Exponents Lesson 5

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① Journal => Hand in /5
② Warm-up Lesson #5

Math 10

Unit 2: Exponents

Lesson 5: pages 21-25

Warm-Up #1: Simplify or evaluate as far as possible (#1-6), or re-write radicals as exponents (#7-10). Express answers with positive exponents.

1. $16^{\frac{1}{4}} = \sqrt[4]{16} = 2$

2. $27^{-\frac{1}{3}} = \frac{1}{27^{1/3}} = \frac{1}{\sqrt[3]{27}} = \frac{1}{3}$

3. $-(25)^{\frac{1}{2}} = -\sqrt{25} = -5$ ⊖ carries through

* exponent only applies to the base. NOT the negative.

4. $(-25)^{\frac{1}{2}} = \sqrt{-25} =$ NO SOLUTION

* the BASE in this case is ⊖ so exponent applies to entire term

cannot take $\sqrt{}$ of a ⊖ number

5. $1024^{0.5} = 1024^{1/2} = \sqrt{1024}$

$0.5 = \frac{1}{2}$ $= 32$

6. $((-2)^{-2})^{\frac{1}{2}} = (-2)^{-\frac{2}{1}\cdot\frac{1}{2}} = (-2)^{-\frac{2}{2}} = (-2)^{-1} = \frac{1}{-2^1} = \boxed{-\frac{1}{2}}$ power of a power

7. $8\sqrt[3]{a} = 8 \cdot \sqrt[3]{a} = 8 \cdot a^{1/3} = \boxed{8a^{1/3}}$

8. $\sqrt{16y^8} = \sqrt{16} \cdot \sqrt{y^8} \rightarrow \frac{8}{1}\cdot\frac{1}{2} = \frac{8}{2} = 4$

$= 4 \cdot (y^8)^{1/2}$

$= \boxed{4y^4}$

9. $\frac{50}{\sqrt[3]{xy}} = \frac{50}{(xy)^{1/3}} = \frac{50}{x^{1/3}y^{1/3}}$ OR $50x^{-1/3}y^{-1/3}$ OR $50(xy)^{-1/3}$

* either is correct.

10. $\left(\sqrt[3]{\sqrt{z}}\right)^6 = \left(\sqrt[3]{z^{1/2}}\right)^6$

$= \left(\left(z^{\frac{1}{2}}\right)^{\frac{1}{3}}\right)^6$ power of a power rule!

$= z^{\frac{1}{2}\cdot\frac{1}{3}\cdot\frac{6}{1}} = \frac{1\cdot1\cdot6}{2\cdot3\cdot1} = \frac{6}{21}$

$= z^{\frac{6}{21}} \overset{\div 3}{=} \boxed{z^{\frac{2}{7}}}$

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Warm-Up #2:

1. Re-write the exponents below as a product of two fractions, remembering that $\frac{a}{b} = \frac{a}{1} \times \frac{1}{b}$. Then, evaluate. The first one is done as an example ☺

a. $9^{\frac{3}{2}} = (9^{\frac{3}{1}})^{\frac{1}{2}} = (729)^{\frac{1}{2}} = \sqrt{729} = 27$

$9^3 = 729$

$\frac{5}{2} = \frac{5}{1} \cdot \frac{1}{2}$

b. $100^{\frac{5}{2}} = (100^{\frac{5}{1}})^{\frac{1}{2}} = (10\,000\,000\,000)^{\frac{1}{2}} = \sqrt{10\,000\,000\,000} = 100\,000$

$100^5 = 10\,000\,000\,000$

$\frac{2}{3} = \frac{2}{1} \cdot \frac{1}{3}$

c. $216^{\frac{2}{3}} = (216^{\frac{2}{1}})^{\frac{1}{3}} = (46656)^{\frac{1}{3}} = \sqrt[3]{46656} = 36$

$216^2 = 46656$

This works, but there's an easier way!

Exponent Law:

Exponent Laws	Example #1 (simplify & evaluate where possible)
$e^x = x10^{\wedge}$ $\wedge$ y^x x^y **Rational Exponents** *(with numerator ≠ 1)* $x^{\frac{m}{n}} = \sqrt[n]{x^m}$ "root" $= (\sqrt[n]{x})^m$	a) $32^{\frac{3}{5}} = \sqrt[5]{32^3} = \sqrt[5]{32768} = 8$ $(\sqrt[5]{32})^3 = (2)^3 = 8$ b) $(-32)^{\frac{3}{5}}$ $(\sqrt[5]{-32})^3 = (-2)^3 = -8$ c) $16^{\frac{7}{4}}$ $(\sqrt[4]{16})^7 = (2)^7 = 128$ d) $(-27)^{\frac{2}{3}}$ $(\sqrt[3]{-27})^2 = (-3)^2 = -3 \cdot -3 = 9$ e) $(-25)^{\frac{5}{2}}$ $(\sqrt{-25})^5$ = no solution f) $-25^{\frac{5}{2}}$ $-(\sqrt{25})^5 = -(5)^5 = -3125$ * sign changes on exp only! g) $-25^{\frac{5}{2}} = -\frac{1}{25^{5/2}} = -\frac{1}{(\sqrt{25})^5} = -\frac{1}{(5)^5} = -\frac{1}{3125}$ h) $16^{1.5}$ $1.5 = \frac{3}{2}$ $16^{\frac{3}{2}} = (\sqrt{16})^3 = (4)^3 = 64$ i) $1000^{-\frac{2}{3}} = \frac{1}{1000^{\frac{2}{3}}} = \frac{1}{(\sqrt[3]{1000})^2} = \frac{1}{(10)^2} = \frac{1}{100}$

$\sqrt[n]{x} = x^{\frac{1}{n}}$

Example #2 (1) (2)

Example #2: Write the following with exponents. Then, use exponent laws and evaluate.

1. $\sqrt{8} \times \sqrt{8^3} = 8^{\frac{1}{2}} \cdot (8^3)^{\frac{1}{2}}$ $\quad \frac{3}{1} \cdot \frac{1}{2} = \frac{3}{2}$

$= 8^{\frac{1}{2}} \cdot 8^{\frac{3}{2}} = 8^{\frac{1}{2}+\frac{3}{2}} = 8^{\frac{4}{2}} = 8^2 = 64$ (1) (2)

2. $\sqrt[2]{g^5} \times \sqrt[2]{g^7} = g^{\frac{5}{2}} \cdot g^{\frac{7}{2}} = g^{\frac{5}{2}+\frac{7}{2}} = g^{\frac{12}{2}} = g^6$

3. $\sqrt[4]{\sqrt{16^3}} = \sqrt{16^{\frac{3}{4}}} = \left(16^{\frac{3}{4}}\right)^{\frac{1}{2}} = 16^{\frac{3}{4}\cdot\frac{1}{2}} = 16^{\frac{3}{8}} = \left(\sqrt[8]{16}\right)^3 = (2)^3 = 8$

4. $\sqrt[3]{x^2} \cdot \sqrt[4]{x} = x^{\frac{2}{3}} \cdot x^{\frac{1}{4}} = x^{\frac{2}{3}\cdot\frac{4}{4}+\frac{1}{4}\cdot\frac{3}{3}} = x^{\frac{8}{12}+\frac{3}{12}} = x^{\frac{11}{12}}$

5. $\left(\sqrt[5]{18}\right)^2 \cdot \sqrt[5]{18^3} = 18^{\frac{2}{5}} \cdot 18^{\frac{3}{5}} = 18^{\frac{2}{5}+\frac{3}{5}} = 18^{\frac{5}{5}} = 18^1 = 18$

6. $\sqrt[3]{64} \cdot \sqrt[4]{16^3} = 64^{\frac{1}{3}} \cdot 16^{\frac{3}{4}} = (4^3)^{\frac{1}{3}} \cdot (4^2)^{\frac{3}{4}} = 4^{\frac{3}{3}} \cdot 4^{\frac{6}{4}} = 4^{\frac{3}{3}+\frac{6}{4}} = 4^{\frac{10}{4}} = 32$

$64 = 4^3$ $\quad 16 = 4^2$

$\left[\sqrt[4]{4^{10}}\right]$

Different bases! have to simplify bases

same bases! now we can apply exponent laws.

Example #3: Find the area of a triangle that has a base of $82\frac{4}{5}cm$ and a height of $82\frac{11}{5}cm$. (Hint: $A = \frac{b \times h}{2}$)

$A = \frac{b \cdot h}{2}$

$= \frac{82\frac{4}{5} \cdot 82\frac{11}{5}}{2} = \frac{82^{\frac{4}{5}+\frac{11}{5}}}{2} = \frac{82^{\frac{15}{5}}}{2} = \frac{82^3}{2} = 275684 km^2$

Rational Exponents in the form: $x^{\frac{m}{n}}$ where m is not 1.

Consider the power $27^{\frac{2}{3}}$. To understand the meaning of the rational exponent we can use the exponent law:
$(a^m)^n = a^{m \times n}$.

If we take $27^{\frac{2}{3}}$ and split the exponent into two parts we get the following…

$27^{\frac{2}{3}} = \left(27^{\frac{1}{3}}\right)^2$

This can then be written as…

$\left(\sqrt[3]{27}\right)^2$

The power can be evaluated from this point…

$\left(\sqrt[3]{27}\right)^2 = (3)^2 = 9$

The Rule…

$$a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m \qquad \textit{and} \qquad a^{-\frac{m}{n}} = \frac{1}{\sqrt[n]{a^m}} = \frac{1}{\left(\sqrt[n]{a}\right)^m}$$

Two more examples:

Eg.1 Evaluate $8^{\frac{2}{3}}$ without using a calculator.

$8^{\frac{2}{3}} = \left(8^{\frac{1}{3}}\right)^2 = \left(\sqrt[3]{8}\right)^2 = (2)^2 = 4$

Means square of the cube root of 8.

Eg.2 Evaluate $9^{-\frac{3}{2}}$ without using a calculator.

$9^{-\frac{3}{2}} = \left(\frac{1}{9}\right)^{\frac{3}{2}} = \frac{\left(1^{\frac{1}{2}}\right)^3}{\left(9^{\frac{1}{2}}\right)^3} = \frac{1}{(\sqrt{9})^3} = \frac{1}{(3)^3} = \frac{1}{27}$

Means "the reciprocal" of the cube of the square root of 9.

Write each of the following using radicals. (Do not evaluate)

123. $4^{\frac{2}{5}}$

124. $4^{\frac{3}{5}}$

125. $4^{\frac{4}{5}}$

126. $4^{-\frac{2}{5}}$

127. $4^{-\frac{3}{5}}$

128. $4^{-\frac{4}{5}}$

Evaluate each of the following.

129. $4^{\frac{1}{2}}$

130. $125^{\frac{1}{3}}$

131. $8^{\frac{2}{3}}$

132. $81^{\frac{3}{4}}$

133. $4^{\frac{3}{2}}$

134. $16^{-\frac{3}{4}}$

135. $(-27)^{-\frac{2}{3}}$

136. $(-8)^{-\frac{5}{3}}$

137. $9^{2.5}$

138. $(-1)^{-\frac{8}{5}}$

139. $\left(\frac{100}{9}\right)^{\frac{3}{2}}$

140. $\left(\frac{27}{8}\right)^{-\frac{2}{3}}$

Write each of the following using exponents. (Do not evaluate)

Eg. $\sqrt{12} = 12^{\frac{1}{2}}$ Eg. $\left(\sqrt[3]{7}\right)^4 = 7^{\frac{4}{3}}$ Eg. $\frac{1}{\left(\sqrt[3]{7}\right)^2} = 7^{-\frac{2}{3}}$

141. $\sqrt{7}$

142. $\sqrt[3]{34}$

143. $\sqrt[3]{-11}$

144. $\sqrt[5]{a^2}$

145. $\sqrt[3]{6^4}$

146. $\left(\sqrt[3]{x}\right)^2$

147. $\left(\sqrt[5]{6}\right)^3$

148. $\left(\sqrt[4]{2x}\right)^5$

149. $\frac{1}{\sqrt[3]{a}}$

150. $\frac{1}{\left(\sqrt[5]{x}\right)^4}$

151. $\frac{1}{\sqrt[4]{x^3}}$

152. $\sqrt[3]{2b^3}$

Evaluate if possible.

153. $(-9)^{\frac{1}{2}}$

154. $100000^{\frac{3}{5}}$

155. $\left(\frac{27}{8}\right)^{\frac{2}{3}}$

156. $3^{\frac{1}{2}} \times 3^{\frac{1}{2}}$

157. $-9^{\frac{1}{2}}$

158. $(2^5)^{0.4}$

Evaluate if possible.

159.

a. $-8^{\frac{4}{3}}$

b. $(-8)^{\frac{4}{3}}$

What important rule is explored above?

160. $4^{\frac{3}{2}} \div 16^{\frac{1}{4}}$

161. $(-1)^{-\frac{3}{2}}$

162. $\left(\sqrt[3]{5^2}\right)\left(\sqrt[3]{5}\right)$

163. $\left(\sqrt[4]{16}\right)\left(\sqrt[5]{32}\right)$

164. $\sqrt{\sqrt[3]{729}}$

165. Evaluate to two decimal places using a calculator

$$\frac{1}{\sqrt[5]{300}}$$

166. Evaluate to two decimal places using a calculator

$$\frac{5}{\sqrt[6]{256}}$$

167. Evaluate to two decimal places using a calculator

$$\frac{1}{\sqrt[13]{2500}}$$

168. Challenge

Write the following radicals as a single power.

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

Write each of the following radicals as a single power.

169. $\left(\sqrt{x^3}\right)\left(\sqrt[3]{x}\right)$

$\left(x^{\frac{3}{2}}\right)\left(x^{\frac{1}{3}}\right)$ Write as powers (both base-x).

$\left(x^{\frac{9}{6}}\right)\left(x^{\frac{2}{6}}\right)$ Create common denominators.

$\left(x^{\frac{9+2}{6}}\right)$ Add numerators.

$\left(x^{\frac{11}{6}}\right)$

170. $\left(\sqrt[3]{x^2}\right)\left(\sqrt[4]{x^3}\right)$

171. $\left(\sqrt[5]{x^3}\right)\left(\sqrt[3]{x^2}\right)$

More rational exponents…

172. The height and the base of a triangle each measure $2^{\frac{3}{2}}$ cm. Without using a calculator, what is the area of the triangle?

173. Find the area of a rectangle if the length is $5^{\frac{2}{3}}$ and the width is $5^{\frac{2}{5}}$. Write your answer in exponential form, then approximate to two decimal places.

174. Inscribe a square inside another square such that the corners of the internal square contact the midpoint of sides of the larger square. If the side length of the larger square is $\sqrt{7}$, what is the area of the inscribed square? Answer in exact form.

175. Simplify(write as a single power.)

$$\left[\left(\sqrt[3]{x^4}\right)\left(\sqrt[5]{x}\right)\right]^{-2}$$

176. Simplify (write as a single power.)

$$\left[\left(\sqrt[4]{x^9}\right)\left(\sqrt[3]{x^6}\right)\right]^{\frac{2}{3}}$$

177. Ei-Q evaluated $64^{\frac{3}{2}}$ using the following steps. In which step did she make her first error?

Step 1: $64^{\frac{3}{2}} = \left(\sqrt{64}\right)^3$
Step 2: $64^{\frac{3}{2}} = (8)^3$
Step 3: $64^{\frac{3}{2}} = 24$

a) In step 1.
b) In step 2.
c) In step 3.
d) She made no error.

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178. Flinflan started to evaluate $81^{-\frac{3}{4}}$ in two different ways shown below. Which of the following statements is correct?

Method 1: $81^{-\frac{3}{4}} = \left(\sqrt[4]{81}\right)^{-3}$ Method 2: $81^{-\frac{3}{4}} = \frac{1}{\sqrt[4]{81^3}}$

a) Method 1 will produce the correct answer but method 2 will not.
b) Method 2 will produce the correct answer but method 1 will not.
c) Both methods will produce the correct answer.
d) Neither method will produce the correct answer.

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179. Simplify: $\left[\left(\sqrt[3]{x^4}\right)\left(\sqrt[5]{x^2}\right)\right]^{-1}$

180. Simplify: $\left[\left(\sqrt[3]{a^5}\right)\left(\sqrt[4]{a^3}\right)\right]^{-2}$

181. Simplify:

$$\sqrt[3]{\left(a^{\frac{2}{3}}\right)^{\frac{1}{4}}}$$

182. Simplify:

$$\sqrt[4]{\left(x^{\frac{1}{3}}\right)^{\frac{1}{5}}}$$

Match each item in column 1 with an equivalent item in column 2

Column 1	Column 2
183. $\left(\frac{t}{j}\right)^{\frac{2}{3}}$	A. $\sqrt[3]{\frac{j^2}{t^2}}$
184. $\left(\frac{j}{t}\right)^{\frac{3}{2}}$	B. $-\left(\frac{j}{t}\right)^{\frac{3}{2}}$
185. $\left(\frac{t}{j}\right)^{-\frac{2}{3}}$	C. $\sqrt{\frac{j^3}{t^3}}$
186. $\left(\frac{j}{t}\right)^{-\frac{3}{2}}$	D. $-\left(\frac{t}{j}\right)^{\frac{2}{3}}$
187. $\left(\frac{t}{j}\right)^{-\frac{3}{2}}$	E. $\sqrt{\frac{t^3}{j^3}}$
	F. $\sqrt[3]{\frac{t^2}{j^2}}$
	G. $-\left(\frac{t}{j}\right)^{\frac{3}{2}}$

188. Which of the following is equivalent to $3a^{\frac{1}{2}} \times (5a)^{\frac{1}{2}}$

a. $15a$
b. $a\sqrt{15}$
c. $3\sqrt{5a}$
d. $3a\sqrt{5}$

189. Which of the following is equivalent to $2x^{\frac{1}{2}} \times (3x)^{\frac{1}{2}}$

a. $6x$
b. $x\sqrt{6}$
c. $2\sqrt{3x}$
d. $2x\sqrt{3}$

190. Which of the following is not equivalent to $x^{\frac{2}{3}}$?

a. $\sqrt[3]{x^2}$
b. $\left(\sqrt[6]{x}\right)^4$
c. $(x^2)\left(\sqrt[3]{x}\right)$
d. $\sqrt{x^3}$

191. Which of the following is not equivalent to $a^{\frac{3}{2}}$?

a. $\sqrt[4]{a^6}$
b. $\sqrt[3]{a^2}$
c. $a\sqrt{a}$
d. $\sqrt{\sqrt{a^6}}$

192. Evaluate. Answer in simplest fraction form.

$$\frac{3^0 + 2^{-1}}{3^2 + 2^2}$$

193. Evaluate. Answer in simplest fraction form.

$$\frac{3^{-2} + 3^2}{3^{-2} + 2^0}$$

Answers:

1. 81
2. 2
3. x^8
4. $2x$
5. $9 \times 9 = 81$ or $3 \times 3 \times 3 \times 3 = 81$ or $3^4 = 81$
6. Answers vary. Similar to above.
7. $16,8,4,2,1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$
8. Divide by 2 as you go down the list
9. Fits the pattern above.
10. Yes follows the division pattern.
11. Decreasing exponent value is like dividing by two in this case.
12. 4
13. 2^5
14. 2
15. -4^2
16. -9^2
17. $\frac{2x^3}{2x^3}, (5x)^0$
18. $(-3)^2$
19. -64
20. -27
21. -16
22. $\frac{1}{16}$
23. $-\frac{1}{16}$
24. $\frac{1}{81}$
25. $\frac{1}{81}$
26. $-\frac{1}{81}$
27. 16
28. 16
29. -16
30. 1
31. -1
32. 1
33. a^9
34. g^4
35. $15m^6$
36. a^9
37. a^{-2}
38. f^{2+x}
39. x^1
40. 2^{-2}
41. g^4
42. m^4
43. t^5
44. x^{10}
45. $15m^6$
46. $5x^6$
47. $-\frac{1}{2}a^2 = -\frac{a^2}{2}$
48. $\frac{4x^2}{5}$
49. $\frac{a^3}{3}$
50. $\frac{2}{3}$
51. 15625
52. m^6
53. $8m^{12}$
54. m^6
55. 1
56. $x^{-6}y^{-9} = \frac{1}{x^6y^9}$
57. $8m^{12}$
58. $2^{-3}c^{-12}d^{-9} = \frac{1}{8c^{12}d^9}$
59. $(-3)^{-4}x^8y^{-12} = \frac{x^8}{81y^{12}}$
60. $3^{-3}x^6y^9 = \frac{1}{27}x^6y^9$ or $\frac{x^6y^9}{27}$
61. $-18x^5y^9$
62. $128a^{12}b^2$
63. $\frac{8}{125}$
64. $\frac{8}{8}$
65. $\frac{x^3}{8}$
66. $\frac{16y^2}{9x^{10}}$
67. $\frac{x^3}{8}$
68. $\frac{a^4}{b^4}$
69. $\frac{x^{10}}{y^{15}}$
70. $\frac{-8a^6}{27y^9}$
71. $\frac{a^6}{b^4}$
72. $\frac{16x^2}{9y^2}$
73. $\frac{16y^2}{9x^{10}}$
74. $\frac{25a^6b^4c^{12}}{4}$
75. $\frac{n^3}{8m^3}$
76. $27b^6$
77. $\frac{4x^{10}}{y^{12}}$
78. $\frac{2a^2}{b^3} = \frac{2a^2}{1} \times \frac{1}{b^3}$ and $\frac{1}{b^3} = b^{-3}$
79. $\frac{12x^3}{y} = \frac{12x^3}{1} \times \frac{1}{y}$ and $\frac{1}{y} = y^{-1}$
80. $\frac{3a^2}{b^5}$
81. $\frac{3a^2}{b^5}$
82. $\frac{1}{8x^3y^3}$
83. $\frac{3a^2}{b^5}$
84. $\frac{a^2}{b^5}$
85. $2x^5y^5$
86. $\frac{3a^2}{b^5c^5}$
87. $\frac{y^6z^2}{x^8}$
88. $\frac{9}{2x^7y^{11}}$
89. $\frac{1}{8x^3y^3}$
90. $\frac{4}{a^{15}b^9}$
91. $\frac{2}{m^2n}$
92. Remember that a negative exponent can be evaluated by reciprocating the base, therefore expressions like a^{-3} become $\frac{1}{a^3}$. Notice the exponent became positive.
93. $\frac{4y^{12}}{9x^8}$
94. $\frac{27b^3}{8a^3}$
95. $\frac{1}{8x^9y^6}$
96. $\frac{4x^6}{3y^7}$
97. $\frac{1}{2}$
98. $\frac{1}{3}$
99. $x^{\frac{1}{n}} = \sqrt[n]{x}$
100. Possible answer:
$\sqrt[4]{3} \times \sqrt[4]{3} \times \sqrt[4]{3} \times \sqrt[4]{3} = 3$
$3^{\frac{1}{4}} \times 3^{\frac{1}{4}} \times 3^{\frac{1}{4}} \times 3^{\frac{1}{4}} = 3$
$\therefore \sqrt[4]{3} = 3^{\frac{1}{4}}$
101. 7
102. -4
103. *no real number*
104. 4
105. $\frac{1}{3}$
106. $\frac{1}{2}$
107. 10
108. $2x$
109. $\frac{1}{3x^2}$
110. $\sqrt{7}$
111. $\sqrt[3]{3x}$
112. $\sqrt[3]{4}$
113. $\frac{1}{\sqrt[3]{4}}$
114. $-\sqrt[3]{64}$
115. $\frac{1}{\sqrt[3]{64}}$
116. $13^{\frac{1}{2}}$
117. $-3x^{\frac{1}{2}}$
118. $(2y)^{\frac{1}{2}}$
119. $4^{\frac{1}{4}}$
120. $4^{\frac{1}{2}}$
121. $(3x)^{-\frac{1}{5}}$
122. $27^{\frac{2}{3}} = \left(27^{\frac{1}{3}}\right)^2$
$27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2$
$27^{\frac{2}{3}} = (3)^2$
$27^{\frac{2}{3}} = 9$
123. $\sqrt[3]{4^2}$ or $\left(\sqrt[3]{4}\right)^2$
124. $\sqrt[3]{4^3}$ or $\left(\sqrt[3]{4}\right)^3$
125. $\sqrt[3]{4^4}$ or $\left(\sqrt[3]{4}\right)^4$
126. $\frac{1}{\sqrt[3]{4^2}}$ or $\frac{1}{\left(\sqrt[3]{4}\right)^2}$
127. $\frac{1}{\sqrt[3]{4^3}}$ or $\frac{1}{\left(\sqrt[3]{4}\right)^3}$
128. $\frac{1}{\sqrt[3]{4^4}}$ or $\frac{1}{\left(\sqrt[3]{4}\right)^4}$
129. $\sqrt{4} = 2$
130. $\sqrt[3]{125} = 5$
131. $\left(\sqrt[3]{8}\right)^2 = 4$
132. $\left(\sqrt[3]{81}\right)^3 = 27$
133. $\left(\sqrt{4}\right)^3 = 8$
134. $\frac{1}{\left(\sqrt[4]{16}\right)^3} = \frac{1}{8}$
135. $\frac{1}{\left(\sqrt[3]{-27}\right)^2} = \frac{1}{9}$
136. $\frac{1}{\left(\sqrt[3]{-8}\right)^5} = -\frac{1}{32}$
137. $9^{\frac{5}{2}} = \left(\sqrt{9}\right)^5 = 243$
138. 1
139. $\frac{1000}{27}$
140. $\frac{4}{9}$
141. $7^{\frac{1}{2}}$
142. $34^{\frac{1}{3}}$
143. $(-11)^{\frac{1}{3}}$
144. $a^{\frac{2}{5}}$
145. $6^{\frac{4}{3}}$
146. $x^{\frac{2}{3}}$
147. $6^{\frac{3}{5}}$
148. $(2x)^{\frac{5}{4}}$
149. $a^{-\frac{1}{3}}$
150. $x^{-\frac{4}{5}}$
151. $x^{-\frac{3}{4}}$
152. $2^{\frac{1}{2}}b$
153. *no real solution*
154. 1000
155. $\frac{9}{4}$
156. 3
157. -3
158. 4
159. a)-16 b) 16
160. 4
161. *no real solution*
162. 5
163. 4
164. 3
165. 0.32
166. 1.98
167. 0.55
168. $x^{\frac{11}{6}}$
169. *Answered on page.*
170. $x^{\frac{17}{12}}$
171. $x^{\frac{19}{15}}$
172. $4\ cm^2$
173. $5\frac{16}{15}\ \text{cm}^2 \cong 5.57\ \text{cm}^2$
174. $\frac{7}{2}$ *or* $3.5\ cm^2$
175. $x^{-\frac{46}{15}}$ or $\frac{1}{x^{\frac{46}{15}}}$
176. $x^{\frac{17}{6}}$
177. c
178. c
179. $x^{-\frac{26}{15}} = \frac{1}{x^{\frac{26}{15}}}$
180. $a^{-\frac{29}{6}} = \frac{1}{a^{\frac{29}{6}}}$
181. $a^{\frac{1}{18}}$
182. $x^{\frac{1}{60}}$
183. F
184. C
185. A
186. E
187. C
188. D
189. D
190. C,D
191. B
192. $\frac{3}{26}$
193. $\frac{41}{5}$