Name:

BLC150-Homework 12- The Quadratic

The Ur quadratic: $y = x^2$

y = x^2	
x	*y*
0	*0*
1	*1*
2	*4*
3	*9*
-1	*1*
-2	*4*
-3	*9*
1/2	*1/4*
-1/2	*1/4*

With the advent of computers, a new notation for exponents has come into fashion: x^2 = x^2. That little hat is shift-6. E.g. x^5 = x^5.

Plot some points. Choose some easy values for x and evaluate the y.

If x = 0, $y = 0^2$, then y = 0

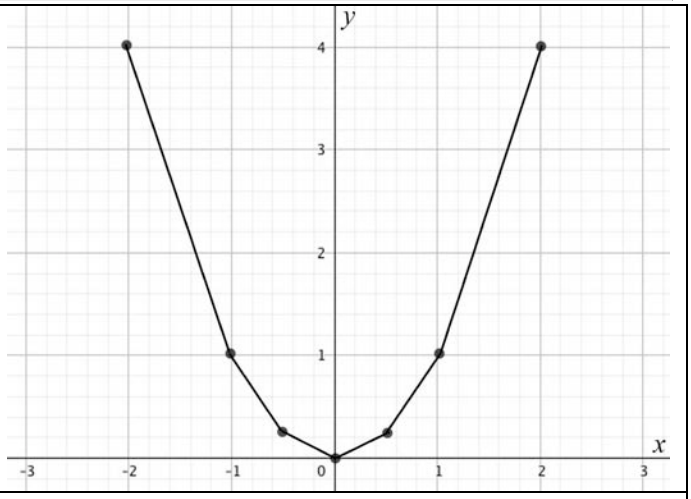
If x = 1, $y = 1^2$, then y = 1

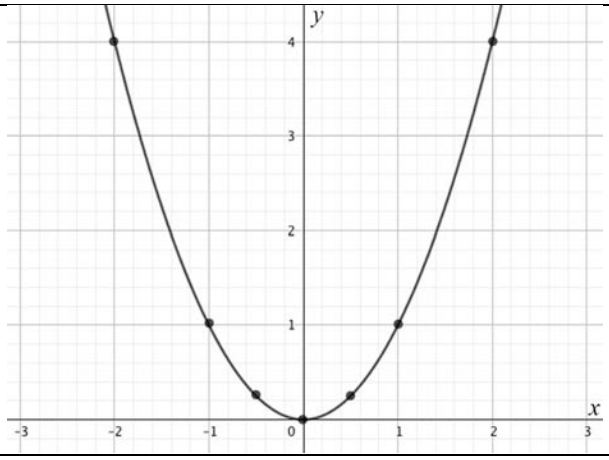
If x = -1, $y = (-1)^2$, then y = 1, because -1(-1) = 1

If x = 2, $y = 2^2$, then y = 4.

If x = -2, $y = (-2)^2$, then y = 4, etc.

Now plot those points on a graph and connect the dots.



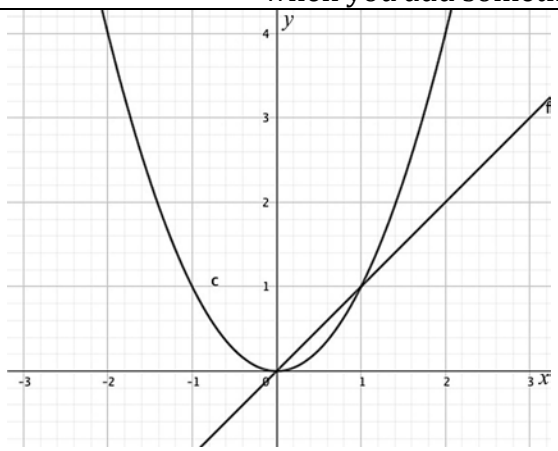


y = x^2	
x	*y*
0.00	*0*
0.25	*0.0625*
0.50	*0.25*
0.75	*0.5625*
1.00	*1*
1.25	*1.5625*
1.50	*2.25*
1.75	*3.0625*
2.00	*4*

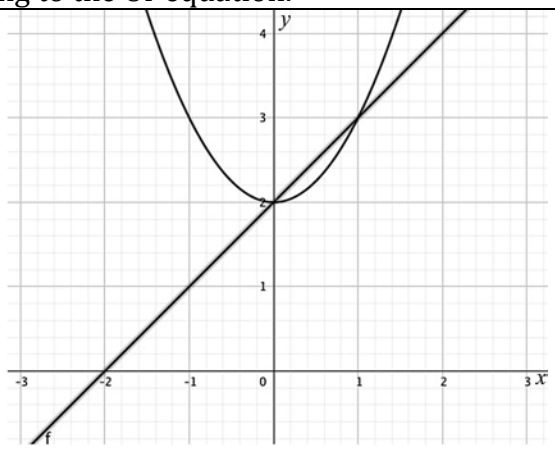
If you calculate a lot more dots, the graph will smooth out.

A computer graphing program is handy. I personally like GeoGebra:
https://www.geogebra.org/?lang=en
It's free and easy to use. It can work without a link to the internet. I put a link on the web site. I suggest you get it and play around with it when you do homework.

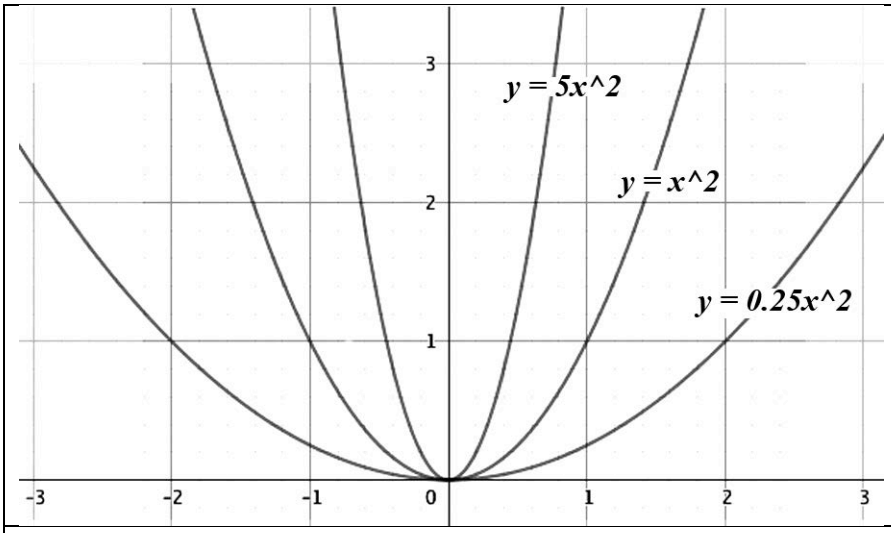
Like linear equations, quadratic equations move up and down
when you add something to the Ur equation.



The Ur equations $y = x$ *and* $y = x^2$

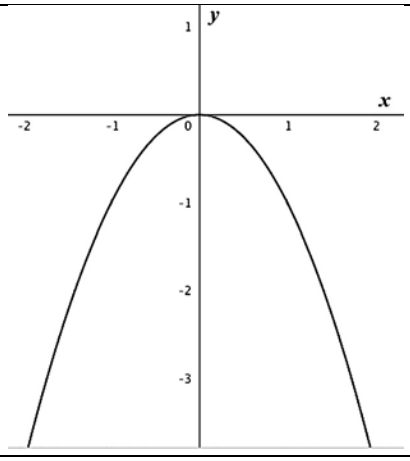


$y = x + 2$ *and* $y = x^2 + 2$



In a linear equation a slope makes it steeper. $y = 5x$ is a steep slope. In a quadratic equation a similar concept isn't called slope, but it makes the parabola tighter. The higher the number, the tighter and narrower the curve.

A negative "quadratic slope"
flips the smile over to a frown.
If the x^2 term is positive, then a smile.
If the x^2 term is negative, then a frown.
To the right is a graph of $y = -x^2$ *Sad. [y = -x^2]*
[The ones above are all happy.]



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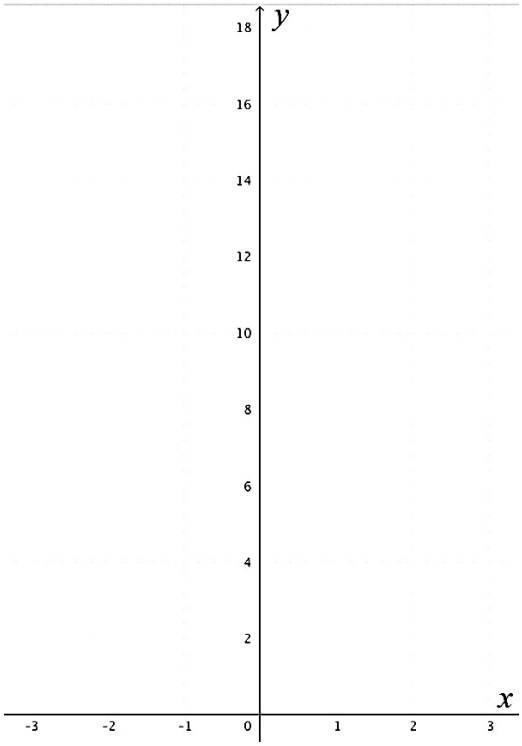
HW-12

1. Plot the following points for the quadratic equation, $y = 2x^2$. Then connect the dots smoothly.

y = 2x^2	
x	y
0	
1	
-1	2
2	
-2	
3	18
-3	



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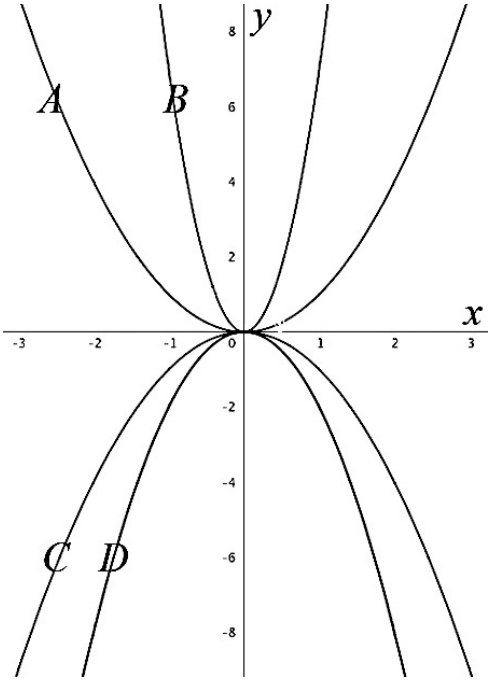
2. Identify which equation goes with which graph. Take note of happy or sad and narrower or wider compared with Ur.

	happy or sad	wider or narrower	Choose A, B, C, or D.
$y = 7x^2$			
$y = x^2$		wider	
$y = -x^2$	sad		
$y = -2x^2$			D

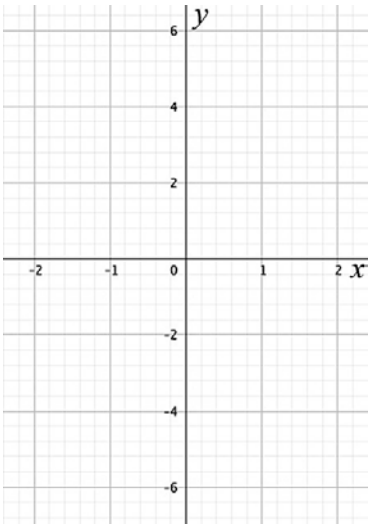


3. Graph the following two quadratic equations on the graph.
You will want to plot a few points.

a. $y = 2x^2 - 2$ b. $y = -2x^2 + 2$

x	y
0	-2
-1	
1	0
-2	
2	6

x	y
0	
-1	0
1	
-2	-6
2	



Just like in linear equations, you find the *y-intercepts* by setting $x = 0$.

4. Find the y-intercepts for the following.
Just solve for $x = 0$. Easy.

E.g. $y = 3.5x^2 - 8$	*y-intercept* is –8
a. $y = 4x^2 - 16$	
b. $y = x^2 + 16.3$	$y_{intercept}$ is 16.3
c. $y = -3.5x^2 - 8$	
d. $y = 0.002x^2 + 7$	
e. $y = x^2$	

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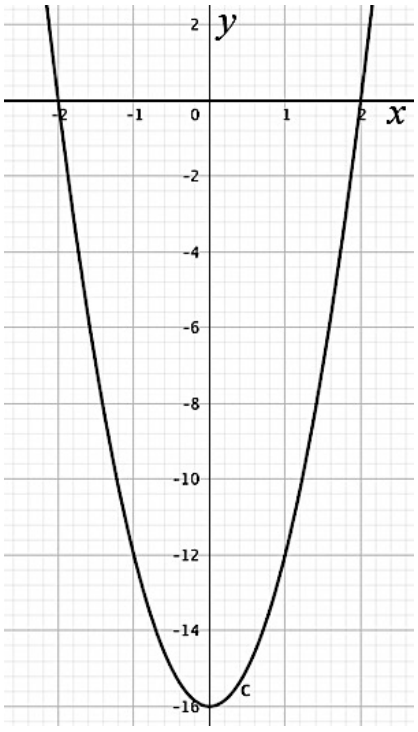
5. Find the *x* and *y-intercepts* for the following.
The *x-intercepts* are much trickier.
You set $y = 0$ and solve for *x*.
The graph to the right goes with the example.

	x-intercepts	*y-intercept*	*Happy or Sad*
E.g. $y = 4x^2 - 16$ $0 = 4x^2 - 16$ $16 = 4x^2$ $x^2 = 4$ $x = \pm 2$	*x-intercept is -2 and +2.* *See the graph to the right.*	*-16*	*Happy* 0 0 *Because the x^2 term is positive.*
a. $y = x^2 - 4$	*-2 and +2*		*Happy*
b. $y = -x^2 + 4$		4	
c. $y = -3x^2 + 27$	*-3 and +3*		*Sad*
d. $y = 2x^2 - 18$		-18	
e. $y = x^2$	0		



E.g. You have 12 meters of fencing material to make a rectangular enclosure for your dog. To save on material you decide to use the side of your house for one of the sides of the enclosure. The fencing material used will be divided up like this:

2x + y = 12.
[see diagram]

The enclosed area is this:
A = xy.

What should be the dimensions of the enclosure to maximize the area enclosed?

Here's how you do this....

Solve *2x + y = 12* *for y.*

y = 12 – 2x.

Then plug this result into the Area equation.

$A = xy = x(12 - 2x)$

$A = 12x - 2x^2$

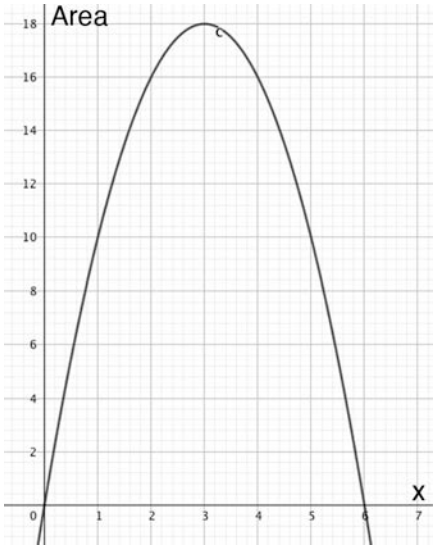
...or rearranging for aesthetic reasons...

$$\boldsymbol{A = -2x^2 + 12x.}$$

Now graph it.....

Keep in mind that a negative x makes no sense in this situation (what is -x meters of fencing) so just graph positive x values. Also, negative areas make no sense, so disregard any negative areas.

x	A
0	0
1	10
2	16
3	18
4	16
5	10
6	0
7	-14



The maximum area is $18m^2$ with an x of 3. Going back to the first equation, *2x + y = 12...*

Therefore if x is 3m, then y is 6m. A 3 x 6 meter enclosure.

6. Now it is your turn. You have 16 meters of fencing material to make a rectangular enclosure for your dog. To save on material you decide to use the side of your house for one of the sides of the enclosure. See diagram to right. Figure it out by plotting points and graphing it.

x	A
0	
1	14
2	
3	
4	
5	
6	
7	
8	
9