Math 20-1

KEY

62
[redacted] – Worksheet – 5.3 Radical Equations

Pg 300 #3: Solve each radical equation. Verify your solutions and identify any extraneous roots.

$2x \geq 0$, $x \geq 0$

$\sqrt{2x} = 3$

$2x = 3^2$

$2x = 9$

$x = 9/2$

$-8x \geq 0$, $x \leq 0$

$\sqrt{-8x} = 4$

$-8x = 4^2$

$-8x = 16$

$x = -2$

$7 = \sqrt{5 - 2x}$

$7^2 = 5 - 2x$

$49 = 5 - 2x$

$-5 \quad -5$

$44 = -2x$

$-22 = x$

$5 - 2x \geq 0$

$-2x \geq -5$

$x \leq 5/2$

Pg 300 #4ab: Solve each radical equation. Verify your solutions.

$z \geq 0$

$\sqrt{z} + 8 = 13$

$\sqrt{z} = 5$

$z = 5^2$

$z = 25$

$2 - \sqrt{y} = -4$

$-2 \quad -2$

$-1\sqrt{y} = -6$

$\div(-1) \quad \div(-1)$

$\sqrt{y} = 6$

$y = 6^2$

$y = 36$

$y \geq 0$

Pg 300 #4cd: Solve each radical equation. Verify your solutions.

$3x \geq 0$, $x \geq 0$

$\sqrt{3x} - 8 = -6$

$+8 \quad +8$

$\sqrt{3x} = 2$

$3x = 2^2$

$3x = 4$

$x = 4/3$

$-5 = 2 - \sqrt{-6m}$

$-2 \quad -2$

$-7 = -1\sqrt{-6m}$

$\div(-1) \quad \div(-1)$

$7 = \sqrt{-6m}$

$7^2 = -6m$

$49 = -6m$

$m = -49/6$

$-6m \geq 0$

$m \leq 0$

KEY

Math 20-1

Pg 300 #6ac: Isolate each radical term. Then, solve the equation.

$-3\sqrt{n-1}+7=-14, n\geq 1$

$-3\sqrt{n-1}+7=-14$
$\quad -7 \quad -7$
$-3\sqrt{n-1}=-21$
$\div(-3) \quad \div(-3)$
$\sqrt{n-1}=7$
$n-1=7^2$
$n-1=49$
$\quad +1 \quad +1$
$n=50$

$n-1\geq 0$
$n\geq 1$

$12=-3+5\sqrt{8-x}, x\leq 8$

$12=-3+5\sqrt{8-x}$
$+3 \quad +3$
$15=5\sqrt{8-x}$
$\div 5 \quad \div 5$
$3=\sqrt{8-x}$
$3^2=8-x$
$9=8-x$
$-8 \quad -8$
$1=-1x$
$\div(-1) \quad \div(-1)$
$-1=x$

$8-x\geq 0$
$-x\geq -8$
$x\leq 8$

Pg 300 #8ab: Solve each radical equation.

$5+\sqrt{3x-5}=x$

$5+\sqrt{3x-5}=x$
$-5 \quad -5$
$\sqrt{3x-5}=x-5$
$3x-5=(x-5)^2$
$3x-5=(x-5)(x-5)$
$(3x-5)=(x^2-10x+25)$
$0=x^2-13x+30$
$0=(x-10)(x-3)$

$x-10=0$ or $x-3=0$
$x=10$ or $x=3$

$3x-5\geq 0$
$3x\geq 5$
$x\geq 5/3$

Both are $\geq 5/3$.

VERIFY

$5+\sqrt{3(10)-5}=(10)$
$5+\sqrt{25}=10$
$5+5=10$
$10=10$
Yep! Works.

$x=10$

$5+\sqrt{3(3)-5}=(3)$
$5+\sqrt{4}=3$
$5+2=3$
$7\neq 3$
Nope. Throw this one out.

$\sqrt{x^2+30x}=8$

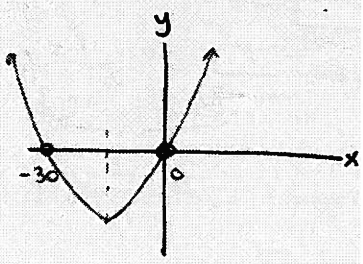
$x^2+30x=8^2$
$x^2+30x=64$
$x^2+30x-64=0$
$(x+32)(x-2)=0$

$x+32=0$ or $x-2=0$
$x=-32$ or $x=2$

Both answers work in original equation.

$x=-32$ or 2.

$x^2+30x\geq 0$
$x(x+30)\geq 0$



So $x\geq 0$ or $x\leq -30$

(Don't worry, you'll learn this in Quadratics).

Key

Math 20-1

Pg 300 #8cd: Solve each radical equation.

$\sqrt{d+5} = d-1$ $\quad d+5 \geq 0$, $d \geq -5$

$d+5 = (d-1)^2$

$d+5 = (d-1)(d-1)$

$d+5 = d^2-2d+1$

$0 = d^2-3d-4$

$0 = (d-4)(d+1)$

$d-4=0$ $\quad d+1=0$

$d=4$ $\quad d=-1$

VERIFY

$\sqrt{4+5} = 4-1$ $\quad \sqrt{-1+5} = -1-1$

$\sqrt{9} = 3$ $\quad \sqrt{4} = -2$

$3=3.$ $\quad$ Nope. Only positive roots.

$\boxed{d=4}$

Pg 300 #10ac: Solve.

$\sqrt{z+5} = \sqrt{2z-1}$

$z+5 = 2z-1$

$-z \quad -z$

$5 = z-1$

$+1 \quad +1$

$z=6$

$\sqrt{\frac{j+1}{3}} + 5j = 3j-1$

$-5j \quad -5j$

$\sqrt{\frac{j+1}{3}} = -2j-1$

$\frac{j+1}{3} = (-2j-1)^2$

$\frac{j+1}{3} = (-2j-1)(-2j-1)$

$\frac{j+1}{3} = (4j^2+4j+1)$

$j+1 = 3(4j^2+4j+1)$

$j+1 = 12j^2+12j+3$

$0 = 12j^2+11j+2$

$0 = (4j+1)(3j+2)$

$4j+1=0$ $\quad 3j+2=0$

$j=-1/4$ $\quad j=-2/3$

Doesn't verify. (Work not shown) $\quad$ This one works.

$\boxed{j=-2/3}$

Factoring $12j^2+11j$

$+3 \quad +8$

$\square+\square=11$

$\square\times\square=24$

$12j^2+3j+8j+2$

$(12j^2+3j)+(8j+2)$

$3j(4j+1)+2(4j+1)$

$(4j+1)(3j+2)$

$\sqrt{5r-9} - 3 = \sqrt{r+4} - 2$

$\sqrt{5r-9} = \sqrt{r+4}+1$

$5r-9 = (\sqrt{r+4}+1)^2$

$5r-9 = (\sqrt{r+4}+1)(\sqrt{r+4}+1)$

$5r-9 = (r+4) + 2\sqrt{r+4} + 1$

$5r-9 = r+5 + 2\sqrt{r+4}$

$-r \quad -5 \quad -r \quad -5$

$4r-14 = 2\sqrt{r+4}$

$\div 2 \quad \div 2 \quad \div 2$

$2r-7 = \sqrt{r+4}$

$(2r-7)^2 = r+4$

$(2r-7)(2r-7) = r+4$

$4r^2-28r+49 = r+4$

$4r^2-29r+45 = 0$

$(r-5)(4r-9) = 0$

$r-5=0$ $\quad 4r-9=0$

$r=5$ $\quad r=9/4$

This one works. $\quad$ Doesn't verify. (Work not shown).

$\boxed{r=5}$

Factor $4r^2-49r+45$

$-20 \quad -9$

$\square+\square=-29$

$\square\times\square=180$

$4r^2-20r-9r+45$

$(4r^2-20r)+(-9r+45)$

$4r(r-5)-9(r-5)$

$(r-5)(4r-9)$

Math 20-1

KEY

Pg 300 #14: In 1805, Rear-Admiral Beaufort created a numerical scale to help sailors quickly assess the strength of the wind. The integer scale ranges from 0 to 12. The wind scale, B, is related to the wind velocity, v, in kilometers per hour, by the formula $B = 1.33\sqrt{v + 10.0} - 3.49, v \geq -10$.

a. Determine the wind scale for a wind velocity of 40 km/h.
b. What wind velocity results in a wind scale of 3?

(A) $B = 1.33\sqrt{40 + 10.0} - 3.49$

$B = 1.33\sqrt{50} - 3.49$

$B = 1.33(7.07) - 3.49$

$B = 9.40 - 3.49$

$B = 5.91$

Integer Scale!

$B = 6$

(B) $3 = 1.33\sqrt{v + 10.0} - 3.49$

$+3.49 \qquad +3.49$

$6.49 = 1.33\sqrt{v + 10.0}$

$\div 1.33 \quad \div 1.33$

$4.88 = \sqrt{v + 10}$

$23.81 = v + 10$

$13.81 = v$

$v \simeq 13.8$ km/h.

Pg 300 #16: Two more than the square root of a number, n, is equal to the number. Model this situation using a radical equation. Determine the value(s) of n algebraically.

$\sqrt{n} + 2 = n$

$\sqrt{n} = n - 2$

$n = (n-2)^2$

$n = (n-2)(n-2)$

$n = n^2 - 4n + 4$

$0 = n^2 - 5n + 4$

$0 = (n-4)(n-1)$

$n - 4 = 0 \qquad n - 1 = 0$

$n = 4 \qquad n = 1$

This one works. Doesn't verify.

$\boxed{n = 4}$