$\sqrt[p]{\text{number}}$

Variable Explinations:

g	guess at the next digit of the answer, selected as explained below
l	lead number of the answer that has been computed thus far
p	power you are taking the root of
q	a multiplier selected from the array explained below
sub	function to subtract from your work

Q: $q_{(x,y)}$

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
2	2	1							
3	3	3	1						
4	4	6	4	1					
5	5	10	10	5	1				
6	6	15	20	15	6	1			
7	7	21	35	35	21	7	1		
8	8	28	56	70	56	28	8	1	
9	9	36	84	126	126	84	36	9	1

$$q_{(1,a)} = a$$

$$q_{(b,b)} = 1$$

$$q_{(x,y)} = q_{(x-1,y-1)} + q_{(x,y-1)}$$

Instructions:

1. Break the number into groups of digits of a count equal to the power (p) starting from the decimal point and working to the left and right.
2. Begin with the leftmost group as your working number.
3. Select the maximum g such that sub is less than or equal to the working number.
4. Compute sub according to the following formula and subtract it from your working number as if performing long division.
   $$sub = q_{(1,p)} 10^{(p-1)} l^{(p-1)} g^1 + q_{(2,p)} 10^{(p-2)} l^{(p-2)} g^2 + \ldots + q_{(p-1,p)} 10^1 l^1 g^{(p-1)} + q_{(p,p)} 10^0 l^0 g^p$$
   Or, written in another way:
   $$sub = \sum q_{(1\ldots p,p)} 10^{(p-1\ldots 0)} l^{(p-1\ldots 0)} g^{(1\ldots p)}$$
5. Place g in the results area above the group of digits you are working with.
6. If there are more groups of digits remaining in the original number, bring the next group of digits down and append it to your working number, as is done with single digits in long division. If the working number is not 0 and there are no remaining groups to bring down, a group of all zeros can be used.
7. Return to step 3.

Samples of *sub* function at various powers:

$p = 2$	$sub = 2 \cdot 10^1 \cdot l^1 \cdot g^1 + 1 \cdot 10^0 \cdot l^0 \cdot g^2$ $sub = 20 \cdot l \cdot g + g^2$
$p = 3$	$sub = 3 \cdot 10^2 \cdot l^2 \cdot g^1 + 3 \cdot 10^1 \cdot l^1 \cdot g^2 + 1 \cdot 10^0 \cdot l^0 \cdot g^3$ $sub = 300 \cdot l^2 \cdot g + 30 \cdot l \cdot g^2 + g^3$
$p = 4$	$sub = 4 \cdot 10^3 \cdot l^3 \cdot g^1 + 6 \cdot 10^2 \cdot l^2 \cdot g^2 + 4 \cdot 10^1 \cdot l^1 \cdot g^3 + 1 \cdot 10^0 \cdot l^0 \cdot g^4$ $sub = 4000 \cdot l^3 \cdot g + 600 \cdot l^2 \cdot g^2 + 40 \cdot l^1 \cdot g^3 + g^4$
$p = 5$	$sub = 5 \cdot 10^4 \cdot l^4 \cdot g^1 + 10 \cdot 10^3 \cdot l^3 \cdot g^2 + 10 \cdot 10^2 \cdot l^2 \cdot g^3 + 5 \cdot 10^1 \cdot l^1 \cdot g^4 + 1 \cdot 10^0 \cdot l^0 \cdot g^5$ $sub = 50{,}000 \cdot l^4 \cdot g^1 + 10{,}000 \cdot l^3 \cdot g^2 + 1{,}000 \cdot l^2 \cdot g^3 + 50 \cdot l^1 \cdot g^4 + g^5$