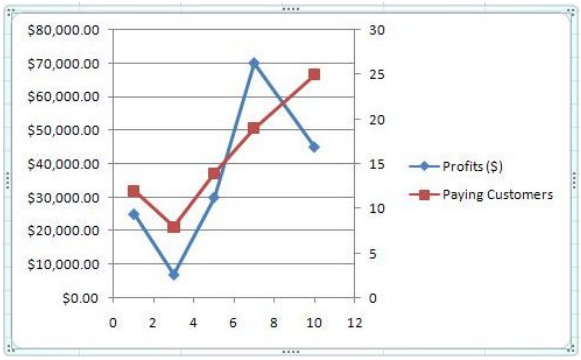
Math 1030 **Test #1 ANSWER KEY** **September 16^{th}, 2008**

1. (____/11 points) Use the following table of data to create a graph in Excel. Change to a "double ended" by graphing the "Paying Customers" along a secondary axis.

Month	January	March	May	July	October
	1	3	5	7	10
Profits ($)	$25,000	$7,000	$30,000	$70,000	$45,000
Paying Customers	12	8	14	19	25

Briefly explain how you added your secondary axis and then sketch the resulting graph.



To add a secondary axis you must first select a data set. To do this click on the "paying customers" data (the red data). Then "right-click" and select "Format Data Series". Finally, choose "Secondary Axis" in the pop-up box.

2. (____/12 points) Using the profits data from problem #1, model the profits using linear and exponential trendlines. Write down equations you found along with predictions for December's profits.

	Equation:	December's Profits:
Linear	$y = 4418x + 12426$	$65,442
Exponential	$y = 12573e^{0.1524x}$	$78,284.66

By clicking on the "Profits" data then "right-clicking" and choosing "Add Trendline", we can get Linear and Exponential models for this data – don't forget to select "Display Equation". Finally, by plugging in $x = 12$, we get predictions for December's profits. For example: The exponential model predicts "$= 1257 * \text{EXP}(0.1524 * 12)$" which is $78,284.66

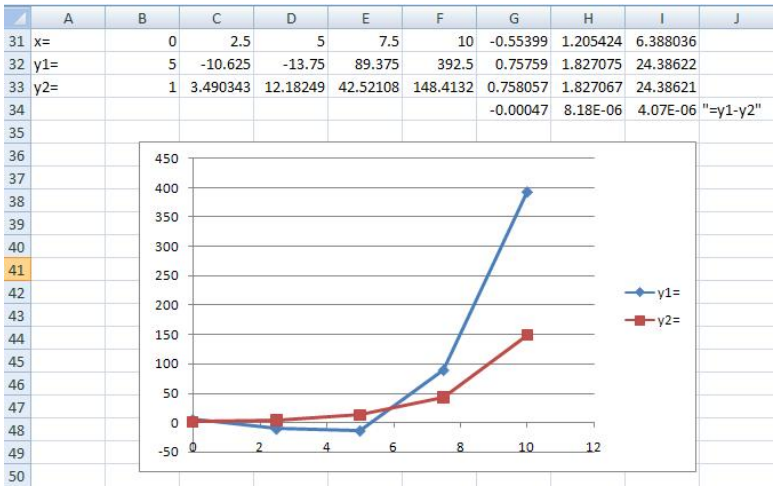
3. (____/15 points) Suppose that my "x" value is located in cell A1. Write an Excel formula for each of the following functions (I want the EXACT INPUT – that is exactly what you should type):

(a) $f(x) = \dfrac{2x^3}{\sqrt{3x-5}}$ `=2*A1^3/SQRT(3*A1-5)` or `=2*A1^3/(3*A1-5)^0.5`

(b) $f(x) = 15e^{-x^2}$ `=15*EXP(-(A1^2))` Remember the Excel error!

(c) $f(x) = \begin{cases} 0 & \text{if } x \le 10 \\ 0.15(x-10) & \text{if } x > 10 \end{cases}$ `=IF(A1<=10,0,0.15*(A1-10))`

4. (____/12 points) Consider the functions $f(x) = x^3 - 6.5x^2 + 3.75x + 5$ and $g(x) = e^{0.5x}$. How many times do the graphs of $f(x)$ and $g(x)$ cross if $0 < x < 10$? Determine the both coordinates (that is $(x, y) = (?, ?)$) for each point of intersection.



	A	B	C	D	E	F	G	H	I	J
31	x=	0	2.5	5	7.5	10	-0.55399	1.205424	6.388036	
32	y1=	5	-10.625	-13.75	89.375	392.5	0.75759	1.827075	24.38622	
33	y2=	1	3.490343	12.18249	42.52108	148.4132	0.758057	1.827067	24.38621	
34							-0.00047	8.18E-06	4.07E-06	"=y1-y2"

I entered the following formulas (and then copied across): `=B31^3-6.5*B31^2+3.75*B31+5` and `=EXP(0.5*B31)` Setting cell `G34` to `=G32-G33`, I ran "Goal Seek" on `G34` setting its value to 0 by changing `G31`. Excel then found $(-0.554, 0.758)$ which is **not** one of the answers since we need $0 < x < 10$ and $x = -0.554 < 0$. So in columns H and I, I repeated Goal Seek with seed values of 1 and 6 in `H31` and `I31` respectively. This found the answers we're looking for.

Answer: The graphs cross 2 times (for $0 < x < 10$) at the points $(1.205, 1.827)$ and $(6.388, 24.386)$.

5. (____/12 points) Jim invested some money in an account which earned 6% interest compounded quarterly. He made the following investments at the **beginning** of each quarter:

Quarter	1	2	3	4
Deposit	\$1,000	\$1,500	\$1,250	\$700
Balance (at the end of the quarter)	\$1,015	\$2,552.73	\$3,859.77	\$4,628.16

Fill in the table above and state the formulas you used to arrive at your answers.

If the deposits are located in cells, `B54`, `C54`, `D54`, and `E54`, then you could use the following formulas: `=B54*(1+6%/4)`, `=(B55+C54)*(1+6%/4)`, `=(C55+D54)*(1+6%/4)`, and `=(D55+E54)*(1+6%/4)`. These use the interest formula $F = P(1 + rt)$ where $r = 6\%$ and $t = 1/4$ (one quarter). Remember that the deposits are made at the beginning of the quarter so you should include them with the balance from the end of last quarter when computing interest.

Alternatively, you could use Excel's built-in "FV" function. In that case your formulas should look something like: `=FV(6%/4,1,0,-B54)`, `=FV(6%/4,1,0,-C54-B55)`, `=FV(6%/4,1,0,-D54-C55)`, and `=FV(6%/4,1,0,-E54-D55)`.

6. (____/13 points) You want to buy a house which costs $250,000. So you make a 10% down payment and take out a 30 year mortgage at 7% (compounded monthly) to pay off the rest.

(a) What will your monthly mortgage payments be? [Also, state the formula you used to find your answer.]

10% down on $250,000 is $25,000 which means we need to take out a $225,000 mortgage. To find the monthly payment we should use the "PMT" function: `=PMT(7%/12,12*30,-225000)`. This tells us that our monthly payment should be $1,496.93

To make sure that this will actually pay off the loan I entered the following formula: `=FV(7%/12,12*30,-1496.93,225000)` and found out that this leaves a balance of $0.75, so we need to round up to $1,496.94

Answer: $1,496.94 (I will also accept $1,496.93).

(b) How much will you still owe after 15 years? [Also, state the formula you used to find your answer.]

If `PMT=1496.94`, then `=FV(7%/12,12*15,-1496.94,225000)` tells us that we'll still owe $166,539.47.

...or...

If `PMT=1496.93`, then `=FV(7%/12,12*15,-1496.93,225000)` tells us that we'll still owe $166,542.64. If we plug in the payment directly from the "PMT" formula (which is actually 1496.930614), into "FV" then we get $166,542.45.

7. (____/13 points) A very crafty car dealer says he can get you a $11,000 car for only $250 a month. Although, you do have to make these car payments for 5 years. What interest rate (compounded monthly) is he charging? [Please decribe how you found your answer and include the formulas you used.]

I used the function `=PMT(A1/12,12*5,11000)` in cell `A2` and then ran "Goal Seek" on `A2` setting its value to -250 by changing `A1`. Goal seek then found the answer 0.129496. So the dealer is charging me approximately 12.95% interest (compounded monthly) – quite a bad deal!

Note: You could also use the "RATE" function to do this problem. In this case you could enter `=RATE(12*5,-250,11000)*12` which returns the same answer (change the cell format to general and it will display the full answer). Notice that "RATE" returns the monthly rate, so I needed to multiply it by 12 to get the annual rate.

8. (____/12 points) If you can afford to make payments of $300 a month on a 3 year loan which charges 8% interest (compounded monthly), how much can you afford to borrow? [Please decribe how you found your answer and include the formulas you used.]

Use `=PV(8%/12,12*3,-300)` which returns $9,573.54.