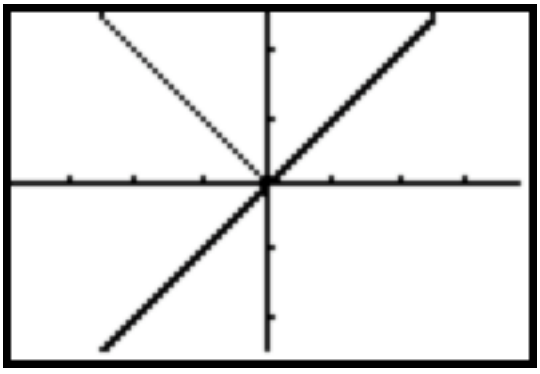
Question 1: Does $\sqrt{x^2} = x$, for all real values of x?
Consider a graph of $y1 = \sqrt{x^2}$ and $y2 = x$ on the same set of axis and also their table of values.



X	Y1	Y2
-3	3	-3
-2	2	-2
-1	1	-1
0	0	0
1	1	1
2	2	2
3	3	3

X= -3

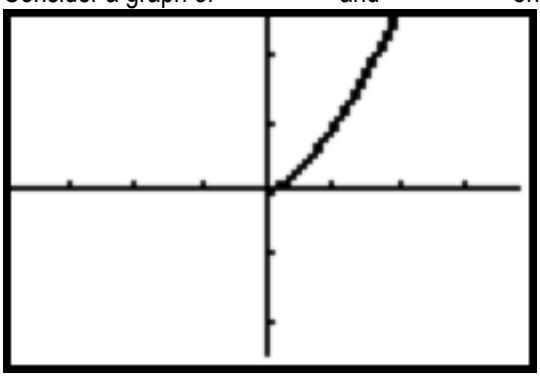
1) Can we actually say that $\sqrt{x^2} = x$ according to the graph and table?

2) What can be done to y2, so that y2 = y1? You must take the absolute value of y2 to get y1. Therefore $\sqrt{x^2} = |x|$

*Students should see that if you take the absolute value of y2 there is a reflection across the x axis.

Question 2: Does $\sqrt{x^3} = x\sqrt{x}$ for all real values of x?

Consider a graph of $y1 = \sqrt{x^3}$ and $y2 = x\sqrt{x}$ on the same set of axis and also their table of values.



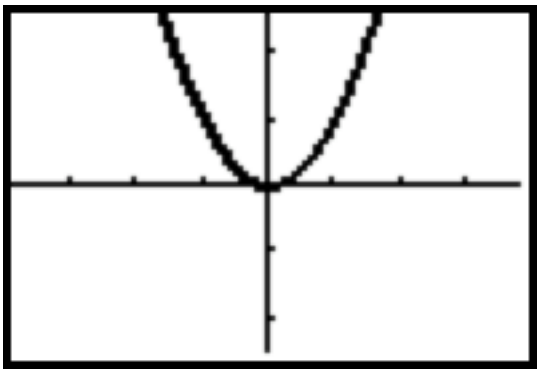
X	Y1	Y2
-2	ERROR	ERROR
-1	ERROR	ERROR
0	0	0
1	1	1
2	2.8284	2.8284
3	5.1962	5.1962
4	8	8

X=4

The two functions are identical; therefore no absolute value is necessary we can say that $\sqrt{x^3} = x\sqrt{x}$ for all real values of x

Question 3: Does $\sqrt{x^4} = x^2$ for all real values of x?

Consider a graph of $y1 = \sqrt{x^4}$ and $y2 = x^2$ on the same set of axis and also their table of values.



X	Y1	Y2
-3	9	9
-2	4	4
-1	1	1
0	0	0
1	1	1
2	4	4
3	9	9

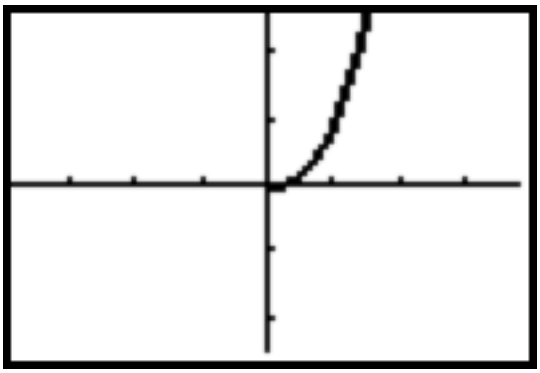
X= -3

The two functions are identical; therefore no absolute value is necessary.

We can safely say that $\sqrt{x^4} = x^2$ for all real values of x

Question 4: Does $\sqrt{x^5} = x^2\sqrt{x}$, for all real values of x?

Consider a graph of $y1 = \sqrt{x^5}$ and $y2 = x^2\sqrt{x}$ on the same set of axis and also their table of values.



X	Y1	Y2
-2	ERROR	ERROR
-1	ERROR	ERROR
0	0	0
1	1	1
2	5.6569	5.6569
3	15.588	15.588
4	32	32

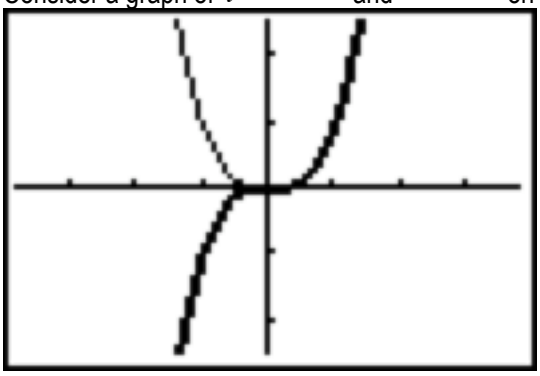
X=4

The two functions are identical; therefore no absolute value is necessary.

We can say that $\sqrt{x^5} = x^2\sqrt{x}$ for all real values of x.

Question 5: Does , $\sqrt{x^6} = x^3$ for all real values of x?

Consider a graph of $y1 = \sqrt{x^6}$ and $y2 = x^3$ on the same set of axis and also their table of values.



X	Y1	Y2
-3	27	-27
-2	8	-8
-1	1	-1
0	0	0
1	1	1
2	8	8
3	27	27

X= -3

1) Can we actually say that $\sqrt{x^6} = x^3$ according to the graph and table?

2) What can be done to y2, so that y2 = y1? You must take the absolute value of y2 to get y1. Therefore $\sqrt{x^6} = |x^3|$

Again you can point similarities to the example in question 1.

What did the absolute value do to y2? A reflection across the x-axis.

Conclusion?:

From these examples or additional ones if you class needs it, we can determine that whenever we take the square root of an even power and the result is an expression with an odd power, we must use the absolute value in the simplification. If we do not, then we are not simplifying the expression correctly. From these examples you can see that if you do not use the absolute value, the simplified expression is not equivalent to the original expression. When we teach the concept of simplifying expressions, we must stress that the resulting expression should be equivalent to the original expression.