00:00:07.690 --> 00:00:10.934
OK, alright this video is on rewriting

00:00:10.934 --> 00:00:13.630
and simplifying square roots,

00:00:13.630 --> 00:00:16.157
cube roots and beyond of numbers that

00:00:16.157 --> 00:00:18.008
aren't perfect squares, cubes and so on.

00:00:18.008 --> 00:00:19.160
So I want to think about,

00:00:19.160 --> 00:00:23.045
for example, what is the square root.

00:00:23.050 --> 00:00:25.550
Of 27 and I want to rewrite it in a

00:00:25.627 --> 00:00:27.817
different form and in this different

00:00:27.817 --> 00:00:31.281
form I want to take as much as I can

00:00:31.281 --> 00:00:34.460
out from underneath the square root.

00:00:34.460 --> 00:00:38.140
So what we can do is we can think well,

00:00:38.140 --> 00:00:42.137
sqrt 27 this is the square root.

00:00:42.140 --> 00:00:48.320
Of 9 * 3 right? 9 * 3 is 27,

00:00:48.320 --> 00:00:50.435
and now what I really want to do is

00:00:50.435 --> 00:00:52.778
I want to write here that this is.

00:00:55.270 --> 00:00:58.932
Sqrt 9. Times sqrt 3 and it is

00:00:58.932 --> 00:01:01.918
but I have to be really careful.

00:01:01.920 --> 00:01:04.664
So what I'm doing up here is I'm

00:01:04.664 --> 00:01:07.565
saying OK I want the square root of.

00:01:07.570 --> 00:01:10.740
9 * 3 right. I want the square root of 27.

00:01:10.740 --> 00:01:12.195
And out here I'm changing

00:01:12.195 --> 00:01:13.587
the order I'm saying, well,

00:01:13.587 --> 00:01:15.403
I want to do sqrt 9 and get

00:01:15.403 --> 00:01:17.077
something and then sqrt 3 and get

00:01:17.077 --> 00:01:18.697
something and I want to multiply

00:01:18.697 --> 00:01:20.599
those numbers after the square root,

00:01:20.600 --> 00:01:21.588
whereas here I'm multiplying

00:01:21.588 --> 00:01:22.576
before the square root.

00:01:22.580 --> 00:01:24.700
So are they the same?

00:01:24.700 --> 00:01:26.500
And we have to think about.

00:01:26.500 --> 00:01:28.396
Let's justify one time that yes,

00:01:28.400 --> 00:01:29.828
you can do this.

00:01:29.828 --> 00:01:32.068
So this number here sqrt 27.

00:01:32.068 --> 00:01:35.300
That's a number where if I square it,

00:01:35.300 --> 00:01:36.521
I get 27.

00:01:36.521 --> 00:01:38.963
So let's check this number here.

00:01:38.970 --> 00:01:41.294
What happens if I square this so?

00:01:43.790 --> 00:01:48.220
Sqrt 9 times sqrt 3.

00:01:48.220 --> 00:01:50.536
Squared well, if you remember right,

00:01:50.540 --> 00:01:52.760
I can put that square on each one of these.

00:01:52.760 --> 00:01:54.656
This is a property of exponents,

00:01:54.660 --> 00:01:58.438
so this is going to be sqrt 9 ^2.

00:01:58.440 --> 00:02:00.600
Times sqrt 3 ^2.

00:02:00.600 --> 00:02:03.753
And that that is 27. Right,

00:02:03.753 --> 00:02:07.830
so this product is the same as this product.

00:02:07.830 --> 00:02:08.958
That's going to help us simplify

00:02:08.958 --> 00:02:10.044
things a great deal, right?

00:02:10.044 --> 00:02:13.050
Because what we're going to get here is just.

00:02:13.050 --> 00:02:16.502
3. Sqrt 3. So that's going to be the

00:02:16.502 --> 00:02:18.185
plan what we're going to do is say,

00:02:18.190 --> 00:02:19.390
OK, like I've got a number.

00:02:19.390 --> 00:02:21.410
It's not a perfect square

00:02:21.410 --> 00:02:23.018
and I'm going to write it.

00:02:23.020 --> 00:02:25.162
In such a way that I can find some

00:02:25.162 --> 00:02:27.260
perfect squares in it and then this

00:02:27.260 --> 00:02:29.507
square root splits really well across

00:02:29.507 --> 00:02:31.602
multiplication and I can just take the

00:02:31.602 --> 00:02:33.760
square root of the perfect squares.

00:02:33.760 --> 00:02:37.270
So let's. You know that's a lot of worrying.

00:02:37.270 --> 00:02:39.949
Does it work?

00:02:39.950 --> 00:02:41.446
Let's look at why we have to worry.

00:02:41.450 --> 00:02:43.374
So what about this?

00:02:43.374 --> 00:02:45.298
What's the square root?

00:02:45.300 --> 00:02:51.180
Of 25 so sqrt. 25 right? That's five.

00:02:51.180 --> 00:02:55.580
What's the square root? Of nine.

00:02:55.580 --> 00:02:59.750
Plus 16, well that's sqrt 25, right?

00:02:59.750 --> 00:03:01.530
That's five.

00:03:01.530 --> 00:03:03.562
And here I'm saying OK I need to

00:03:03.562 --> 00:03:05.798
add and then take the square root.

00:03:05.800 --> 00:03:06.150
OK,

00:03:06.150 --> 00:03:08.600
what if I take the square roots?

00:03:12.350 --> 00:03:17.722
And then add here I'm getting. 7. So.

00:03:17.722 --> 00:03:21.130
Square root. Likes multiplication,

00:03:21.130 --> 00:03:22.810
it works really well with multiplication.

00:03:22.810 --> 00:03:24.210
It's really defined in terms

00:03:24.210 --> 00:03:24.973
of multiplication, right?

00:03:24.973 --> 00:03:26.394
This is the number where if I

00:03:26.394 --> 00:03:28.029
multiply it by itself, I get 27.

00:03:28.029 --> 00:03:29.800
So it turns out that square root

00:03:29.865 --> 00:03:32.400
interacts really well with multiplication.

00:03:32.400 --> 00:03:35.430
It'll sort of split across multiplications.

00:03:35.430 --> 00:03:37.861
Square root does not like addition, right?

00:03:37.861 --> 00:03:40.330
So what's going to happen is, you know,

00:03:40.330 --> 00:03:42.850
probably in whatever class you're taking,

00:03:42.850 --> 00:03:44.383
you do a whole bunch of problems

00:03:44.383 --> 00:03:45.330
that look like this,

00:03:45.330 --> 00:03:47.801
and it's easy to develop this intuition

00:03:47.801 --> 00:03:50.509
that square root splits across operations.

00:03:50.510 --> 00:03:52.082
But you won't do problems that

00:03:52.082 --> 00:03:52.868
look like this,

00:03:52.870 --> 00:03:55.854
and so it does not split across addition.

00:03:55.860 --> 00:03:58.230
You have to be really careful.

00:03:58.230 --> 00:04:00.840
So let's do one more example

00:04:00.840 --> 00:04:02.048
of using this property.

00:04:04.100 --> 00:04:05.440
I want a new color.

00:04:05.440 --> 00:04:07.687
I don't think there's a new color.

00:04:07.690 --> 00:04:09.530
So let's do this.

00:04:09.530 --> 00:04:12.700
Let's do the cube root. Of 24

00:04:18.450 --> 00:04:20.004
so there's no whole number where when

00:04:20.004 --> 00:04:22.002
I cure it, I'm going to get 24, right?

00:04:22.002 --> 00:04:25.730
Three cubed is 27, two cubed is 8 right?

00:04:25.730 --> 00:04:28.376
And 24 just in the middle of those things.

00:04:28.380 --> 00:04:31.370
So what I can do is try to write this

00:04:31.459 --> 00:04:34.699
in a way that some cubes appear so like.

00:04:34.700 --> 00:04:36.340
There there are kind of two approaches right.

00:04:36.340 --> 00:04:38.600
One is to think 08, so perfect cube.

00:04:38.600 --> 00:04:39.964
So this is right.

00:04:39.964 --> 00:04:41.308
This is the cube root of.

00:04:43.620 --> 00:04:48.592
8 * 3 and then this thing up here, cube root,

00:04:48.592 --> 00:04:51.212
square root, 5th root, all those roots.

00:04:51.212 --> 00:04:53.756
They split across multiplication really well,

00:04:53.760 --> 00:04:55.990
so this is going to be the cube root of 8.

00:04:59.350 --> 00:05:00.676
Times the cube root of 3.

00:05:03.600 --> 00:05:05.688
And cube root of 8 is just two.

00:05:05.690 --> 00:05:10.200
So this is 2. Times the cube root of 3.

00:05:10.200 --> 00:05:11.413
We have to be a little careful, right?

00:05:11.413 --> 00:05:12.904
So like probably I should put a

00:05:12.904 --> 00:05:14.440
little bit more space here so it

00:05:14.440 --> 00:05:16.660
doesn't look like 2 ^3 * sqrt 3.

00:05:16.660 --> 00:05:19.960
Let's look at dot or something.

00:05:19.960 --> 00:05:21.695
OK, another thing we could

00:05:21.695 --> 00:05:24.190
do here is we could say well.

00:05:24.190 --> 00:05:26.116
We could write down the prime

00:05:26.116 --> 00:05:27.942
factorization of that number, right?

00:05:27.942 --> 00:05:30.740
So if you're sort of like

00:05:30.740 --> 00:05:32.690

where did 8 come from?

00:05:32.690 --> 00:05:35.993
The other thing we could do is say well.

00:05:36.000 --> 00:05:37.098
Let me just fit it here.

00:05:41.990 --> 00:05:45.940
Let's put a bit of it so the cube root. Of 24

00:05:48.500 --> 00:05:50.420
if you do prime factorization,

00:05:50.420 --> 00:05:51.924
you know, so you do the little tree.

00:05:54.200 --> 00:05:58.004
This is 2 ^3 * 3. And then OK,

00:05:58.004 --> 00:05:59.780
what we'll do is we'll think.

00:05:59.780 --> 00:06:01.172
Well, I want a bunch things

00:06:01.172 --> 00:06:02.616
together in groups of three because

00:06:02.616 --> 00:06:04.240
I'm going to take a cube root,

00:06:04.240 --> 00:06:10.150
so I want. Cube root of 2 ^3.

00:06:10.150 --> 00:06:13.118
Times the cube root.

00:06:13.120 --> 00:06:15.847
Three cube root of 2 ^3 is just two.

00:06:20.790 --> 00:06:22.730
Right, so either way,

00:06:22.730 --> 00:06:25.155
so the main idea is.

00:06:25.160 --> 00:06:26.936
Square root cube root, 5th root.

00:06:26.940 --> 00:06:29.415
All those things split very

00:06:29.415 --> 00:06:30.900

well across multiplication.

00:06:30.900 --> 00:06:32.852
They don't like addition.

00:06:32.852 --> 00:06:35.292
We can use this property.

00:06:35.300 --> 00:06:37.706
To rewrite them in forms that

00:06:37.710 --> 00:06:39.090
are arguably a little simpler.