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## Chapter 5 Review

For each type of question, the achievement level is indicated. Showing work is an important strategy in communicating your knowledge and ideas so please be thorough.

**Learning Goal 5.1**

Express an entire radical as a simplified mixed radical and vice versa. Identify and order irrational numbers.

Developing	Proficient	Extending
1. Write each radical in simplest form, <b>without a calculator</b> . State any restrictions on the variable.		
a. $\sqrt{125}$	b. $\sqrt[3]{216}$	c. $\sqrt{216k^3}$
d. $\sqrt{512}$	e. $\sqrt[4]{405}$	f. $\sqrt[3]{-96xy^4}$
g. $\sqrt{80}$	h. $\sqrt[3]{-100}$	i. $\sqrt[4]{48m^5n^4}$
j. $\sqrt{147}$	k. $\sqrt[3]{80}$	l. $\sqrt[5]{a^7b^{10}c^2d^{12}}$

Developing	Proficient	Extending
2. Write each mixed radical as an entire radical, <b>without a calculator</b> . State any restrictions on the variable.		
a. $2\sqrt{3}$	b. $-2\sqrt[3]{8}$	c. $12\sqrt{k^3}$
d. $3\sqrt{5}$	e. $5\sqrt[4]{2}$	f. $-xy^3\sqrt{9xy^4}$
g. $6\sqrt{3}$	h. $6\sqrt[3]{10}$	i. $-3m^4\sqrt[4]{4mn^4}$
j. $4\sqrt{2}$	k. $-8\sqrt[3]{8}$	l. $a^2d^3\sqrt[5]{a^3b^5c^2}$

Extending
3. Simplify the radical. State any restrictions on the variable. $\sqrt[n]{3 \times 2^n \times x^{2n} \times y^{n+3}}$
4. Write the mixed radical as an entire radical. State any restrictions on the variable. $2ab^2 \cdot \sqrt[n]{5ab^2}$

Proficient	
5. Use a number line to order these numbers from least to greatest, <b>without a calculator</b> .	
a. $\sqrt{25}, \sqrt[3]{30}, \sqrt[3]{-8}, \sqrt[4]{20}, \sqrt{\frac{144}{9}}$	b. $\sqrt[5]{-243}, \sqrt{4}, \sqrt[3]{\frac{27}{216}}, \sqrt{12}, \sqrt[3]{6}$
c. $3\sqrt{28}, \sqrt{45}, 5\sqrt{20}, 2\sqrt{32}, 8\sqrt{3}$	d. $-4\sqrt{6}, -\sqrt{75}, -3\sqrt{20}, -5\sqrt{10}, -6\sqrt{2}$

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**Developing**

6. Simplify. State restrictions on the variable, where applicable.

a.  $5\sqrt{6} - 2\sqrt{6}$

b.  $9\sqrt{5} - 5\sqrt{5}$

c.  $9\sqrt{x} - 15\sqrt{x}$

d.  $6\sqrt{a} + 5\sqrt{a} - 11\sqrt{a}$

e.  $5\sqrt{q} + 3\sqrt{q} - 4\sqrt{q}$

f.  $2\sqrt{x} - 3\sqrt{y} + 5\sqrt{x} + 2\sqrt{y}$

g.  $7\sqrt{m} + 2\sqrt{n} + 5\sqrt{n} - 3\sqrt{m}$

h.  $2\sqrt[3]{3b} + 8\sqrt{3b} - 9\sqrt[3]{3b} + 3\sqrt{3b}$

**Proficient**

i.  $\sqrt[3]{128} - \sqrt[3]{16} - \sqrt[3]{54}$

j.  $\sqrt[3]{24} - \sqrt[3]{192} - \sqrt[3]{375}$

k.  $\sqrt{20} + \sqrt{18} + \sqrt{45} - \sqrt{50}$

l.  $\sqrt{63} + \sqrt{40} - \sqrt{90} - \sqrt{28}$

m.  $\sqrt{25a^2b} + \sqrt{4a^2b}$

n.  $\sqrt[4]{81p^3q^5} - 2\sqrt[4]{p^3q^5}$

o.  $5\sqrt{8x^3} + 4y\sqrt{75y^3} - 2\sqrt{27y^5} - 3x\sqrt{50x}$

p.  $2\sqrt[3]{-3b} + 8\sqrt{-3b} - 9\sqrt[3]{-3b} + 3\sqrt{-3b}$

q.  $3\sqrt{32a^5} - 2\sqrt{45b^3} + 5b\sqrt{125b} - 2a\sqrt{72a^3}$

r.  $3\sqrt{x^3} + 5\sqrt{2x} - \sqrt{4x^3}$

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**Learning Goal 5.2**

Evaluate expressions with fractional and negative exponents. Connect fractional exponents to radicals, and negative exponents to reciprocals.

Developing		
1. Simplify each power, to a mixed radical where appropriate, <b>without a calculator</b> .		
a. $20^{1/2}$	b. $12^{1/2}$	c. $15^{1/3}$
d. $18^{1/3}$	e. $32^{1/2}$	f. $\left(\frac{2}{3}\right)^{-4}$
g. $\left(\frac{1}{10}\right)^{-2}$	h. $\left(\frac{5}{2}\right)^{-3}$	i. $\left(\frac{6}{2}\right)^{-4}$
Proficient		
j. $18^{2/3}$	k. $32^{4/3}$	l. $50^{3/2}$
m. $125^{2/3}$	n. $27^{5/3}$	o. $0.5^{-2}$
p. $\left(\frac{1}{4}\right)^{-1/2}$	q. $(-1000)^{-2/3}$	r. $(-0.008)^{-4/3}$
s. $(0.6)^{-3}$	t. $(0.75)^{-3.5}$	u. $(0.75)^{-3/2}$
Extending		
v. $((25^9 \times 5^{-8})^3)^{-2}$	w. $(3^{-4} \times 81^2)^{-6}$	x. $((p^{-3} \times p^{-8})^{-2})^5$
y. $\left(-\left(\frac{64^{-3}}{16^3}\right)^2\right)^{-3}$	z. $\frac{\left(\frac{k^5}{k^{-9}}\right)^2}{k^{10}}$	aa. $-\left(\frac{b^{-2}}{b^x}\right)^4$

Developing		
2. Express each radical as a power. State any restrictions on the variable, where applicable.		
a. $\sqrt{17^3}$	b. $\sqrt[4]{15^5}$	c. $\sqrt[2]{12^6}$
d. $\sqrt{(4x^2)^3}$	e. $\sqrt[3]{64x^6}$	f. $(\sqrt[4]{81a^8})^2$

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Developing	Proficient
3. Write each power as a radical in <b>two different ways</b> .	Write each power as a radical in <b>two different ways</b> , then write in simplest form <b>without a calculator</b> .
a. $26^{2/5}$	b. $20^{2/3}$
c. $19^{3/4}$	d. $25^{2/3}$
e. $6^{5/2}$	f. $(9n^4)^{3/2}$
g. $40^{2/3}$	h. $(40a^3b^4)^{2/3}$
i. $3^{5/4}$	j. $(72p^3q)^{5/2}$

Extending
4. Suppose you want \$5000 in three years. The interest rate for a savings account is 2.9% compounded annually. The money, $P$ dollars, you must invest now is given by the formula $P = 5000(1.029)^{-3}$ How much must you invest now to have \$5000 in three years?

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**Learning Goal 5.3**

Apply order of operations to radical expressions.

Proficient	Extending
1. Simplify <b>without using a calculator</b> . Your answers should contain only positive, whole number exponents.	
a. $2m^2 \times 2m^3$	b. $(x^{-2}x^{-3})^4$
c. $m^4 \times 2m^{-3}$	d. $(n^4)^{-1/3} \times 2n^{-1}$
e. $\frac{a^3}{a^5} \times a^{-2}$	f. $x^2y^{-4} \times (xy)^2$
g. $4n^4 \times 2n^{-3}$	h. $(2x^4y^{-3})^{-1}$
i. $\frac{2x^4y^{-4}z^{-3}}{3x^2y^{-3}z^4}$	j. $\frac{(20a^2b^5)^{-1/2}}{2ab^3}$
k. $2x^3y^{-3} \times 2x^{-1}y^3$	l. $\left(\frac{x^2y}{y^{-2}}\right)^{-2}$
m. $2y^{5/2} \times 3y^{-3}$	n. $ba^4 \times (2b^6a^3)^{-3/2}$
o. $4v^3 \times v^{-1/3}u^{-2}$	p. $\frac{(2x^{-3}z^2)^3}{x^3y^4z^2 \times x^{-4}z^3}$
q. $4a^3b^2 \times 3a^{-4}b^{-3}$	r. $\frac{(32pm^{-1})^{-1/4} \times 2m^{-1}p^3}{2pq^2}$
s. $\frac{2y^3 \times 3xy^3}{3x^2y^4}$	t. $(m \times m^{-2} \times n^{5/3})^2$
u. $4r^{-3} \times 2r^2$	v. $\left(\frac{x^{1/2}y^{-2}}{x^2y^{1/2}}\right)^4$
w. $\frac{3m^{-4}}{m^3}$	x. $\frac{(x^3y^2)^{3/2}}{(x^{-1}y^{-2/3})^{1/4}}$
y. $2k^4 \times 4k$	z. $\frac{(x^{-1/2}y^2)^{-5/4}}{x^2y^{1/2}}$

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Developing			
5. Simplify each expression <b>without a calculator</b> . Your answers should contain only positive, whole number exponents. State any restrictions on the variable, where applicable.			
a.	$0.5x^{-2}$	b.	$\left(\frac{a^2}{9}\right)^{-1/2}$
c.	$(-8q^6)^{-2/3}$	d.	$(-0.027m^3)^{-4/3}$
Proficient			
e.	$(12x^3y^2)^{1/2}$	f.	$(18a^2b^5)^{2/3}$
g.	$(32m^2n^8)^{3/4}$	h.	$(81^{-3} \times 27^5)^{-2}$
i.	$(64p^5q^9)^{4/3}$	j.	$3xy\left(\frac{x^2}{y^2}\right)^{-1/2}$
Extending			
k.	$\frac{(9a^3b^6)^{-1/2}}{(3a^3b^6)^{-2}}$	l.	$(8x^{n+2}y^{n+1})^{2/n}$

Developing		Proficient		Extending	
2. Simplify the products/quotients where possible. State any restrictions on the variable, if any.					
a.	$\sqrt{6}(\sqrt{5} + 2)$	b.	$\frac{2}{\sqrt{3}}$	c.	$\frac{2\sqrt{5} + 4}{\sqrt{5}}$
d.	$\sqrt{5}(\sqrt{2} - 4)$	e.	$\frac{1}{5\sqrt{3}}$	f.	$\frac{5\sqrt{8} - 2\sqrt{5}}{\sqrt{6}}$
g.	$\sqrt{2}(-7 + \sqrt{2})$	h.	$(\sqrt{3} + 8)(2\sqrt{3} - 1) - \sqrt{3}(7\sqrt{3})$	i.	$\frac{-3\sqrt{12} + 2\sqrt{3}}{\sqrt{18}}$
j.	$-\sqrt{3}(3 + \sqrt{8})$	k.	$(\sqrt{5} - 2)^2$	l.	$\frac{4\sqrt{2} - 6\sqrt{5}}{2\sqrt{3}}$
m.	$\sqrt{6}(\sqrt{3} + \sqrt{2})$	n.	$(2\sqrt{x} - 3\sqrt{y})(4\sqrt{y} - 3\sqrt{x})$	o.	$\frac{1}{\sqrt{5}} - \frac{1}{\sqrt{3}}$
p.	$\sqrt{w}(2\sqrt{w} + 3)$	q.	$(3\sqrt{m} - 3\sqrt{n})(3\sqrt{m} + 3\sqrt{n})$	r.	$\frac{\sqrt{2}}{\sqrt{12}} - \frac{5\sqrt{3}}{\sqrt{8}}$
s.	$5(2\sqrt{7} - 3\sqrt{5})$	t.	$\frac{\sqrt{40}}{2\sqrt{4}}$	u.	$\frac{2\sqrt{x} + 3\sqrt{y}}{\sqrt{x} - \sqrt{y}}$

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**Learning Goal 5.4**

Solve radical equations, identifying extraneous roots and restrictions to the domain.

**Proficient**

1. Solve each equation. Verify the solution(s).

a.  $3\sqrt{x} = 5$

b.  $4\sqrt{x+1} - 5 = 3$

c.  $3 = 4\sqrt{x}$

d.  $13 = 2\sqrt{x+1} - 7$

e.  $3\sqrt{x} - 4 = 2\sqrt{x} + 1$

f.  $4\sqrt{x} + 3 = 5\sqrt{x} + 1$

g.  $\sqrt{x-2} = 5$

h.  $3 = \sqrt{2x+1}$

i.  $9 = \sqrt{121-2x}$

**Extending**

j.  $\sqrt{5x+3} = \sqrt{3x} + 1$

k.  $\sqrt{-3x+7} = \sqrt{-2x+9}$

l.  $4 - 5\sqrt{6x} = -5 - 4\sqrt{6x}$

m.  $\sqrt{2x+4} - \sqrt{x} = 2$

n.  $\sqrt{x-5} - \sqrt{x+10} = -3$

o.  $\sqrt{y+12} - 2 = \sqrt{y}$

**Extending**

2. John solves the equation  $\sqrt{x+6} - x = 4$ . He determines two solutions:  $x = -2$  and  $x = -5$ . Identify whether either of these values is extraneous.

3. The equation

$$t = \sqrt{\frac{d}{4.9}}$$

describes the time,  $t$ , in seconds, for an object to fall from a height of  $d$  metres. Determine the original height of an object that takes 4.3 s to reach the ground. Express the answer to the nearest tenth of a metre.