**GUIDED NOTES (TEACHER GUIDE)**

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

1. −2 6 1( *n*+ + =−)3 4 6

|  |  |
| --- | --- |
| **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*= .  3  15  6  −+ | 3  3  6  15  6  6  15  6  *n*  *n*  −+  =  −+  = |

1. 3(*x*+ =1)P33#yIS1 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 | (  )  (  )  4  3  4  3  4  4  3  16  1  1  16  1  2  *x*  *x*  *x*  =  +  +  =  +=± | | |
| Now, what is the opposite of a third root? | Take each side to the power of 3.  3 *x*+ =±1 2  3  (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)P167#yIS1− =−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 2  4  (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*)P281#yIS1+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*) | (  )  (  )  2  3  2  3  3  9  3  9  3  3  3  *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*

4

3

3

4

3

4

3

4

4

7

9

*x*

*andx*

=

=−

(

)

(

)

(

)

(

)

4

3

4

3

4

4

3

3

3

3

16

1

16

1

1

2

1

2

1

8

18

18

9

7

*x*

*x*

*x*

*x*

*x*

*x*

*andx*

*andx*

*x*

+=

=

+

+=±

+=±

+=±

=−+

=−−

=

=−

(

)

1

16

*x*

+=

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*

(

)

(

)

(

)

1

4

4

1

4

4

3

2

3

2

316

33

13

*x*

*x*

*x*

*x*

=

+





=

+









+=

−

−

=

(

)

(

)

4

4

4

4

32

2

3

316

33

13

*x*

*x*

*x*

*x*

+=

+

=

+=

−−

=

*exponential*

*radical*

(

)

(

)

(

)

2

3

3

3

2

2

2

2

3

3

93

3

3

33

273

9

*m*

*m*

*m*

*m*

*m*

=





=









=

±

±

=

±=

(

)

(

)

(

)

(

)

2

3

2

3

3

3

3

3

9

3

9

3

3

3

3

3

273

9

*m*

*m*

*m*

*m*

*m*

*m*

=

=

±=

±=

±=

±=

2

3

4

4

=

−

−

even root

−4 −4

−2 6 1( *n*+ )3 −10

=

−2 −2

(6 1*n*+ =)3 5

(

)

3

3

3

3

3

3

3

5

61

5

61

11

6

1

5

6

1

5

6

6

1

5

6

*n*

*n*

*n*

*n*

*n*

+=

+=

−−

=−+

−+

=

−+

=



**3)** (*x*+3)− =−8 6

 + +8 8

# (*x*+3)=2

9 3=( *m*)