

ADVANCED ALGEBRA
Radicals Test Review

Name Key hr

Simplify. Write in simplest radical form.

1. $\sqrt{63}$
 $\begin{array}{c} 9 \quad 7 \\ \swarrow \quad \searrow \\ 3\sqrt{7} \end{array}$

2. $\sqrt{72}$
 $\begin{array}{c} 36 \quad 2 \\ \swarrow \quad \searrow \\ 6\sqrt{2} \end{array}$

3. $\sqrt{g^5 h^8}$
 $g^2 h^4 \sqrt{g}$

4. $\sqrt[3]{x^5 y^8 z^4}$
 $xy^2 z \cdot \sqrt[3]{x^2 y^2 z}$

5. $\sqrt[3]{32a^9 b^{10}}$
 $2ab^2 \cdot \sqrt[3]{a^4}$

6. $\sqrt{80x^9}$
 $\begin{array}{c} 16 \quad 5 \\ \swarrow \quad \searrow \\ 4x^4 \cdot \sqrt{5x} \end{array}$

7. $\sqrt[3]{-81x^5 y^9}$
 $\begin{array}{c} -27 \quad 3 \\ \swarrow \quad \searrow \\ -3xy^3 \cdot \sqrt[3]{3x^2} \end{array}$

8. $\sqrt[3]{-27a^7 b^{10}}$
 $-3a^2 b^3 \cdot \sqrt[3]{ab}$

9. $\frac{\sqrt{81x^4}}{\sqrt{3x^3}}$ Divide!
 $\begin{array}{c} \sqrt{27x} \\ \begin{array}{c} 9 \quad 3 \\ \swarrow \quad \searrow \end{array} \\ 3\sqrt{3x} \end{array}$

10. $\frac{\sqrt{25x}}{\sqrt{5}}$ Divide!
 $\sqrt{5x}$

11. $\frac{\sqrt[3]{81x^9}}{\sqrt[3]{3x^4}}$ Divide!
 $\begin{array}{c} 3\sqrt[3]{27x^5} \\ 3x \cdot \sqrt[3]{x^2} \end{array}$

12. $\frac{10}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{10\sqrt{5}}{\sqrt{25}} =$
 $\frac{10\sqrt{5}}{5} = 2\sqrt{5}$

see pg 3 for alternate methods

13. $\frac{12}{\sqrt[3]{2}} \cdot \frac{\sqrt[3]{2}}{\sqrt[3]{2}} \cdot \frac{\sqrt[3]{2}}{\sqrt[3]{2}}$
 $\frac{12 \cdot \sqrt[3]{4}}{2} = 6\sqrt[3]{4}$

14. $\frac{16}{\sqrt[4]{2x^2}} \cdot \frac{\sqrt[4]{2x^2}}{\sqrt[4]{2x^2}} \cdot \frac{\sqrt[4]{2x^2}}{\sqrt[4]{2x^2}}$
 $\frac{16 \cdot \sqrt[4]{8x^6}}{2x^2} = \frac{16x \cdot \sqrt[4]{8x^2}}{2x^2} =$
 $\frac{8\sqrt[4]{8x^2}}{x}$

15. $\frac{16}{\sqrt{18}} \cdot \frac{\sqrt{18}}{\sqrt{18}} =$
 $\frac{16\sqrt{18}}{18} = \frac{48\sqrt{2}}{18} =$
 $\frac{8\sqrt{2}}{3}$

16. $\frac{10}{4-\sqrt{2}} \cdot \frac{4+\sqrt{2}}{4+\sqrt{2}} =$
 FOIL
 $\frac{40+10\sqrt{2}}{14} = \frac{20+5\sqrt{2}}{7}$

17. $\sqrt{32} + 4\sqrt{72}$
 $\begin{array}{c} 16 \quad 2 \quad 36 \quad 2 \\ \swarrow \quad \searrow \quad \swarrow \quad \searrow \\ 4\sqrt{2} + 4 \cdot 6\sqrt{2} \\ 4\sqrt{2} + 24\sqrt{2} \\ 28\sqrt{2} \end{array}$

18. $3\sqrt{12} + 8\sqrt{75}$
 $\begin{array}{c} 4 \quad 3 \quad 25 \quad 3 \\ \swarrow \quad \searrow \quad \swarrow \quad \searrow \\ 3 \cdot 2\sqrt{3} + 8 \cdot 5\sqrt{3} \\ 6\sqrt{3} + 40\sqrt{3} \\ 46\sqrt{3} \end{array}$

19. $\sqrt{14}(3+\sqrt{2})$
 $\begin{array}{c} 3\sqrt{14} + \sqrt{28} \\ \begin{array}{c} 4 \quad 7 \\ \swarrow \quad \searrow \end{array} \\ 3\sqrt{14} + 2\sqrt{7} \end{array}$

20. $(\sqrt{6}+3)(\sqrt{6}-5)$
 FOIL
 $\sqrt{36} - 5\sqrt{6} + 3\sqrt{6} - 15$
 $6 - 5\sqrt{6} + 3\sqrt{6} - 15$
 $-9 - 2\sqrt{6}$

Solve. Check for extraneous solutions.

21. $\sqrt{x+4}+3=8$

$$\begin{array}{r} -3 \quad -3 \\ \sqrt{x+4} = 5 \end{array}$$

$$x+4 = 25$$

$$\begin{array}{r} -4 \quad -4 \\ x = 21 \end{array}$$

$$\boxed{x=21}$$

$$\sqrt{21+4}+3=8$$

$$\sqrt{25}+3=8$$

$$5+3=8$$

$$8=8 \checkmark$$

22. $-\sqrt{x+1}=-6$

$$\begin{array}{r} -1 \quad -1 \\ \sqrt{x+1} = 6 \end{array}$$

$$x+1 = 36$$

$$\begin{array}{r} -1 \quad -1 \\ x = 35 \end{array}$$

$$\boxed{x=35}$$

$$-\sqrt{35+1}=-6$$

$$-\sqrt{36}=-6$$

$$-6=-6$$

$$\checkmark$$

23. $\sqrt[3]{3x-2}=12$

$$\begin{array}{r} +2 \quad +2 \\ \sqrt[3]{3x} = 14 \end{array}$$

$$3x = 2744$$

$$\begin{array}{r} 3 \quad 3 \\ x = 914 \frac{2}{3} \end{array}$$

$$\boxed{x=914 \frac{2}{3}}$$

$$\sqrt[3]{3(914 \frac{2}{3})}-2=12$$

$$\sqrt[3]{2744}-2=12$$

$$14-2=12$$

$$12=12$$

$$\checkmark$$

24. $\sqrt{5x+1}=\sqrt{6x-6}$

$$\begin{array}{r} 5x+1 = 6x-6 \\ -5x \quad -5x \\ 1 = x-6 \end{array}$$

$$\begin{array}{r} +6 \quad +6 \\ 7 = x \end{array}$$

$$\boxed{7=x}$$

$$\sqrt{5 \cdot 7 + 1} = \sqrt{6 \cdot 7 - 6}$$

$$\sqrt{35+1} = \sqrt{42-6}$$

$$\sqrt{36} = \sqrt{36}$$

$$6=6 \checkmark$$

See pg 3 for Alt. solution method

25. $3x^{\frac{1}{2}}+5=113$

$$\begin{array}{r} -5 \quad -5 \\ 3x^{\frac{1}{2}} = 108 \end{array}$$

$$\begin{array}{r} 3x^{\frac{1}{2}} = 108 \\ \frac{3}{3} \quad \frac{3}{3} \end{array}$$

$$(x^{\frac{1}{2}})^2 = (36)^2$$

$$\boxed{x=1296}$$

$$3 \cdot 1296^{\frac{1}{2}} + 5 = 113$$

$$3 \cdot 36 + 5 = 113$$

$$108 + 5 = 113$$

$$113 = 113 \checkmark$$

26. $((2x+3.8)^{\frac{3}{4}})^{\frac{4}{3}} = (3.29)^{\frac{4}{3}}$

$$2x+3.8 = 4.89 \text{ rounded}$$

$$\begin{array}{r} -3.8 \quad -3.8 \\ 2x = 1.09 \end{array}$$

$$\begin{array}{r} 2x = 1.09 \\ \frac{2}{2} \quad \frac{2}{2} \end{array}$$

$$\boxed{x=.545}$$

$$(2 \cdot .545 + 3.8)^{\frac{3}{4}} = 3.29$$

$$(1.09 + 3.8)^{\frac{3}{4}} = 3.29$$

$$(4.89)^{\frac{3}{4}} = 3.29$$

$$3.29 = 3.29 \checkmark$$

Solve.

27. How far would a submarine periscope have to be above the water to locate a ship that is a distance 4.2 mi. away? The equation for the distance in miles that the lookout can see is $d = 1.4\sqrt{h}$, where h is the height in feet above the surface of the water. Find the height to the nearest tenth.

$$d = 1.4\sqrt{h}$$

$$\frac{4.2}{1.4} = \frac{1.4\sqrt{h}}{1.4}$$

$$3 = \sqrt{h}$$

$$9 = h$$

$$\boxed{9 \text{ ft}}$$

28. An object is dropped from a bridge. Find the distance the object has fallen when the speed reaches 100 ft/s. Use the equation $v = \sqrt{64d}$, where v is the speed of the object and d is the distance. Round your answer to the nearest hundredth.

$$v = \sqrt{64d}$$

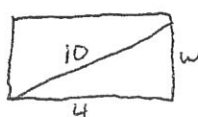
$$100^2 = \sqrt{64d}^2$$

$$\frac{10000}{64} = \frac{64d}{64}$$

$$156.25 = d$$

$$\boxed{156.25 \text{ ft}}$$

29. Find the width of a rectangle in simplest radical form that has a diagonal of 10 ft. and a length of 4 ft.



$$w^2 + 4^2 = 10^2$$

$$w^2 + 16 = 100$$

$$\begin{array}{r} -16 \quad -16 \\ w^2 = 84 \end{array}$$

$$\sqrt{w^2} = \sqrt{84}$$

$$w = \sqrt{84}$$

$$\begin{array}{r} 4 \quad 21 \\ w = 2\sqrt{21} \end{array}$$

$$w = 2\sqrt{21}$$

$$\boxed{2\sqrt{21} \text{ ft}}$$

30. Solve for b in the following equation:

$$a^2 + b^2 = c^2$$

$$a^2 + b^2 = c^2$$

$$\begin{array}{r} -a^2 \quad -a^2 \\ b^2 = c^2 - a^2 \end{array}$$

$$\sqrt{b^2} = \sqrt{c^2 - a^2}$$

$$\boxed{b = \sqrt{c^2 - a^2}}$$

Alternate ways of simplifying / solving for select problems.

$$13) \frac{12}{\sqrt[3]{2}} \cdot \frac{\sqrt[3]{4}}{\sqrt[3]{4}} = \frac{12 \cdot \sqrt[3]{4}}{\sqrt[3]{8}} = \frac{12 \cdot \sqrt[3]{4}}{2} = \boxed{6 \cdot \sqrt[3]{4}}$$

$$14) \frac{16}{\sqrt[4]{2x^2}} \cdot \frac{\sqrt[4]{8x^2}}{\sqrt[4]{8x^2}} = \frac{16 \cdot \sqrt[4]{8x^2}}{\sqrt[4]{16x^4}} = \frac{16 \cdot \sqrt[4]{8x^2}}{2x} = \boxed{\frac{8 \cdot \sqrt[4]{8x^2}}{x}}$$

$$15) \frac{16}{\sqrt{18}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{16\sqrt{2}}{\sqrt{36}} = \frac{16\sqrt{2}}{6} = \boxed{\frac{8\sqrt{2}}{3}}$$

$$25) \begin{array}{r} 3x^{1/2} + 5 = 113 \\ -5 \quad -5 \\ \hline 3x^{1/2} = 108 \\ \frac{3}{3} \quad \frac{3}{3} \end{array}$$

$$x^{1/2} = 36$$

$$\sqrt{x}^2 = 36^2$$

$$\boxed{x = 1296}$$

$$3(1296)^{1/2} + 5 = 113$$

$$3 \cdot 36 + 5 = 113$$

$$108 + 5 = 113$$

$$113 = 113 \checkmark$$

$$26) (2x + 3.8)^{3/4} = 3.29$$

$$\sqrt[4]{(2x + 3.8)^3} = 3.29^4$$

$$\sqrt[3]{(2x + 3.8)^3} = \sqrt[3]{17.16} \text{ (rounded)}$$

$$2x + 3.8 = 4.89 \text{ (rounded)}$$

$$\begin{array}{r} -3.8 \quad -3.8 \\ \hline 2x = 1.09 \\ \frac{2}{2} \quad \frac{2}{2} \end{array}$$

$$\boxed{x = 0.545}$$

$$(2 \cdot 0.545 + 3.8)^{3/4} = 3.29$$

$$(1.09 + 3.8)^{3/4} = 3.29$$

$$(4.89)^{3/4} = 3.29$$

$$3.29 = 3.29 \checkmark$$

Practice ws 7-5 (# 22, 27)

$$22) \quad 2x^{4/3} - 2 = 160$$

$$\begin{array}{r} +2 \quad +2 \\ \hline 2x^{4/3} = 162 \\ \hline 2 \quad 2 \end{array}$$

$$x^{4/3} = 81$$

$$\sqrt[3]{x^4} = 81$$

$$(\sqrt[3]{x^4})^3 = (81)^3$$

$$x^4 = 531,441$$

$$\sqrt[4]{x^4} = \sqrt[4]{531,441}$$

$$\boxed{x = \pm 27}$$

Check 27

$$2(27)^{4/3} - 2 = 160$$

$$2(81) - 2 = 160$$

$$162 - 2 = 160$$

$$160 = 160 \checkmark$$

Check -27

$$2(-27)^{4/3} - 2 = 160$$

$$2(81) - 2 = 160$$

$$162 - 2 = 160$$

$$160 = 160 \checkmark$$

$$27) \quad \sqrt{x+2} = x-18$$

$$(\sqrt{x+2})^2 = (x-18)^2$$

$$x+2 = (x-18)(x-18)$$

$$x+2 = x^2 - 18x - 18x + 324$$

$$x+2 = x^2 - 36x + 324$$

$$\begin{array}{r} -x-2 \quad -x \quad -2 \\ 0 = x^2 - 37x + 322 \end{array}$$

$$0 = x^2 - 37x + 322$$

$$0 = (x-23)(x-14)$$

$$0 = x-23 \quad x-14=0$$

$$\boxed{23=x}$$

$$x=14$$

extraneous solution

(Means 14 is not a solution but 23 is.)

Check 23

$$\sqrt{23+2} = 23-18$$

$$\sqrt{25} = 5$$

$$5 = 5 \checkmark$$

check 14

$$\sqrt{14+2} = 14-18$$

$$\sqrt{16} = -4$$

$$4 \neq -4 \quad X$$