**GUIDED NOTES (TEACHER GUIDE)**

Find the solution(s) to each of the following equations.

1. −2 6 1( *n*+ + =−)3 4 6

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| --- | --- |
| **Teacher**  | **Students**  |
| How do we isolate a variable?  | Use inverse operations.  |
| Remember that when we solve, we go backwards through the order of operations. Do we have any addition or subtraction **outside of the parentheses** we can undo?  | Yes, we need to start by subtracting 4 from both sides.  −2 6 1( *n*+ + =−)3 4 6 −4 −4 −2 6 1( *n*+ =−)3 10 |
| Continuing to look outside of the parentheses, which operation should we undo next?  | Divide both sides by −2. −2 6 1( *n*+ )3 −10= −2 −2 (6 1*n*+ =)3 5 |
| What’s the opposite of a power/exponent?  | a radical/root  |
| Let’s take the third root of both sides, since that’s the opposite of a third power.  |  3 (6 1*n*+ =)3 3 5 6 1*n*+ = 3 5 |
| Now, our parentheses are also gone, so we start back at the bottom of order of operations. Let’s subtract 1 from both sides.  Remember that we always write the radical on the end, so that minus 1 goes in front of the 3 5 .  | 6 1*n*+ = 3 5 − −1 1 6*n*=− +1 53 |
| Now, let’s divide both sides by 6. And we get a final answer of *n*= . 3156−+ | 3361566156*n**n*−+=−+=  |

1. 3(*x*+ =1) 48

|  |  |
| --- | --- |
| **Teacher**  | **Students**  |
| What operation do we need to undo first?  | Divide both sides by 3. P39C4T2#yIS1 (*x*+ =1) 16 |
| Now, we have two options: We can solve this using radicals or rational exponents. Let’s see what both options would look like. Let’s draw a T-chart under the equation and label each side.  | (*x*+ =1) 16

|  |  |
| --- | --- |
| exponential  | radical  |
|   |   |

 |
| What we’ve been given is already written with rational exponents, so we’ll copy that in the first column.  | (*x*+ =1) 16

|  |  |
| --- | --- |
| exponential  | radical  |
| (*x*+ =1) 16  |   |

 |
| Remember that something to the four-thirds power is the third root of something to the power of 4. That power of 4 could be written inside or outside of the radical. It will make the numbers smaller and easier to work with if we write the power outside of the radical.  | (*x*+ =1) 16

|  |  |
| --- | --- |
| exponential  | radical  |
| (*x*+ =1) 16  | 4(3 *x*+1) =16  |

 |
| Let’s start with the left column and solve this using rational exponents, then we’ll come back and solve it again using radicals.  |   |
| The only operation outside of the parentheses is the exponent of four-thirds. We need that exponent to be 1 so that we no longer need those parentheses.  Four-thirds times what is 1?      | three-fourths   |

|  |  |
| --- | --- |
| **Teacher**  | **Students**  |
| So, let’s raise each side to the power of threefourths.  Remember that we need to write ± since we’ve technically taken an even root.  | (*x*+ =1) 16

|  |  |
| --- | --- |
| exponential  | radical |
| (*x*+1) =16 4  3 (*x*+1)3  =(16)4    *x*+ =±1 (16) | 4(3 *x*+1) |

 |  =16  |
| Now, let’s simplify the right-hand side of this equation by rewriting 16 as a base to a power.  |  *x*+ =±1 (16)  *x*+ =±1 (24) |  |
| Continuing to simplify the right-hand side…  |  *x*+ =±1 (24)*x*+ =±1 23 *x*+ =±1 8 |  |
| Now, let’s subtract 1 from both sides.  Again, notice we’re putting the plus or minus stuff on the end to continue that good habit.  | *x*+ =±1 8− −1 1 *x*=− ±1 8 |  |
| We can simplify further, so we should. We get a final answer of *x*=7and *x*=−9 .  | *x*=− +1 8*and x*=− −1 8 *x*=7 *and x*=−9 |  |
| Now, let’s go back and solve again, but this time using radicals.  | (*x*+ =1) 16

|  |  |
| --- | --- |
| exponential  | radical  |
| (*x*+ =1) 16  | 4(3 *x*+1) =16  |

 |
| We need to undo the power of 4. What’s the opposite of a power of 4?       | a fourth root   |
| **Teacher**  | **Students**  |
| So, let’s take the fourth root of each side.  Don’t forget the ± with that even root.  | (*x*+ =1) 16

|  |  |
| --- | --- |
| exponential  | radical  |
| (*x*+ =1) 16  | ()()434344316111612*x**x**x*=++=+=±  |

 |
| Now, what is the opposite of a third root?  | Take each side to the power of 3.  3 *x*+ =±1 23(3 *x*+ = ±1) ( 2)3 *x*+ =±1 8 |
| Now, let’s subtract 1 from both sides.  Again, notice we’re putting the plus or minus stuff on the end to continue that good habit.  | *x*+ =±1 8− −1 1 *x*=− ±1 8 |
| We can simplify further, so we should. We get a final answer of *x*=7and *x*=−9 .  | *x*=− +1 8*and x*=− −1 8 *x*=7 *and x*=−9 |
| Notice that we got the same answer each time.  |   |

1. (*x*+3)− =−8 6

|  |  |
| --- | --- |
| **Teacher**  | **Students**  |
| If our goal is to solve for *x* , what should be our first step?        | Add 8 to both sides.  (*x*+3)− =−8 6+8 +8 (*x*+3)=2 |
| Let’s draw a T-chart under the equation and label each side.  | (*x*+3)=2

|  |  |
| --- | --- |
| exponential  | radical  |
|   |   |

 |
| What we’ve been given is already written with rational exponents, so we’ll copy that in the first column.  | (*x*+3)=2

|  |  |
| --- | --- |
| exponential  | radical  |
| (*x*+3)=2  |   |

 |
| A one-fourth power is what kind of root?  | a fourth root  |
| So, let’s rewrite the equation with a radical and put it in the second column.  | (*x*+3)=2

|  |  |
| --- | --- |
| exponential  | radical  |
| (*x*+3)=2  | 4*x*+ =3 2  |

 |
| Looking at the rational exponents column, what is the opposite of a one-fourth power?            | Take both sides to the power of 4. (*x*+3)=2

|  |  |
| --- | --- |
| exponential  | radical  |
| (*x*+3) =2 1 4 4(*x*+3)4  =(2)  *x*+ =3 16 | 4*x*+ =3 2  |

 |
| **Teacher**  | **Students**  |
| What should our next step be?   And we get a final answer of *x*=13.  | Subtract 3 from both sides. *x*+ =3 16− −3 3 *x*=13 |
| Now, let’s solve this again, but this time using radicals.  | (*x*+3)=2

|  |  |
| --- | --- |
| exponential  | radical  |
| (*x*+3)=2  | 4*x*+ =3 2  |

 |
| What’s the opposite of a fourth root?  | Take both sides to the power of 4. (*x*+3)=2

|  |  |
| --- | --- |
| exponential  | radical  |
| (*x*+3)=2  | 4 *x*+ =3 24(4 *x*+3) =(2)4 *x*+ =3 16 |

 |
| What should our next step be?   And we get a final answer of *x*=13.  | Subtract 3 from both sides. *x*+ =3 16− −3 3 *x*=13 |
| Wait a minute. I saw an even root in our problem—why does our answer not have a plus or minus symbol?  | The fourth root was already in the problem—we did not take an even root. We were given an even root, so there is only one solution.  |

1. − =−31 4 3( *m*)+5

|  |  |
| --- | --- |
| **Teacher**  | **Students**  |
| Where should we start?  | Subtract 5 from both sides. − =−31 4 3( *m*)+5 −5 −5  − =−36 4 3( *m*) |
| What operation should we perform next?  | Divide both sides by −4. P291C6T4#yIS1 9 3=( *m*) |
| Now, we see that rational exponent, so for our notes, we’re going to make a table to show both methods.  | 9 3=( *m*)

|  |  |
| --- | --- |
| exponential  | radical  |
|   |   |

 |
| Fill in each column with that first line.  Consider rewriting 9 as a base to a power in the rational exponents column.  When we write that radical, should the power go inside or outside of the radical?  | The power should go on the outside. 9 3=( *m*)

|  |  |
| --- | --- |
| exponential  | radical  |
| 32 =(3*m*)  | 9=(3 3*m*)2  |

 |
| Let’s solve the equation using rational exponents. What is the opposite of a twothirds power?  Don’t forget the ± ; we did take an even root.  | Take both sides to the power of threehalves. 9 3=( *m*)

|  |  |
| --- | --- |
| exponential  | radical  |
| 32 =(3*m*)(32)23 =(3*m*)32    ±3 33 = *m* ±27 3= *m* | 9=(3 3*m*)2  |

 |
| **Teacher**  | **Students**  |
| Now, let’s divide both sides by 3 and get a final answer of positive 9 and negative 9.  | ±27 3*m*= 3 3 ± =9 *m* |
| One more time, but this time with radicals.      | 9 3=( *m*)

|  |  |
| --- | --- |
| exponential  | radical  |
| 32 =(3*m*)  | 9=(3 3*m*)2  |

 |
| What is the opposite of a second power?  | Take the second root (or square root) of both sides. 9 3=( *m*)

|  |  |
| --- | --- |
| exponential  | radical  |
| 32 =(3*m*)  | ()()23233939333*m**m**m*==±=  |

 |
| What is the opposite of a third root?  | Take both sides to the power of 3. ± =3 3 3*m* (± =3)3 (3 3*m*)3 ± =27 3*m* |
| Now, let’s divide both sides by 3. We get a final answer of plus or minus 9.  | ±27 3*m*= 3 3 ± =9 *m* |

**GUIDED NOTES (MODEL NOTES)**

Find the solution(s) to each of the following equations.

**1)** −2 6 1( *n*+ + =−)3 4 6

# **2)** 3(*x*+ =1)48

*exponential*

*radical*

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3

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*x*

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Write

the

power

outside of

the radical

to keep the

numbers

smaller (so

it’s easier).

even root

# (*x*+1) =16

 4  3 (*x*+1)3  =(16)4

 

 *x*+ =±1 (16)

 *x*+ =±1 (2 )

*x*+ =±1 23 *x*+ =±1 8 − −1 1 *x*=− ±1 8

*x*=− +1 8*and x*=− −1 8

# **4)** − =−31 4 3( *m*)+5 −5 −5

*exponential*

*radical*

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**3)** (*x*+3)− =−8 6

 + +8 8

# (*x*+3)=2

9 3=( *m*)