x^y = y^x
take natural log on both sides.
=> yln(x)=xln(y)
=> ln(x)/x = ln(y)/y

now differentiate ln(x)/x wrt x and compare it with zero.

=> d/dx(ln(x)/x)
=> 1/x^2 - ln(x)/x^2
=> (1-ln(x))/x^2

for all real x, x^2 >=0
therefore : (1-ln(x)) >=0 for x<=e (~ 2.71)

1-ln(x) < 0 for x>e
So ln(x)/x is increasing in range <=e, i.e. for integers, its increasing for 1,2
and decreasing else where.

Following are the cases :

Case 1 : x<3 and y<3
As in this range function ln(x)/x is increasing
so f(x)>f(y), for x>y
=> ln(x)/x > ln(y)/y
=> x^y > y^x, for x>y and x<3 and y<3

Case 2 : x>3 and y>3
As in this range function is decreasing, so
f(x)<f(y), for="" x="">y
=> ln(x)/x < ln(y)/y
=> x^y < y^x , for x>y and x>3 and y>3

Case 3 : x<3 and y>=3
Here x=1,2
Case 3.1 : x=1
this is trivial case 1^n=1
so x^y < y^x

=> 1<y case="" 3.2="" :="" x="2" here="" x^y="2^y" and="" y^x="y^2" comparing="" the="" graph="" of="" exponential="" and="" parabola,="" following="" are="" results="" as="" y="">=3,
2^3 < 3^2 => 8<9
2^4 = 4^2 => 16=16
2^5 > 5^2 => 32>25
2^6 > 6^2 => 64>36
2^7 > 7^2 => 128>49
2^8 > 8^2 => 512 > 64
.... and so on.
So, x^y > y^x, for x=2, and y>3

x^y < y^x, for x=1,2 and y>=3

Note :
I have taken natural, you can take log for any base, answer will remain same because :

d/dx(lnx)=1/x
and d/dx(log(x)) = 1/x.log(b)

where b is base, for which log is taken.

Hope this will help.
If any this is incorrect, let me know.