Ch. 5 & 6 Solutions

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Chapter 5: Radical Expressions & Equations

1. Express $3xy\sqrt[3]{2x}$ as an entire radical.

$= \sqrt[3]{3xy \cdot 3xy \cdot 3xy \cdot 2x}$

$= \boxed{\sqrt[3]{54x^4y^3}}$

2. Express $\sqrt{48a^3b^2c^5}$ as a simplified mixed radical.

12 4

4 3 2 2

2 2

$= \boxed{4abc^2\sqrt{3ac}}$, $a, c \geq 0$

3. Order the set of numbers from least to greatest.

$3\sqrt{6}, \sqrt{36}, 2\sqrt{3}, \sqrt{18}, 2\sqrt{9}, \sqrt[3]{8}$

$=\sqrt{54}$ $=\sqrt{12}$ $=\sqrt{36}$ $=2$ $=\sqrt{4}$

$\rightarrow \sqrt[3]{8}, 2\sqrt{3}, \sqrt{18}, 2\sqrt{9} = \sqrt{36}, 3\sqrt{6}$

4. Simplify each expression. Identify any restrictions on the values for the variables.

a) $4\sqrt{2a} + 5\sqrt{2a}$

$= \boxed{9\sqrt{2a}, \ a \geq 0}$

b) $10\sqrt{20x^2} - 3x\sqrt{45}$

4 5 9 5

2 2 3 3

$= 20x\sqrt{5} - 9x\sqrt{5}$

$= \boxed{11x\sqrt{5}, \ x \in \mathbb{R}}$

5. Simplify. Identify any restrictions on the values of the variable in part c).

a) $2\sqrt[3]{4}\left(-4\sqrt[3]{6}\right)$

$= -8\sqrt[3]{24} = \boxed{-16\sqrt[3]{3}}$

6 4

3 2 2 2

b) $\sqrt{6}\left(\sqrt{12} - \sqrt{3}\right)$

$= \sqrt{72} - \sqrt{18} = 6\sqrt{2} - 3\sqrt{2} = \boxed{3\sqrt{2}}$

6 12 2 9

2 3 2 6 3 3

2 3

c) $\left(6\sqrt{a} + \sqrt{3}\right)\left(2\sqrt{a} - \sqrt{4}\right)$

$= 12a - 6\sqrt{4a} + 2\sqrt{3a} - \sqrt{12}$

$= \boxed{12a - 12\sqrt{a} + 2\sqrt{3a} - 2\sqrt{3}, \ a \geq 0}$

6. Rationalize each denominator.

a) $\frac{\sqrt{12}}{\sqrt{4}} = \frac{\sqrt{12}}{2} = \frac{\cancel{2}\sqrt{3}}{\cancel{2}} = \boxed{\sqrt{3}}$

b) $\frac{2}{(2+\sqrt{3})} \times \frac{(2-\sqrt{3})}{(2-\sqrt{3})} = \frac{4-2\sqrt{3}}{4-\cancel{2\sqrt{3}}+\cancel{2\sqrt{3}}-3} = \boxed{4-2\sqrt{3}}$

c) $\frac{(\sqrt{7}+\sqrt{28})}{(\sqrt{7}-\sqrt{14})} \times \frac{(\sqrt{7}+\sqrt{14})}{(\sqrt{7}+\sqrt{14})} = \frac{7+\sqrt{98}+\sqrt{7\cdot 28}+\sqrt{28\cdot 14}}{7+\cancel{\sqrt{7\cdot 14}}-\cancel{\sqrt{7\cdot 14}}-14} = \frac{7+\sqrt{98}+14+\sqrt{28\cdot 14}}{-7} =$

$= \frac{21+7\sqrt{2}+14\sqrt{2}}{-7} = \frac{21+21\sqrt{2}}{-7} = \boxed{-3-3\sqrt{2}}$

98: 7, 14; 7, 2

28·14: 4, 7, 7, 2; 2 2

7. Solve the radical equation $(\sqrt{x+6})^2 = (x)^2$ Verify your anwer(s).

$x+6=x^2$

$0=x^2-x-6$

$0=(x-3)(x+2)$

$x=3,-2$

Check:

$\sqrt{3+6}=3$ ✓

$\sqrt{-2+6}=-2$ ✗ (extraneous)

$\boxed{x=3}$

8. On a children's roller coaster ride, the speed in a loop depends on the height of the hill the car has just come down and the radius of the loop. The velocity, v, in feet per second, of a car at the top of a loop of radius r, in feet, is given by the formula $v=\sqrt{h-2r}$, where h is the height of the previous hill, in feet.

a) Find the height of the hill when the velocity at the top of the loop is 20 ft/s and the radius of the loop is 15 ft.

$20=\sqrt{h-2(15)}$

$(20)^2=(\sqrt{h-30})^2$

$400=h-30$

$430=h$

The height is 430 feet.

b) Would you expect the velocity of the car to increase or decrease as the radius of the loop increases? Explain your reasoning. $h=100$

Increase $r=10$ $r=20$

$V=\sqrt{100-2(10)}$ $V=\sqrt{100-2(20)}$

$V=\sqrt{80}$ $V=\sqrt{60}$

The velocity decreases.

Chapter 6: Rational Expressions & Equations

9. Simplify each expression. Identify any non-permissible values.

a) $\frac{\cancel{12}^{1}\cancel{a^2}\cancel{b}}{\cancel{48}_{4}\cancel{a^2}b^{4}{}^{3}}$

$= \frac{1}{4b^3}$

npv's: $a \neq 0$
$b \neq 0$

b) $\frac{4-x}{x^2-8x+16}$ } factor!

$= \frac{-\cancel{(-4+x)}}{\cancel{(x-4)}(x-4)}$

$= \frac{-1}{x-4}$

npv's $x \neq 4$

c) $\frac{(x-3)(x+5)}{x^2-1} \div \frac{x-3}{x+1}$

$= \frac{\cancel{(x-3)}(x+5)}{\cancel{(x+1)}(x-1)} \times \frac{\cancel{x+1}}{\cancel{x-3}}$

$= \boxed{\frac{x+5}{x-1}}$

npv's $x \neq -1, 1, 3$

d) $\frac{5x-10}{6x} \times \frac{3x}{15x-30}$

$= \frac{{}^{1}\cancel{5}\cancel{(x-2)}}{{}_{2}\cancel{6x}} \times \frac{\cancel{3x}}{{}_{3}\cancel{15}\cancel{(x-2)}}$

$= \boxed{\frac{1}{6}}$, $x \neq 0, 2$

f) $\left(\frac{x+2}{x-3}\right)\left(\frac{x^2-9}{x^2-4}\right) \div \left(\frac{x+3}{x-2}\right)$

$= \frac{\cancel{(x+2)}}{\cancel{(x-3)}} \frac{\cancel{(x+3)}\cancel{(x-3)}}{\cancel{(x+2)}\cancel{(x-2)}} \times \frac{\cancel{(x-2)}}{\cancel{(x+3)}}$

$= 1$, $x \neq 3, -2, 2, -3$

10. Determine the sum or difference. Express answers in lowest terms. Identify any non-permissible values.

Find Common Denominator (LCD)

a) ${}^{(a-7)}\frac{10}{a+2} + \frac{a-1}{a-7}{}^{(a+2)}$

LCD $= (a+2)(a-7)$

$= \frac{10(a-7) + (a-1)(a+2)}{(a+2)(a-7)}$

$= \frac{10a - 70 + a^2 + 2a - a - 2}{(a+2)(a-7)}$

$= \boxed{\frac{a^2 + 11a - 72}{(a+2)(a-7)} \quad \text{npv's } a \neq -2, 7}$

b) $\frac{3x+2}{x+\cancel{1}2} - \frac{x-5}{x^2-4} = {}^{(x-2)}\frac{3x+2}{x+2} - \frac{x-5}{(x+2)(x-2)}$

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

$= \frac{(3x+2)(x-2) - (x-5)}{(x+2)(x-2)}$

$= \frac{3x^2 - 6x + 2x - 4 - x + 5}{(x+2)(x-2)}$

$= \boxed{\frac{3x^2 - 5x + 1}{(x+2)(x-2)} \quad \text{npv's } x \neq 2, -2}$

c) $\frac{2x}{x^2-25}-\frac{3}{x^2-4x-5}=\frac{(x+1)\,2x}{(x+5)(x-5)}-\frac{3\,(x+5)}{(x-5)(x+1)}$

LCD $=(x+5)(x-5)(x+1)$

$=\frac{2x(x+1)-3(x+5)}{(x+5)(x-5)(x+1)}$

$=\frac{2x^2+2x-3x-15}{(x+5)(x-5)(x+1)}$

$=\frac{2x^2-x-15}{(x+5)(x-5)(x+1)}$

$\boxed{=\frac{(2x+5)(x-3)}{(x+5)(x-5)(x+1)}}$

$x\neq 5,-5,-1$

11. Sandra simplified the expression $\frac{(x+2)\cancel{(x+5)}}{\cancel{x+5}}$ to $x+2$. She stated that they were equivalent expressions. Do you agree or disagree with Sandra's statement? Explain.

Yes, but only as long as $x\neq -5$

12. Mrs. Baldwin marks 1 set of tests in 2 hours. If she and Mr. Suderman work together, they can mark 1 set of tests in only 2/3 of an hour. How long does Mr. Suderman take if he marks the set of tests alone?

Rate $=\frac{\text{Job}}{\text{Time}}$

$R_B=\frac{1}{2}$ ← class ← hours

$R_S=\frac{1}{x}$

$R_{combined}=\frac{1}{2/3}=\frac{3}{2}$

$R_B+R_S=R_C$

$\left(\frac{1}{2}+\frac{1}{x}=\frac{3}{2}\right)\times 2x$

$x+2=3x$

$2=2x$

$x=1$

Mr. Suderman takes 1 hour