

A.REI.A.2: Solving Radicals 1

- 1 The solution set for the equation $\sqrt{56-x} = x$ is
 - 1) $\{-8, 7\}$
 - 2) $\{-7, 8\}$
 - 3) $\{7\}$
 - 4) $\{\}$
- 2 What is the solution set of $x = \sqrt{3x+40}$?
 - 1) $\{-5, 8\}$
 - 2) $\{8\}$
 - 3) $\{-4, 10\}$
 - 4) $\{\}$
- 3 The solution set for the equation $\sqrt{3(x+6)} = x$ is
 - 1) $\{6, -3\}$
 - 2) $\{-6, 3\}$
 - 3) $\{6\}$
 - 4) $\{-3\}$
- 4 What is the solution set for x in the equation below?
$$\sqrt{x+1} - 1 = x$$
 - 1) $\{1\}$
 - 2) $\{0\}$
 - 3) $\{-1, 0\}$
 - 4) $\{0, 1\}$
- 5 The solution set of the equation $x - 1 = \sqrt{2x+6}$ is
 - 1) $\{5, -1\}$
 - 2) $\{5\}$
 - 3) $\{-1\}$
 - 4) $\{\}$
- 6 The solution set for the equation $x + 1 = \sqrt{4x+25}$ is
 - 1) $\{\}$
 - 2) $\{6\}$
 - 3) $\{6, -4\}$
 - 4) $\{-4\}$
- 7 The solution set for the equation $b = \sqrt{2b^2 - 64}$ is
 - 1) $\{-8\}$
 - 2) $\{8\}$
 - 3) $\{\pm 8\}$
 - 4) $\{\}$
- 8 The value(s) of x that satisfy $\sqrt{x^2 - 4x - 5} = 2x - 10$ are
 - 1) $\{5\}$
 - 2) $\{7\}$
 - 3) $\{5, 7\}$
 - 4) $\{3, 5, 7\}$
- 9 The solution set for the equation $\sqrt{x+14} - \sqrt{2x+5} = 1$ is
 - 1) $\{-6\}$
 - 2) $\{2\}$
 - 3) $\{18\}$
 - 4) $\{2, 22\}$
- 10 Determine the solution of $\sqrt{3x+7} = x - 1$ algebraically.
- 11 Solve algebraically for all values of x : $\sqrt{4x+1} = 11 - x$
- 12 Solve algebraically for all values of x : $\sqrt{x-5} + x = 7$
- 13 Solve algebraically for all values of x : $\sqrt{x-4} + x = 6$
- 14 Solve the equation $\sqrt{49-10x} + 5 = 2x$ algebraically.
- 15 Solve algebraically for all values of x : $\sqrt{6-2x} + x = 2(x+15) - 9$
- 16 Algebraically solve for x : $2x = 6 + 2\sqrt{x-1}$

- 17 Solve the given equation algebraically for all values of x . $3\sqrt{x} - 2x = -5$
- 18 Solve the equation $\sqrt{2x-7} + x = 5$ algebraically, and justify the solution set.
- 19 The speed of a tidal wave, s , in hundreds of miles per hour, can be modeled by the equation $s = \sqrt{t} - 2t + 6$, where t represents the time from its origin in hours. Algebraically determine the time when $s = 0$. How much faster was the tidal wave traveling after 1 hour than 3 hours, to the *nearest mile per hour*? Justify your answer.
- 20 A Foucault pendulum can be used to demonstrate that the Earth rotates. The time, t , in seconds, that it takes for one swing or period of the pendulum can be modeled by the equation $t = 2\pi\sqrt{\frac{L}{g}}$ where L is the length of the pendulum in meters and g is a constant of 9.81 m/s^2 . The first Foucault pendulum was constructed in 1851 and has a pendulum length of 67 m. Determine, to the *nearest tenth of a second*, the time it takes this pendulum to complete one swing. Another Foucault pendulum at the United Nations building takes 9.6 seconds to complete one swing. Determine, to the *nearest tenth of a meter*, the length of this pendulum.
- 21 The Beaufort Wind Scale was devised by British Rear Admiral Sir Francis Beaufort, in 1805 based upon observations of the effects of the wind. Beaufort numbers, B , are determined by the equation $B = 1.69\sqrt{s + 4.45} - 3.49$, where s is the speed of the wind in mph, and B is rounded to the nearest integer from 0 to 12.

Beaufort Wind Scale	
Beaufort Number	Force of Wind
0	Calm
1	Light air
2	Light breeze
3	Gentle breeze
4	Moderate breeze
5	Fresh breeze
6	Steady breeze
7	Moderate gale
8	Fresh gale
9	Strong gale
10	Whole gale
11	Storm
12	Hurricane

Using the table above, classify the force of wind at a speed of 30 mph. Justify your answer. In 1946, the scale was extended to accommodate strong hurricanes. A strong hurricane received a B value of exactly 15. Algebraically determine the value of s , to the *nearest mph*. Any B values that round to 10 receive a Beaufort number of 10. Using technology, find an approximate range of wind speeds, to the *nearest mph*, associated with a Beaufort number of 10.

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Answer Section

1 ANS: 3
 $\sqrt{56-x} = x$ -8 is extraneous.

$$56 - x = x^2$$

$$0 = x^2 + x - 56$$

$$0 = (x+8)(x-7)$$

$$x = 7$$

REF: 061605aaii

2 ANS: 2
 $x^2 = 3x + 40$. $x = -5$ is an extraneous solution.

$$x^2 - 3x - 40 = 0$$

$$(x-8)(x+5) = 0$$

$$x = 8, -5$$

REF: 012010aaii

3 ANS: 3
 $\sqrt{3x+18} = x$ -3 is extraneous.

$$3x + 18 = x^2$$

$$x^2 - 3x - 18 = 0$$

$$(x-6)(x+3) = 0$$

$$x = 6, -3$$

REF: 082315aaii

4 ANS: 3
 $\sqrt{x+1} = x+1$

$$x+1 = x^2 + 2x + 1$$

$$0 = x^2 + x$$

$$0 = x(x+1)$$

$$x = -1, 0$$

REF: 011802aaii

5 ANS: 2

$$(x-1)^2 = 2x+6 \quad -1 \text{ is extraneous.}$$

$$x^2 - 2x + 1 = 2x + 6$$

$$x^2 - 4x - 5 = 0$$

$$(x-5)(x+1) = 0$$

$$x = 5, -1$$

REF: 082411aii

6 ANS: 2

$$x+1 = \sqrt{4x+25} \quad -4+1 < 0$$

$$x^2 + 2x + 1 = 4x + 25$$

$$x^2 - 2x - 24 = 0$$

$$(x-6)(x+4) = 0$$

$$x = 6, -4$$

REF: 062408aii

7 ANS: 2

$$b^2 = 2b^2 - 64 \quad -8 \text{ is extraneous.}$$

$$-b^2 = -64$$

$$b = \pm 8$$

REF: 061919aii

8 ANS: 3

$$x^2 - 4x - 5 = 4x^2 - 40x + 100$$

$$3x^2 - 36x + 105 = 0$$

$$x^2 - 12x + 35 = 0$$

$$(x-7)(x-5) = 0$$

$$x = 5, 7$$

REF: 081807aii

9 ANS: 2

$$\sqrt{x+14} = \sqrt{2x+5} + 1 \qquad \sqrt{22+14} - \sqrt{2(22)+5} = 1$$

$$x+14 = 2x+5+2\sqrt{2x+5}+1 \qquad 6-7 \neq 1$$

$$-x+8 = 2\sqrt{2x+5}$$

$$x^2 - 16x + 64 = 8x + 20$$

$$x^2 - 24x + 44 = 0$$

$$(x-22)(x-2) = 0$$

$$x = 2, 22$$

REF: 081704aia

10 ANS:

$$3x+7 = x^2 - 2x+1 \quad -1 \text{ is extraneous.}$$

$$0 = x^2 - 5x - 6$$

$$0 = (x-6)(x+1)$$

$$x = 6, -1$$

REF: 062326aia

11 ANS:

$$\sqrt{4x+1} = 11-x \qquad 20 \text{ is extraneous.}$$

$$4x+1 = 121 - 22x + x^2$$

$$0 = x^2 - 26x + 120$$

$$0 = (x-6)(x-20)$$

$$x = 6, 20$$

REF: 082227aia

12 ANS:



$$\sqrt{x-5} = -x+7 \quad \sqrt{x-5} = -9+7 = -2 \text{ is extraneous.}$$

$$x-5 = x^2 - 14x + 49$$

$$0 = x^2 - 15x + 54$$

$$0 = (x-6)(x-9)$$

$$x = 6, 9$$

REF: spr1508aai

13 ANS:

$$\sqrt{x-4} = -x+6 \quad \sqrt{x-4} = -8+6 = -2 \text{ is extraneous.}$$

$$x-4 = x^2 - 12x + 36$$

$$0 = x^2 - 13x + 40$$

$$0 = (x-8)(x-5)$$

$$x = 5, 8$$

REF: 061730aai

14 ANS:

$$\sqrt{49-10x} = 2x-5 \quad -\frac{3}{2} \text{ is extraneous.}$$

$$49-10x = 4x^2 - 20x + 25$$

$$0 = 4x^2 - 10x - 24$$

$$0 = 2x^2 - 5x - 12$$

$$0 = (2x+3)(x-4)$$

$$x = -\frac{3}{2}, 4$$

REF: 012333aai

15 ANS:

$$\sqrt{6-2x} + x = 2x + 30 - 9 \quad \sqrt{6-2(-29)} \neq -29 + 21, \text{ so } -29 \text{ is extraneous.}$$

$$\sqrt{6-2x} = x + 21 \quad \sqrt{64} \neq -8$$

$$6 - 2x = x^2 + 42x + 441$$

$$x^2 + 44x + 435 = 0$$

$$(x + 29)(x + 15) = 0$$

$$x = -29, -15$$

REF: 061833aaii

16 ANS:

$$2x - 6 = 2\sqrt{x-1} \quad 2 \text{ is extraneous.}$$

$$4x^2 - 24x + 36 = 4(x-1)$$

$$x^2 - 6x + 9 = x - 1$$

$$x^2 - 7x + 10 = 0$$

$$(x-5)(x-2) = 0$$

$$x = 2, 5$$

REF: 012434aaii

17 ANS:

$$3\sqrt{x} - 2x = -5 \quad 1 \text{ is extraneous.}$$

$$3\sqrt{x} = 2x - 5$$

$$9x = 4x^2 - 20x + 25$$

$$4x^2 - 29x + 25 = 0$$

$$(4x - 25)(x - 1) = 0$$

$$x = \frac{25}{4}, 1$$

REF: 011936aaii

18 ANS:

$$\begin{aligned} (\sqrt{2x-7})^2 &= (5-x)^2 & \sqrt{2(4)-7}+4=5 & \sqrt{2(8)-7}+8=5 \\ 2x-7 &= 25-10x+x^2 & \sqrt{1} &= 1 & \sqrt{9} &\neq -3 \\ 0 &= x^2-12x+32 \\ 0 &= (x-8)(x-4) \\ x &= 4,8 \end{aligned}$$

REF: 081635aai

19 ANS:

$$\begin{aligned} 0 &= \sqrt{t}-2t+6 \quad 2\left(\frac{9}{4}\right)-6 < 0, \text{ so } \frac{9}{4} \text{ is extraneous.} \\ 2t-6 &= \sqrt{t} \\ 4t^2-24t+36 &= t \\ 4t^2-25t+36 &= 0 \\ (4t-9)(t-4) &= 0 \\ t &= \frac{9}{4}, 4 \\ (\sqrt{1}-2(1)+6) - (\sqrt{3}-2(3)+6) &= 5-\sqrt{3} \approx 3.268 \text{ 327 mph} \end{aligned}$$

REF: 011737aai

20 ANS:

$$\begin{aligned} t = 2\pi\sqrt{\frac{67}{9.81}} &\approx 16.4 \quad 9.6 = 2\pi\sqrt{\frac{L}{9.81}} \\ L &\approx 22.9 \end{aligned}$$

REF: 062234aai

21 ANS:

$B = 1.69\sqrt{30+4.45} - 3.49 \approx 6$, which is a steady breeze.

$$15 = 1.69\sqrt{s+4.45} - 3.49$$

$$18.49 = 1.69\sqrt{s+4.45}$$

$$\frac{18.49}{1.69} = \sqrt{s+4.45}$$

$$\left(\frac{18.49}{1.69}\right)^2 = s+4.45$$

$$s = \left(\frac{18.49}{1.69}\right)^2 - 4.45$$

$$s \approx 115$$

$$9.5 = 1.69\sqrt{s+4.45} - 3.49$$

$$10.49 = 1.69\sqrt{s+4.45} - 3.49 \quad 55-64$$

$$12.99 = 1.69\sqrt{s+4.45}$$

$$13.98 = 1.69\sqrt{s+4.45}$$

$$\frac{12.99}{1.69} = \sqrt{s+4.45}$$

$$\frac{13.98}{1.69} = \sqrt{s+4.45}$$

$$\left(\frac{12.99}{1.69}\right)^2 = s+4.45$$

$$\left(\frac{13.98}{1.69}\right)^2 = s+4.45$$

$$s = \left(\frac{12.99}{1.69}\right)^2 - 4.45$$

$$s = \left(\frac{13.98}{1.69}\right)^2 - 4.45$$

$$s \approx 55$$

$$s \approx 64$$

REF: 081937aII