Operations on Radicals Lesson #5:
Practice Test

1. $2\sqrt[3]{7}$, written as an entire radical, is

$= \sqrt[3]{8}\sqrt[3]{7} = \sqrt[3]{56}$

(A.) $\sqrt[3]{56}$ B. $\sqrt[3]{98}$
C. $\sqrt[3]{686}$ D. $\sqrt[3]{2744}$

2. Consider the following numbers. $10\sqrt{6}$, $4\sqrt{15}$, $7\sqrt{10}$, $12\sqrt{5}$
If the numbers are ranked from largest to smallest, which number has the second largest value?

A. $12\sqrt{5} = \sqrt{144}\sqrt{5} = \sqrt{720}$
B. $4\sqrt{15} = \sqrt{16}\sqrt{15} = \sqrt{240}$
C. $7\sqrt{10} = \sqrt{49}\sqrt{10} = \sqrt{490}$
(D.) $10\sqrt{6} = \sqrt{100}\sqrt{6} = \sqrt{600}$

3. Consider the following statements
Statement **1** : $\sqrt{96} = 4\sqrt{6}$ ✓ *Statement* **2** : $7\sqrt{2} = 98$ ✗
Statement **3** : $24 = 4\sqrt{6}$ ✗
Which of the these statements is true?

$\sqrt{96} = \sqrt{16}\sqrt{6} = 4\sqrt{6}$
$7\sqrt{2} = \sqrt{49}\sqrt{2} = \sqrt{98}$
$24 = 4(6)$ not $4\sqrt{6}$

(A.) **1** only B. **1** and **2** only
C. **1**, **2**, and **3** D. some other combination of **1**, **2**, and **3**

4. When $3\sqrt{80} + 4\sqrt{405}$ is written in the form $k\sqrt{5}$, the value of k is

A. 7
(B.) 48
C. 92
D. 372

$3\sqrt{16}\sqrt{5} + 4\sqrt{81}\sqrt{5}$
$= 3(4)\sqrt{5} + 4(9)\sqrt{5}$
$= 12\sqrt{5} + 36\sqrt{5}$
$= 48\sqrt{5}$ $k = 48$

5. The exact value of $\left(4\sqrt{11}\right)^2$ is the whole number w.
The value of w is

$\left(4\sqrt{11}\right)^2 = 16(11) = 176$

A. 44 (B.) 176
C. 484 D. 1936

Numerical Response **1.** The expression $\sqrt{2}\left(\sqrt{5}-12\sqrt{3}\right)-\sqrt{3}\left(\sqrt{8}-2\sqrt{30}\right)$ can be written in simplest form $a\sqrt{b}-c\sqrt{d}$ where a, b, c, d are all positive integers.
The value of $a+b+c+d$ is _____.
(Record your answer in the numerical response box from left to right.)

3	7		

$= \sqrt{10} - 12\sqrt{6} - \sqrt{24} + 2\sqrt{90}$

$= \sqrt{10} - 12\sqrt{6} - \sqrt{4}\sqrt{6} + 2\sqrt{9}\sqrt{10}$

$= \sqrt{10} - 12\sqrt{6} - 2\sqrt{6} + 2(3)\sqrt{10}$

$= \sqrt{10} - 12\sqrt{6} - 2\sqrt{6} + 6\sqrt{10}$

$= 7\sqrt{10} - 14\sqrt{6}$

$= a\sqrt{b} - c\sqrt{d}$

$a = 7$, $b = 10$, $c = 14$, $d = 6$

$a+b+c+d = 7+10+14+6 = 37$

6. $\left(\sqrt{5}\right)^5$ is equivalent to

A. $5\sqrt{5}$ **B.** $10\sqrt{5}$

C. $25\sqrt{5}$ **D.** $625\sqrt{5}$

$= \sqrt{5}\cdot\sqrt{5}\cdot\sqrt{5}\cdot\sqrt{5}\cdot\sqrt{5}$

$= 5 \cdot 5 \cdot \sqrt{5}$

$= 25\sqrt{5}$

7. $\sqrt{x}\left(4-\sqrt{x}\right)$ is equivalent to

A. $4\sqrt{x}-\sqrt{x}$ **B.** $\sqrt{4x}-x$

C. $4\sqrt{x}-x$ **D.** $4\sqrt{x}-2\sqrt{x}$

$= 4\sqrt{x} - x$

Numerical Response **2.** $2\sqrt{3}\left(\sqrt{243}-2\right)-\sqrt{2}\left(5+7\sqrt{2}\right)$ can be expanded and simplified to the form $p+q\sqrt{2}+r\sqrt{3}$. The value of $p+q+r$ is _____.
(Record your answer in the numerical response box from left to right.)

3	1		

$2\sqrt{3}\left(\sqrt{81}\sqrt{3}-2\right) - \sqrt{2}\left(5+7\sqrt{2}\right)$

$= 2\sqrt{3}\left(9\sqrt{3}-2\right) - 5\sqrt{2} - 7(2)$

$= 18(3) - 4\sqrt{3} - 5\sqrt{2} - 14$

$= 54 - 4\sqrt{3} - 5\sqrt{2} - 14$

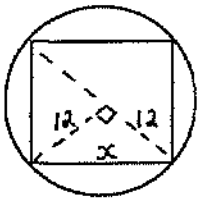
$= 40 - 5\sqrt{2} - 4\sqrt{3} = p + q\sqrt{2} + r\sqrt{3}$

$p = 40$ $q = -5$ $r = -4$

$p+q+r = 40-5-4$

$= 31$

8. A square is inscribed in a circle as shown. If the area of the circle is 144π cm^2, then the exact perimeter of the square is



Let x cm = side length of the square

A. $12\sqrt{2}$ cm

B. $24\sqrt{2}$ cm

C. $36\sqrt{2}$ cm

(D.) $48\sqrt{2}$ cm

$A = \pi r^2 = 144\pi$

$r^2 = 144 \quad r = 12$

$x^2 = 12^2 + 12^2 = 144 + 144$

$x^2 = 288$

$x = \sqrt{288} = \sqrt{144}\sqrt{2} = 12\sqrt{2}$

perimeter $= 4x = 4(12\sqrt{2}) = 48\sqrt{2}$ cm.

9. If $2\sqrt[3]{4}\left(2\sqrt[3]{54} - \sqrt[3]{x}\right)$ is equal to 16, then x is equal to

A. 2

B. 4

(C.) 16

D. 64

$4\sqrt[3]{216} - 2\sqrt[3]{4x} = 16$

$4(6) - 16 = 2\sqrt[3]{4x}$

$24 - 16 = 2\sqrt[3]{4x}$

$8 = 2\sqrt[3]{4x}$

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

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

$64 = 4x$

$x = 16$

10. $5 - 3\sqrt{2}$, multiplied by its conjugate, is

A. -11 **(B.)** 7

C. 19 **D.** $43 + 6\sqrt{2}$

$(5 - 3\sqrt{2})(5 + 3\sqrt{2})$

$= 25 - 9(2) = 25 - 18 = 7$

Numerical Response

3. $\left(2\sqrt{12} + \sqrt{24}\right)^2$ can be expressed in simplest form as $a + b\sqrt{c}$.

The value of abc is _____.

(Record your answer in the numerical response box from left to right.)

6	9	1	2

$\left(2\sqrt{4}\sqrt{3} + \sqrt{4}\sqrt{6}\right)^2 = \left(2(2)\sqrt{3} + 2\sqrt{6}\right)^2$

$= \left(4\sqrt{3} + 2\sqrt{6}\right)^2 = 16(3) + 2\left(8\sqrt{18}\right) + 4(6)$

$= 48 + 16\sqrt{9}\sqrt{2} + 24$

$= 48 + 16(3)\sqrt{2} + 24$

$= 72 + 48\sqrt{2} = a + b\sqrt{c}$

$a = 72$

$b = 48$

$c = 2$

$abc = (72)(48)(2)$

$= 6912$

11. Consider the following three equations.

$$3\sqrt[3]{64} = p, \qquad 48\sqrt{p} = q\sqrt{3}, \qquad 40\sqrt[4]{q} = r\sqrt[4]{6}.$$

Which of the statements below is correct?

A. $p < q < r$

B. $p < r < q$

C. $q < r < p$

D. $r < p < q$

$p = 3\sqrt[3]{64} = 3(4) = 12$

$q = \frac{48\sqrt{p}}{\sqrt{3}} = \frac{48\sqrt{12}}{\sqrt{3}} = 48\sqrt{4} = 48(2) = 96$

$r = \frac{40\sqrt[4]{q}}{\sqrt[4]{6}} = \frac{40\sqrt[4]{96}}{\sqrt[4]{6}} = 40\sqrt[4]{16} = 40(2) = 80$

12. A sequence of three terms is such that $\frac{t_3}{t_2} = \frac{t_2}{t_1}$.

If the first two terms of the sequence are $6\sqrt{2}$ and 12, then the third term of the sequence is

A. $12\sqrt{2}$ **B.** $18\sqrt{2}$

C. $24\sqrt{2}$ **D.** $24 - 6\sqrt{2}$

$\frac{t_3}{t_2} = \frac{t_2}{t_1} \qquad \frac{t_3}{12} = \frac{12}{6\sqrt{2}} \qquad t_3 = \frac{12(12)}{6\sqrt{2}}$

$= \frac{144}{6\sqrt{2}} = \frac{24}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{24\sqrt{2}}{2} = 12\sqrt{2}$

13. If $A = 15\sqrt{48}$ and $B = 6\sqrt{150}$, then $\frac{A}{B}$ is equal to

A. $\frac{18\sqrt{2}}{5}$ **B.** $\sqrt{2}$

C. $\frac{19\sqrt{2}}{42}$ **D.** $2\sqrt{2}$

$\frac{15\sqrt{48}}{6\sqrt{150}} = \frac{15\sqrt{16}\sqrt{3}}{6\sqrt{25}\sqrt{6}} = \frac{15(4)\sqrt{3}}{6(5)\sqrt{6}} = \frac{60\sqrt{3}}{30\sqrt{6}}$

$= \frac{2}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{2\sqrt{2}}{2} = \sqrt{2}$

Numerical Response

4. If $m * n$ means "$(m+n)$ multiplied by m", then the value of $\sqrt{10} * (\sqrt{5} * \sqrt{2})$ can be written as the sum of a rational number and an irrational number.
The rational number is _____.

(Record your answer in the numerical response box from left to right.)

2	0		

$\sqrt{5} * \sqrt{2} = \sqrt{5}(\sqrt{5} + \sqrt{2}) = 5 + \sqrt{10}$

$\sqrt{10} * (5 + \sqrt{10}) = \sqrt{10}(\sqrt{10} + 5 + \sqrt{10}) = 10 + 5\sqrt{10} + 10$

$= 20 + 5\sqrt{10}$

rational number is 20

14. $\dfrac{6}{-5\sqrt{3}+1}$, expressed with a rational denominator, is

A. $\dfrac{-15\sqrt{3}+3}{38}$

B. $\dfrac{-15\sqrt{3}+3}{37}$

C. $\dfrac{-15\sqrt{3}-3}{38}$

(D.) $\dfrac{-15\sqrt{3}-3}{37}$

$\dfrac{6}{-5\sqrt{3}+1} \cdot \dfrac{-5\sqrt{3}-1}{-5\sqrt{3}-1} = \dfrac{-30\sqrt{3}-6}{25(3)-1}$

$= \dfrac{-30\sqrt{3}-6}{75-1} = \dfrac{-30\sqrt{3}-6}{74} = \dfrac{-15\sqrt{3}-3}{37}$

15. $\dfrac{1}{\sqrt{q}+\sqrt{r}}$ is equivalent to

A. $\dfrac{\sqrt{q}+\sqrt{r}}{q-r}$

B. $\dfrac{\sqrt{q}+\sqrt{r}}{q+r}$

(C.) $\dfrac{\sqrt{q}-\sqrt{r}}{q-r}$

D. $\dfrac{\sqrt{q}-\sqrt{r}}{q^2-r^2}$

$\dfrac{1}{\sqrt{q}+\sqrt{r}} \cdot \dfrac{\sqrt{q}-\sqrt{r}}{\sqrt{q}-\sqrt{r}}$

$= \dfrac{\sqrt{q}-\sqrt{r}}{q-r}$

Numerical Response

5. The expression $\dfrac{20\sqrt{5}}{\sqrt{10}} - \dfrac{16}{\sqrt{8}}$ can be expressed in the form $k\sqrt{2}$, where $k \in W$.

The value of k is _____.

(Record your answer in the numerical response box from left to right.)

6			

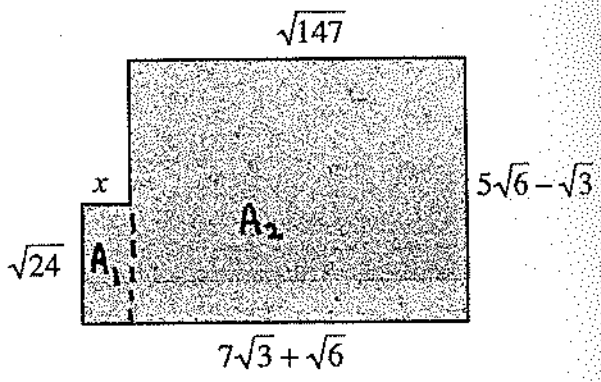
$\dfrac{20\sqrt{5}}{\sqrt{10}} - \dfrac{16}{\sqrt{8}} = \dfrac{20}{\sqrt{2}} - \dfrac{16}{\sqrt{4}\sqrt{2}} = \dfrac{20}{\sqrt{2}} \cdot \dfrac{\sqrt{2}}{\sqrt{2}} - \dfrac{16}{2\sqrt{2}}$

$= \dfrac{20\sqrt{2}}{2} - \dfrac{8}{\sqrt{2}} = 10\sqrt{2} - \dfrac{8}{\sqrt{2}} \cdot \dfrac{\sqrt{2}}{\sqrt{2}} = 10\sqrt{2} - \dfrac{8\sqrt{2}}{2}$

$= 10\sqrt{2} - 4\sqrt{2} = 6\sqrt{2}$ $\quad k = 6$

Written Response - 5 marks

1. Consider the shaded region shown in which the angles are right angles.



- Determine, in simplest radical form, an expression for x.

$x = (7\sqrt{3}+\sqrt{6}) - \sqrt{147}$

$= 7\sqrt{3}+\sqrt{6}-\sqrt{49}\sqrt{3}$

$= 7\sqrt{3}+\sqrt{6}-7\sqrt{3} \quad = \underline{\sqrt{6}}$

- Show that the area of the shaded region is equal to $105\sqrt{2}-9$.

$A_1 = \sqrt{6}\sqrt{24}$

$= \sqrt{144}$

$= 12$

$A_2 = \sqrt{147}(5\sqrt{6}-\sqrt{3})$

$= 7\sqrt{3}(5\sqrt{6}-\sqrt{3}) = 35\sqrt{18}-7(3)$

$= 35\sqrt{9}\sqrt{2}-21 = 35(3)\sqrt{2}-21 = 105\sqrt{2}-21$

total area $= 12 + 105\sqrt{2}-21 = \underline{105\sqrt{2}-9}$

- Determine, in simplest radical form, an expression for the perimeter of the shaded region.

perimeter $= 2(7\sqrt{3}+\sqrt{6}) + 2(5\sqrt{6}-\sqrt{3})$

$= 14\sqrt{3}+2\sqrt{6}+10\sqrt{6}-2\sqrt{3}$

$= \underline{12\sqrt{3}+12\sqrt{6}}$

Answer Key

1. A	2. D	3. A	4. B	5. B	6. C	7. C	8. D
9. C	10. B	11. B	12. A	13. B	14. D	15. C	

Numerical Response

1. | 3 | 7 | | |
2. | 3 | 1 | | |
3. | 6 | 9 | 1 | 2 |
4. | 2 | 0 | | |
5. | 6 | | | |

Written Response

1. • $\sqrt{6}$ • See teacher solution manual. • $12\sqrt{3}+12\sqrt{6}$