - 5x^4y + 10x^3y^2 - 10x^2y^3 + 5xy^4 - y^5$$

$$10. (2x + y)^3$$

$$11. (x + 3y)^4$$

$$8x^3 + 12x^2y + 6xy^2 + y^3$$

$$x^4 + 12x^3y + 54x^2y^2 + 108xy^3 + 81y^4$$

$$12. (x - 2y)^5 \quad x^5 - 10x^4y + 40x^3y^2 - 80x^2y^3 + 80xy^4 - 32y^5$$

$$13. (2x - y)^5 \quad 32x^5 - 80x^4y + 80x^3y^2 - 40x^2y^3 + 10xy^4 - y^5$$

$$14. (x - 3y)^4$$

$$15. (4x - y)^3$$

$$x^4 - 12x^3y + 54x^2y^2 - 108xy^3 + 81y^4$$

$$64x^3 - 48x^2y + 12xy^2 - y^3$$

$$16. (x - 1)^5$$

$$17. (1 - x)^3$$

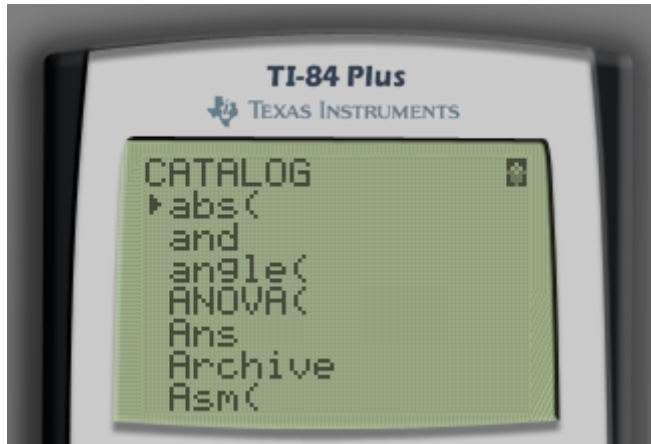
$$x^5 - 5x^4 + 10x^3 - 10x^2 + 5x - 1$$

$$1 - 3x + 3x^2 - x^3$$

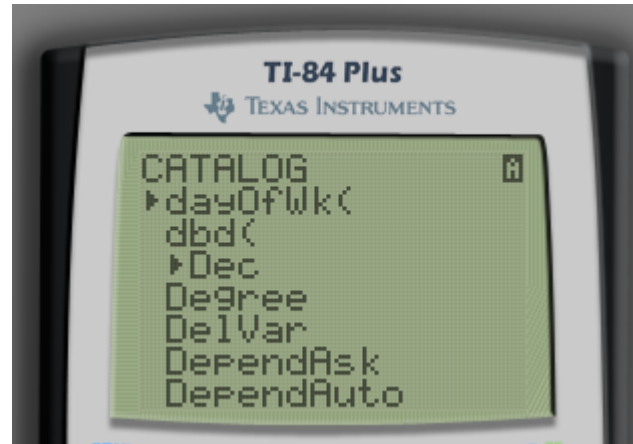
$$18. (x^2 + 1)^3 \quad x^6 + 3x^4 + 3x^2 + 1$$

$$19. (y^2 + a)^4 \quad y^8 + 4y^6a + 6y^4a^2 + 4y^2a^3 + a^4$$

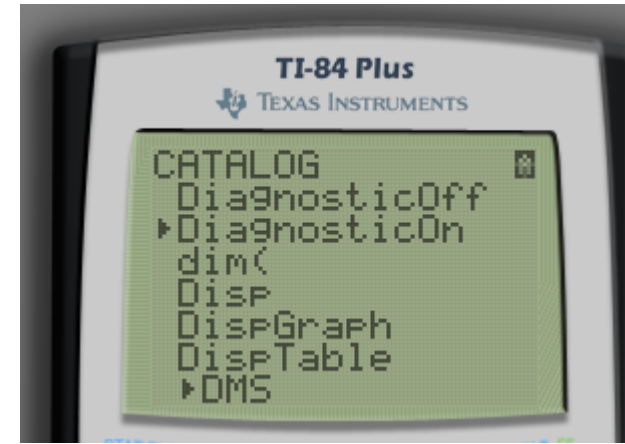
Before we start, we need to make sure you have diagnostics set to on...



2nd 0

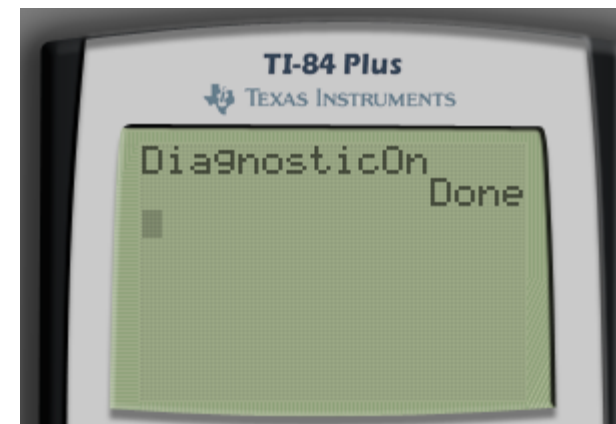


ALPHA x⁻¹



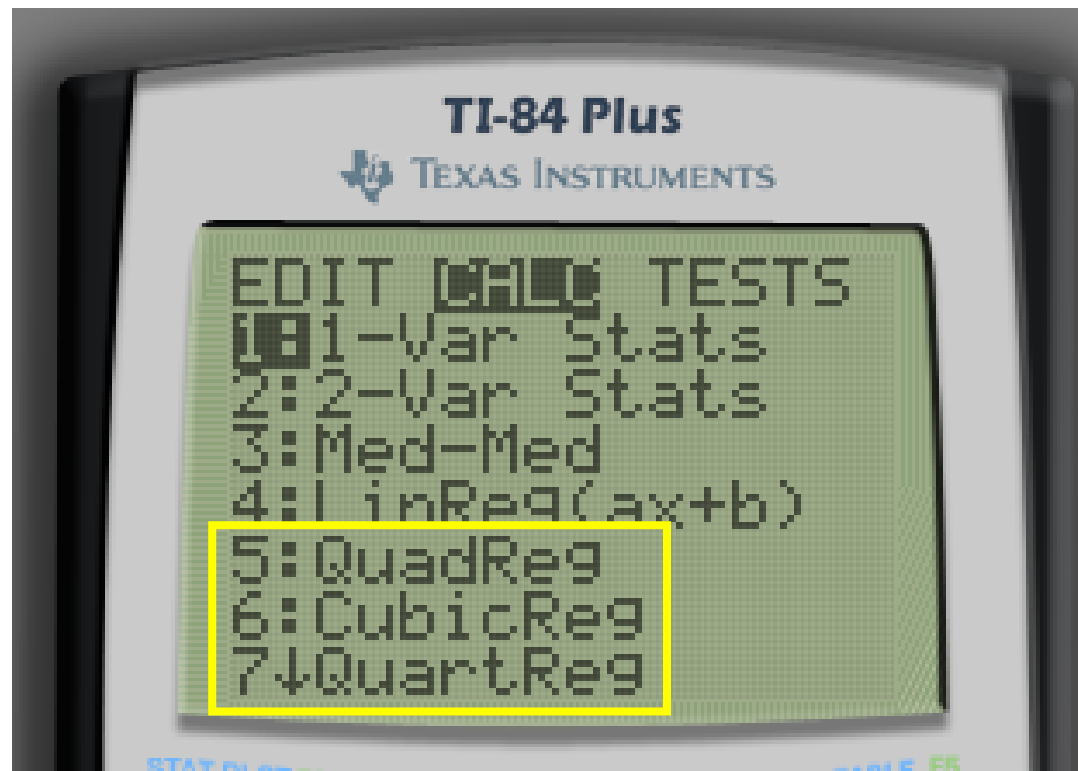
Down Arrow until you see DiagnosticOn

Press Enter twice



You've used linear regressions before. Today we'll look at other types of modeling. Depending on the way your data falls, **Quadratic**, **Cubic** or **Quartic** models help us make predictions about behavior.

Stat Calc



We're working from packet page 17.

Problem Number 10

We're given some data about life expectancy. We can use that data to make a model and make predictions about how long we're expected to stay alive!

First enter your data...

STAT, EDIT

L1	L2	L3	Z
0	74.7	-----	
10	77.4		
20	78.8		
30	79.7		

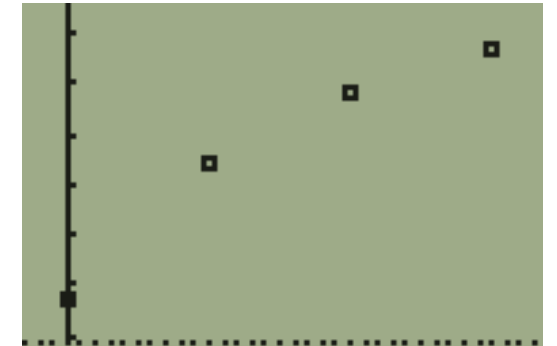
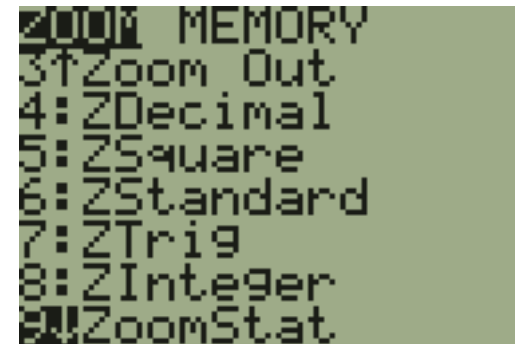
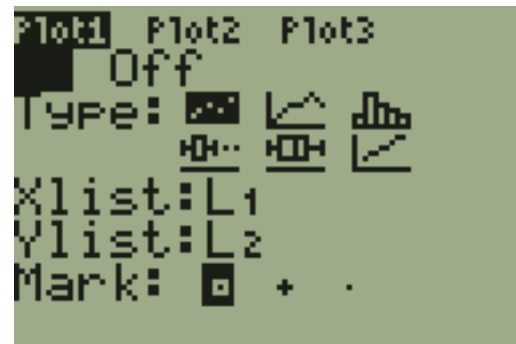
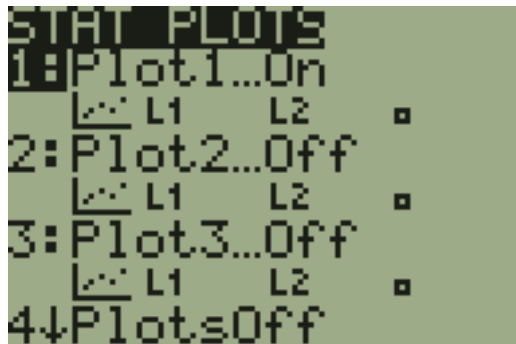
L2(5) =

Now create a scatter plot of the data.

2nd y=

Highlight On

ZOOM STAT



For every model we create, we want to store it in the calculator for use when we make our predictions. To do this we will store the regression equation in y_1 .

```
EDIT [CALC] TESTS
1:1-Var Stats
2:2-Var Stats
3:Med-Med
4:LinReg(ax+b)
5:QuadReg
6:CubicReg
7:QuartReg
```

1. Select the regression model.
[STAT][CALC]

```
VARs Y-VARS
1:Window...
2:Zoom...
3:GDB...
4:Picture...
5:Statistics...
6:Table...
7:String...
```

3. Arrow over to Y-VARS

```
FUNCTION
1:Y1
2:Y2
3:Y3
4:Y4
5:Y5
6:Y6
7:Y7
```

5. Press Enter

```
QuadReg
y=ax2+bx+c
a=-.0045
b=.299
c=74.74
R2=.9977606718
```

7. You'll see the regression model
Press Enter

```
QuadReg
```

2. If you see you see 4 lines downarrow to Store RegEQ, Press [VARS]

```
VARs Y-VARS
1:Function...
2:Parametric...
3:Polar...
4:On/Off...
```

4. Press Enter

```
QuadReg Y1
```

6. Press Enter

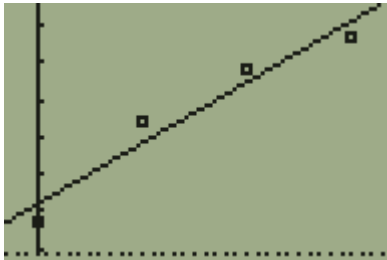
```
Plot1 Plot2 Plot3
\Y1=-.0045X2+.299X+74.74
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
```

8. You should see the regression equation in y_1 .

Now let's determine which model will best fit our data.

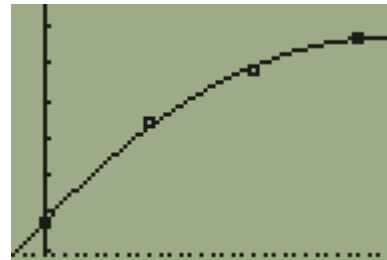
Linear

```
LinReg  
y=ax+b  
a=.164  
b=75.19  
r2=.9410776767  
r=.9700915816
```



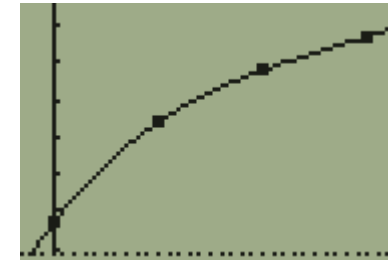
Quadratic

```
QuadReg  
y=ax2+bx+c  
a=-.0045  
b=.299  
c=74.74  
R2=.9977606718
```



Cubic

```
CubicReg  
y=ax3+bx2+cx+d  
a=1.3333333E-4  
b=-.0105  
c=.3616666667  
d=74.7  
R2=1
```



So the **Cubic** model appears the best model for this collection of data.

If we look at the graph of each model we get an idea which model more closely follows the data.

BUT the r^2 value gives us more specific information to make our decision.

The closer the r^2 value is to **1**, the stronger the model.

Now we can use the Cubic Model to make some predictions. Look at question 16 on page 17.


What is the life expectancy of women born in 1986, 1992 and 2005?

In our model what do x values represent? **Years since 1970.**

What x value corresponds to the year 1986? **$1986 - 1970 = 16$**

X	Y ₁
13	77.92
14	78.071
15	78.213
16	78.345
17	78.469
18	78.586
19	78.696

X=16



Look in the table. Find the corresponding y value for the x value you came up with.

If you don't see any data in your table you forgot to store the regression model in y₁. (Remember VARS?)

Now repeat this process for 1992 and 2005.

$1992 - 1970 = 22$

X	Y ₁
22	78.994
23	79.086
24	79.175
25	79.263
26	79.349
27	79.435
28	79.522

X=22

$2005 - 1970 = 35$

X	Y ₁
35	80.213
36	80.333
37	80.461
38	80.598
39	80.744
40	80.9
41	81.067

X=35

How can we use the model when we need to find an x value given a y value? For example...

In what year will the life expectancy reach 100 years?

X	Y ₁
72	96.074
73	97.016
74	97.995
75	99.012
76	100.07
77	101.16
78	102.3

X=78

You can see from the table that the x value (year) is between 75 and 76. To find an exact value for y we need to do some more work.

```
Plot1 Plot2 Plot3
Y1=1.33333333333
307E-4X^3+-.0104
99999999998X^2+.3
6166666666654X+7
Y2=100
Y3=
```

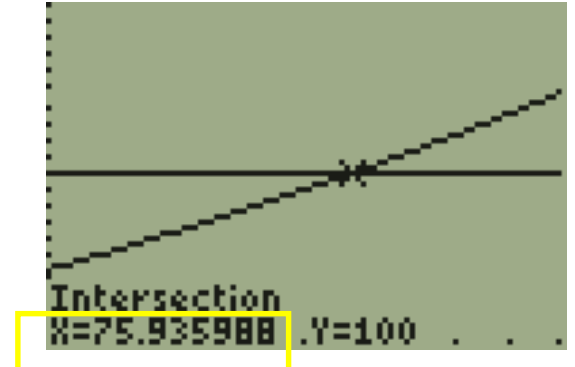
Put the y value you are looking for in y_2 .

```
WINDOW
Xmin=70
Xmax=80
Xscl=1
Ymin=90
Ymax=110
Yscl=1
Xres=1
```

Adjust the x min/max and y min/max to the approximate values you found in the table.

```
CALCULATE
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx
```

2nd TRACE 5



Press enter 3 times.

Work with a partner to complete the problems in your packet.

Save yourself some time!

Do 10 and 16 together

Do 11 and 17 together

Do 12 and 18 together