

Name: Key

Date: _____

Section 4.1 What are Square Roots and Simplifying Radicals

1. Simplify each of the following radicals:

i) $\sqrt{36}$ $= 6$	ii) $\sqrt{25}$ $= 5$	iii) $\sqrt{144}$ 12	iv) $\sqrt{3025}$ 55	v) $\sqrt{289}$ 17
vi) $\sqrt{169}$ 13	vii) $\sqrt{225}$ 15	viii) $\sqrt{14641}$ $= 121$	ix) $\sqrt{729}$ 27	x) $\sqrt{961}$ $= 31$
ix) $\sqrt{9801}$	x) $\sqrt{36} - \sqrt{1225}$ $6 - 35$ $= -29$	xi) $\sqrt{9} - \sqrt{81}$ $3 - 9$ $= 0$	xii) $\sqrt{196} + \sqrt{64}$ $14 + 8$ $= 22$	xiii) $\sqrt{121} - \sqrt{16}$ $11 - 4$ $= 7$
ixx) $\sqrt{\frac{9}{121}}$	xx) $\sqrt{\frac{100}{289}}$	xxi) $\sqrt{\frac{361}{529}}$	xxii) $\sqrt{\frac{48}{75}}$	xxiii) $\sqrt{\frac{343}{252}}$

2. Convert each of the following to a Mixed Radical

i) $\sqrt{32}$ $= \sqrt{16 \times 2}$ $= 4\sqrt{2}$	ii) $\sqrt{24}$ $= \sqrt{4 \times 6}$ $= 2\sqrt{6}$	iii) $\sqrt{150}$ $= \sqrt{25 \times 6}$ $= 5\sqrt{6}$	iv) $\sqrt{75}$ $= \sqrt{25 \times 3}$ $= 5\sqrt{3}$	v) $\sqrt{108}$ $= \sqrt{36 \times 3}$ $= 6\sqrt{3}$
vi) $\sqrt{162}$ $\sqrt{81 \times 2}$ $= 9\sqrt{2}$	vii) $\sqrt{11163}$	viii) $\sqrt{216}$ $= \sqrt{36 \times 6}$ $= 6\sqrt{6}$	ix) $\sqrt{3731}$	x) $\sqrt{847}$

$\frac{25}{32}$
 $\frac{57}{57}$

$\frac{18}{18}$
 $\frac{144}{144}$
 $\frac{18}{24}$

$\frac{219}{24}$
 $\frac{24}{243}$

$\frac{348}{15}$
 $\frac{363}{363}$

ix) $\sqrt{36+64+128}$ $\sqrt{4(9+16+32)}$ $2\sqrt{57} //$	x) $\sqrt{27+81+9+243}$ $\sqrt{9(3+9+1+27)}$ $= \sqrt{9(4)(10)}$ $= 6\sqrt{10}$	xi) $\sqrt{8\sqrt{324}}$ $= \sqrt{8(3\sqrt{2})}$ $= \sqrt{24\sqrt{2}}$ $= 2\sqrt{6\sqrt{2}} //$	xii) $\sqrt{219+\sqrt{576}+\sqrt{75}}$ $\sqrt{219+24+5\sqrt{3}}$ $9\sqrt{3}+5\sqrt{3}$ $= 14\sqrt{3} //$	xiii) $\sqrt{348+\sqrt{36}+\sqrt{81}}$ $\sqrt{348+6+9}$ $= \sqrt{363}$ $= 11\sqrt{3} //$
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ix) $\sqrt{36+64+128}$ $\sqrt{4(9+16+32)}$ $2\sqrt{57} //$	x) $\sqrt{27+81+9+243}$ $\sqrt{9(3+9+1+27)}$ $=\sqrt{9(4)(10)}$ $=6\sqrt{10}$	xi) $\sqrt{8\sqrt{324}}$ $=\sqrt{8(3\sqrt{2})}$ $=\sqrt{24\sqrt{2}}$ $=2\sqrt{6\sqrt{2}} //$	xii) $\sqrt{219+\sqrt{576}+\sqrt{75}}$ $\sqrt{219+24+5\sqrt{3}}$ $9\sqrt{3}+5\sqrt{3}$ $=14\sqrt{3} //$	xiii) $\sqrt{348+\sqrt{36}+\sqrt{81}}$ $\sqrt{348+6+9}$ $=\sqrt{363}$ $=11\sqrt{3} //$
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3. Multiply and Simplify each of the following radicals:

i) $12\sqrt{3} \times (-3\sqrt{18})$	ii) $3\sqrt{24} \times \sqrt{54}$	iii) $5\sqrt{108} \times 4\sqrt{24}$
iv) $3\sqrt{7} \times 2\sqrt{6} \times 12\sqrt{14}$	v) $3\sqrt{48} \times 7\sqrt{75}$	vi) $8\sqrt{24} \times -7\sqrt{72}$
vii) $9\sqrt{108} \times -4\sqrt{28} \times 2\sqrt{343}$	viii) $2\sqrt{12} \times 7\sqrt{15} \times 9\sqrt{10}$	ix) $12\sqrt{1\frac{1}{9}} \times 3\sqrt{\frac{6}{15}}$
x) $4\sqrt{0.3} \times (-3\sqrt{0.6})$	xi) $5\sqrt{1\frac{2}{11}} \times (-8\sqrt{0.27})$	xii) $-8\sqrt{0.343} \times (-2\sqrt{0.7})$

4. Arrange each expression in order from least to greatest

a) $-6\sqrt{2}, -3\sqrt{7}, -2\sqrt{17}, -4\sqrt{5}, -2\sqrt{21}, -5\sqrt{3}$ b) $4\sqrt{5}, 5\sqrt{3}, 2\sqrt{19}, 6\sqrt{2}, 3\sqrt{9}, \sqrt{70}$

c) $6\sqrt{0.1}, 3\sqrt{0.7}, 7\sqrt{0.05}, 2\sqrt{0.8}, 4\sqrt{0.5}, 5\sqrt{0.3}$

5. Simplify each of the following radicals:

i) $\sqrt{5!}$
 $= \sqrt{5 \times 4 \times 3 \times 2 \times 1}$
 $= 2\sqrt{30}$

ii) $\sqrt{5 \times 8!}$
 $= \sqrt{5 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2}$
 $= 5 \times 4 \times 2 \sqrt{7 \times 6 \times 3}$
 $= 40 \sqrt{7 \times 2 \times 3 \times 3}$
 $= 120 \sqrt{14}$

iii) $\sqrt{\frac{9! \times 3!}{5!}}$
 $= \sqrt{\frac{9!}{5!} \times 3!}$
 $= \sqrt{9 \times 8 \times 7 \times 6 \times 3 \times 2}$
 $= 3 \sqrt{2 \times 4 \times 7 \times 3 \times 2}$
 $= 36 \sqrt{14}$

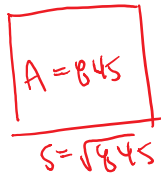
iv) $\sqrt{4^{a-1} + 4^{a-1} + 4^{a-1} + 4^{a-1}}$
 $= \sqrt{4(4^{a-1})}$
 $= \sqrt{4^a} = \sqrt{(2^a)^2}$
 $= 2^a$

v) $\sqrt{\frac{6! \times 4! \times 2! \times 0!}{5 \times 3}}$
 $= \sqrt{\frac{6 \times 5 \times 4! \times 4! \times 2 \times 1}{3 \times 5}}$
 $= \sqrt{2 \times 4! \times 4! \times 2}$
 $= 48$

vi) $\sqrt[3]{7! \times 7! \times 8!}$
 $= 7! \times 2$
 $= 10080$

4! = 24
 5! = 120
 6! = 720
 7! = 5040

6. The area of a square is 845cm². What is the perimeter of the square? Express your answer as a mixed radical



$p = 4 \times \sqrt{845}$
 $= 4 \times \sqrt{169 \times 5}$
 $= 52\sqrt{5}$

$\sqrt[5]{845}$
 169
 34

7. One side of a square is $12+3x$ and the other side is $32+x$. What is the value of the diagonal. Express your answer as a mixed radical

① if $12+3x = 32+x$
 $2x = 20$
 $x = 10$

② KAM slope
 $s = 12+3(10)$
 $s = 42$

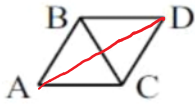
③ DIAGONAL
 $D = 42\sqrt{2}$

8. What is the value of "n" such that the equation is true? $10^n = 10^{-5} \times \sqrt{\frac{10^{73}}{0.001}}$

$10^n = 10^{-5} \times \left(\frac{10^{73}}{10^{-3}}\right)^{\frac{1}{2}}$
 $= 10^{-5} (10^{76})^{\frac{1}{2}}$
 $= 10^{-5} (10^{38}) = 10^{33}$

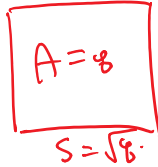
$\therefore n = 33$

9. In the figure, triangles ABC and BCD are equilateral triangles. What is the value of $AD \div BC$ when expressed in simplest radical form?



$$\begin{aligned} \text{IF } BC &= 2x \\ \text{THEN } AD &= 2x\sqrt{3} \\ \therefore \frac{AD}{BC} &= \frac{2x\sqrt{3}}{2x} = \sqrt{3} \end{aligned}$$

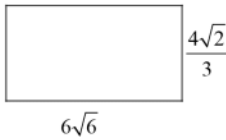
10. The area of a square is 8 and the perimeter is $a\sqrt{b}$, what are the values of "a" and "b"?



$$\begin{aligned} P &= 4 \times \sqrt{8} \\ &= 4 \times 2\sqrt{2} \\ &= 8\sqrt{2} \end{aligned}$$

$$\begin{aligned} a &= 8 \\ b &= 2 \end{aligned}$$

11. Find the PERIMETER and AREA of the following rectangle:



$$\begin{aligned} P &= (6\sqrt{6} + \frac{4\sqrt{2}}{3}) \times 2 \\ P &= 12\sqrt{6} + \frac{8\sqrt{2}}{3} \end{aligned}$$

$$\begin{aligned} A &= \left(\frac{4\sqrt{2}}{3}\right)(6\sqrt{6}) \\ &= 8(\sqrt{12}) \\ &= 16\sqrt{3} \end{aligned}$$

12. Suppose that $\frac{p}{q} = \sqrt{3}$. What is the value of $\frac{2p}{p-q}$? Express your answer in simplest radical form.

$$\begin{aligned} \textcircled{1} \frac{p}{q} &= \sqrt{3} \\ p &= \sqrt{3}(q) \end{aligned}$$

$$\begin{aligned} \textcircled{2} \frac{2p}{p-q} &= \frac{2\sqrt{3}(q)}{\sqrt{3}q - q} \\ &= \frac{2\sqrt{3}}{(\sqrt{3}-1)} \end{aligned}$$

$$\begin{aligned} \textcircled{3} \frac{2\sqrt{3}(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)} &= \frac{6+2\sqrt{3}}{3-1} \\ &= \frac{6+2\sqrt{3}}{2} \\ &= 3+\sqrt{3} \end{aligned}$$