Name KEY Date

5.2 Practice A

In Exercises 1–6, use the properties of rational exponents to simplify the expression.

simplified

1. $(7^2)^{1/4} = 7^{\frac{1}{2}}$

2. $(14^3)^{1/2} = 14^{\frac{3}{2}}$ or $14\sqrt{14}$

3. $\dfrac{5^{1/5}}{5} = \dfrac{1}{5^{\frac{4}{5}}}$ ✓

4. $\dfrac{10}{10^{1/4}} = 10^{\frac{3}{4}}$

5. $\left(\dfrac{6^5}{9^5}\right)^{-1/5} = \dfrac{6^{-1}}{9^{-1}} = \dfrac{9}{6} = \boxed{\dfrac{3}{2}}$

6. $\left(7^{-3/4} \bullet 7^{1/4}\right)^{-1} = \left(7^{-\frac{1}{2}}\right)^{-1} = \boxed{7^{\frac{1}{2}}}$

In Exercises 7–12, use the properties of radicals to simplify the expression.

7. $\sqrt{3} \bullet \sqrt{75}$
$\sqrt{3} \cdot 5\sqrt{3} = \boxed{15}$

8. $\sqrt[3]{81} \bullet \sqrt[3]{9} = \sqrt[3]{729} = 9$

9. $\sqrt[4]{12} \bullet \sqrt[4]{8} = \sqrt[4]{96} = \sqrt[4]{16 \cdot 6}$
$\boxed{2\sqrt[4]{6}}$

10. $\sqrt[4]{9} \bullet \sqrt[4]{9}$
$\sqrt[4]{81} = \boxed{3}$

11. $\dfrac{\sqrt[5]{128}}{\sqrt[5]{4}} = \sqrt[5]{32} = \boxed{2}$

12. $\dfrac{\sqrt{5}}{\sqrt{80}} = \sqrt{\dfrac{1}{16}} = \boxed{\dfrac{1}{4}}$

In Exercises 13–18, write the expression in simplest form.

13. $\sqrt[4]{208} = \sqrt[4]{16 \cdot 13}$
$\boxed{2\sqrt[4]{13}}$

14. $\dfrac{\sqrt[3]{9}}{\sqrt[3]{4}} \cdot \dfrac{\sqrt[3]{16}}{\sqrt[3]{16}} = \dfrac{\sqrt[3]{144}}{4} = \dfrac{\sqrt[3]{8 \cdot 18}}{4}$
$\dfrac{2\sqrt[3]{18}}{4} = \boxed{\dfrac{\sqrt[3]{18}}{2}}$

15. $\sqrt{\dfrac{5}{27}} = \dfrac{\sqrt{5}}{3\sqrt{3}} \cdot \dfrac{\sqrt{3}}{\sqrt{3}} = \boxed{\dfrac{\sqrt{15}}{9}}$

16. $\dfrac{1}{2 + \sqrt{3}} \cdot \dfrac{2-\sqrt{3}}{2-\sqrt{3}} = \dfrac{2-\sqrt{3}}{1}$
$4 -$
$= 2-\sqrt{3}$

17. $\dfrac{6}{4 - \sqrt{5}}$
$\dfrac{6}{(4-\sqrt{5})} \dfrac{(4+\sqrt{5})}{(4+\sqrt{5})} = \dfrac{24+6\sqrt{5}}{16-5} = \boxed{\dfrac{24+6\sqrt{5}}{11}}$

18. $\dfrac{8}{\sqrt{2} + \sqrt{5}} \cdot \dfrac{(\sqrt{2}-\sqrt{5})}{(\sqrt{2}-\sqrt{5})} = \dfrac{8\sqrt{2}-8\sqrt{5}}{-3}$
$= \boxed{\dfrac{-8\sqrt{2}+8\sqrt{5}}{3}}$

In Exercises 19–24, simplify the expression.

19. $8\sqrt[4]{2} + 5\sqrt[4]{2} = \boxed{13\sqrt[4]{2}}$

20. $7\sqrt[5]{13} - 17\sqrt[5]{13}$
$\boxed{-10\sqrt[5]{13}}$

21. $4\left(9^{1/4}\right) + 7\left(9^{1/4}\right) = \boxed{11 \cdot 9^{\frac{1}{4}}}$

22. $4\sqrt{18} - 15\sqrt{2}$
$4\sqrt{9 \cdot 2} - 15\sqrt{2} = \boxed{-3\sqrt{2}}$

23. $8\sqrt{7} + 12\sqrt{63}$
$8\sqrt{7} + 36\sqrt{7} = \boxed{44\sqrt{7}}$

24. $\sqrt[4]{405} + 2\sqrt[4]{5} =$
$\sqrt[4]{81 \cdot 5} + 2\sqrt[4]{5}$
$3\sqrt[4]{5} + 2\sqrt[4]{5} = \boxed{5\sqrt[4]{5}}$

25. The volume of a cube is 80 cubic centimeters.

   a. Use exponents to solve the formula for the volume V of a cube with side length s, $V = s^3$, for s.
   $s = \sqrt[3]{V}$ or $V^{\frac{1}{3}}$

   b. Substitute the expression for s from part (a) into the formula for the surface area of a cube, $S = 6s^2$.
   $S = 6\left(\sqrt[3]{V}\right)^2$ or $6V^{\frac{2}{3}}$

   c. Substitute the volume of the given cube into the formula found in part (b) to find the surface area, S. Simplify, if possible.
   $S = 6\left(\sqrt[3]{80}\right)^2$ or $6(80)^{\frac{2}{3}}$
   $6\left(\sqrt[3]{8 \cdot 10}\right)^2$ $\quad$ $6\left(10 \cdot 2^3\right)^{\frac{2}{3}}$
   $\boxed{24\sqrt[3]{100}}$ $\quad$ $\boxed{24\left(10^{\frac{2}{3}}\right)}$

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5.2 Practice B

$\frac{24}{9} = \frac{8}{3}$

In Exercises 1–6, use the properties of rational exponents to simplify the expression. simplified

1. $\frac{2^{2/5}}{2} = 2^{-\frac{3}{5}}$ or $\frac{1}{2^{3/5}}$

2. $\left(\frac{3^6}{12^6}\right)^{-1/6} = \frac{3^{-1}}{12^{-1}} = 4$

3. $\left(11^{3/2} \bullet 11^{-5/2}\right)^{-1/3} = \left(11^{-1}\right)^{-\frac{1}{3}} = \boxed{11^{\frac{1}{3}}}$

4. $\left(9^{-3/5} \bullet 9^{1/5}\right)^{-1} = 9^{\frac{2}{5}}$

5. $\frac{3^{3/4} \bullet 27^{3/4}}{9^{3/4}} = \frac{3^{\frac{3}{4}} \cdot 3^{3(\frac{3}{4})}}{3^{6/4}} = 3^{\frac{3}{4}+\frac{9}{4}-\frac{6}{4}} = \boxed{3^{\frac{3}{2}}}$

6. $\frac{25^{5/9} \bullet 25^{7/9}}{5^{4/3}} = \frac{5^{\frac{10}{9}} \cdot 5^{\frac{14}{9}}}{5^{\frac{4}{3}}} = \frac{5^{\frac{8}{3}}}{5^{\frac{4}{3}}} = \boxed{5^{\frac{4}{3}}}$

In Exercises 7–12, use the properties of radicals to simplify the expression.

$5^{\frac{2}{3}} \cdot 5^{\frac{4}{3}}$, $5^{\frac{6}{3}} = 5^2$

7. $\sqrt[3]{25} \bullet \sqrt[3]{625}$
$\sqrt[3]{25} \cdot \sqrt[3]{5^4} = \sqrt[3]{5^6} = \boxed{25}$

8. $\sqrt[5]{6} \bullet \sqrt[5]{81}$
$\sqrt[5]{3^4 \cdot 3 \cdot 2} = \boxed{3\sqrt[5]{2}}$

9. $\frac{\sqrt[4]{176}}{\sqrt[4]{11}}$ $\sqrt[4]{\frac{176}{11}} = \sqrt[4]{16} = \boxed{2}$

10. $\frac{\sqrt{7}}{\sqrt{700}} = \frac{\sqrt{7}}{\sqrt{7}\sqrt{100}} = \boxed{\frac{1}{10}}$

11. $\frac{\sqrt[3]{5} \bullet \sqrt[3]{50}}{\sqrt[3]{2}} = \sqrt[3]{5} \cdot \sqrt[3]{25}$
$\sqrt[3]{5^3} = \boxed{5}$

12. $\frac{\sqrt[4]{4} \bullet \sqrt[4]{12}}{\sqrt[8]{3} \bullet \sqrt[8]{3}} = \frac{\sqrt[4]{16 \cdot 3}}{\sqrt[8]{9}} = \frac{2\sqrt[4]{3}}{\sqrt[8]{9}}$
$\frac{2 \cdot 3^{\frac{1}{4}}}{9^{\frac{1}{8}}} = \frac{2 \cdot 3^{\frac{1}{4}}}{3^{\frac{1}{4}}} = \boxed{2}$

In Exercises 13–18, write the expression in simplest form.

13. $\frac{\sqrt[3]{4}}{\sqrt[3]{9}} \cdot \frac{\sqrt[3]{3}}{\sqrt[3]{3}} = \frac{\sqrt[3]{12}}{3}$

14. $\sqrt[3]{\frac{4}{25}} \cdot \frac{\sqrt[3]{5}}{\sqrt[3]{5}} = \frac{\sqrt[3]{20}}{5}$

15. $\sqrt[4]{\frac{2401}{4}} = \frac{7}{\sqrt[4]{4}} \cdot \frac{\sqrt[4]{4}}{\sqrt[4]{4}} = \frac{7\sqrt[4]{4}}{2}$

16. $\frac{7}{\left(5 - \sqrt{3}\right)} \cdot \frac{(5+\sqrt{3})}{(5+\sqrt{3})} = \boxed{\frac{35+7\sqrt{3}}{22}}$

17. $\frac{6}{\sqrt{2} + \sqrt{7}} \cdot \frac{(\sqrt{2}-\sqrt{7})}{(\sqrt{2}-\sqrt{7})} = \frac{6\sqrt{2}-6\sqrt{7}}{-5} = \boxed{\frac{-6\sqrt{2}+6\sqrt{7}}{5}}$

18. $\frac{\sqrt{2}}{\sqrt{15} - \sqrt{3}} \cdot \frac{(\sqrt{15}+\sqrt{3})}{(\sqrt{15}+\sqrt{3})} = \frac{\sqrt{30}+\sqrt{6}}{12}$

In Exercises 19–24, simplify the expression.

19. $10\left(25^{2/3}\right) - 6\left(25^{2/3}\right)$ 5^2
$4(25^{2/3})$

20. $2\sqrt{54} - 11\sqrt{6}$
$6\sqrt{6} - 11\sqrt{6} = \boxed{-5\sqrt{6}}$

21. $13\sqrt[3]{3} - \sqrt[3]{375}$
$13\sqrt[3]{3} - 5\sqrt[3]{3} = \boxed{8\sqrt[3]{3}}$

22. $\sqrt[5]{486} + 10\sqrt[5]{2}$
$\sqrt[5]{243 \cdot 2} \rightarrow 3\sqrt[5]{2} + 10\sqrt[5]{2} = \boxed{13\sqrt[5]{2}}$

23. $4\left(48^{1/4}\right) - 3\left(3^{1/4}\right) = 5(3^{\frac{1}{4}})$ see below

24. $\left(7^{1/3}\right) + 4\left(189^{1/3}\right) = 7^{\frac{1}{3}} + 4(7 \cdot 27)^{\frac{1}{3}}$
$7^{\frac{1}{3}} + 4\left(3^{3(\frac{1}{3})}\right)\left(7^{\frac{1}{3}}\right)$
$7^{\frac{1}{3}} + 12\left(7^{\frac{1}{3}}\right)$
$\boxed{13\left(7^{\frac{1}{3}}\right)}$

25. The volume of a right circular cylinder is $V = 9\pi r^2$, where r is the radius.

   a. Use radicals to solve $V = 9\pi r^2$ for r. Simplify, if possible.

   b. Substitute the expression for r from part (a) into the formula for the surface area of a right cylinder, $S = 18\pi r + \pi r^2$.

   c. Use the answer to part (b) to find the surface area of a right cylinder when the volume is 108 cubic meters.

23) $4(3 \cdot 16)^{\frac{1}{4}} - 3(3^{\frac{1}{4}})$
$4\left(3^{\frac{1}{4}} \cdot 2^{4(\frac{1}{4})}\right) - 3(3^{\frac{1}{4}})$
$8(3^{\frac{1}{4}}) - 3(3^{\frac{1}{4}})$
$5(3^{\frac{1}{4}})$

a) $\frac{V}{9\pi} = r^2$
$\sqrt{\frac{V}{9\pi}} = r$
$\frac{1}{3}\frac{\sqrt{V\pi}}{\pi} = r$

b) $S = 18\pi \frac{1}{3}\frac{\sqrt{V\pi}}{\pi} + \pi\left(\sqrt{\frac{V}{9\pi}}\right)^2$
$S = 6\sqrt{V\pi} + \pi\left(\frac{V}{9\pi}\right)$
$S = 6\sqrt{V\pi} + \frac{V}{9}$

c) $S = 6\sqrt{108\pi} + \frac{108}{9}$
$= (12 + 36\sqrt{3\pi})$ sq meters