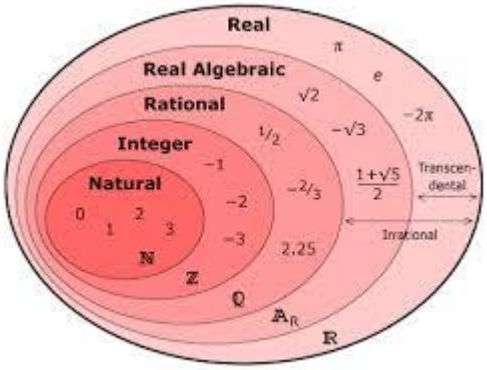
Simplifying Radicals



Up to this point much of our study of numbers has Been using integers (+/-) and rationals (fractions)

Now we look at irrational numbers such as $\sqrt{6}, \sqrt[3]{4}$

These numbers cannot be written as a fraction and have non-repeating decimals.

So, our job will be to write them in simplest form.

Consider $\sqrt{18}$ *since 18 = 9 x 2 this must be* $\sqrt{9\ x\ 2}$ *but we know that* $\sqrt{9} = 3$

Thus: $\sqrt{18} = 3\sqrt{2}$ *This is called "simplest radical form"*

1) Write the following in simplest radical form

a) $\sqrt{54}$

54 = 9 x 6 or 3 x 3 x 3 x 2

(a pair of 3's represent a perfect square and thus they can break out of jail

$\sqrt{54} = 3\sqrt{6}$

b) $\sqrt{98}$

98 = 7 x 7 x 2

$\sqrt{98} = 7\sqrt{2}$

c) $5\sqrt{75}$

75 = 5 x 5 x 3

$5\sqrt{75} = 25\sqrt{3}$

d) $10\sqrt{72}$

72 = 3 x 3 x 2 x 2 x 2

$10\sqrt{72} = 60\sqrt{2}$

e) $\sqrt[3]{54}$

need 3 guys to bust out of this jail …

54 = 3 x 3 x 3 x 2

$\sqrt[3]{54} = 3\sqrt[3]{2}$

f) $7\sqrt[3]{5000}$

need 3 guys to bust out of this jail …

5000 = 2 x 2 x 2 x 5 x 5 x 5 x 5

$7\sqrt[3]{5000} = 70\sqrt[3]{5}$

g) $\sqrt[4]{162}$

need 4 guys to bust out of this maximum security jail …

162 = 2 x 3 x 3 x 3 x 3 $\sqrt[4]{162} = 3\sqrt[4]{2}$

h) $\sqrt{30}$

30 = 3 x 2 x 5 … no pairs … some times prison breaks don't happen

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Breaking back into jail ??? (Why – because we can!)

a) $7\sqrt{5}$

must have had a pair of 7's (7 x 7 x 5) $\sqrt{245}$

b) $6\sqrt[3]{10}$

must have had a triplet of 6's (6 x 6 x 6 x 10) $\sqrt[3]{2160}$

c) *Without a calculator … which is bigger?* $5\sqrt{3}$ *or* $\sqrt{77}$

$5\sqrt{3}$ *must have had a pair of 5's (5x 5 x 3)* $\sqrt{75} < \sqrt{77}$

Benchmarking a root

How big is $\sqrt{30}$*? Since the distance between perfect squares gets larger as x gets bigger … the radical values are almost linear.*

$\sqrt{25} < \sqrt{30} < \sqrt{36}$ $5 < \sqrt{30} < 6$

Differ by 11 *30 is 5 more than 25* *so* $\sqrt{30} \approx 5 + \frac{5}{11}$ *5.454545* $(\sqrt{30} = 5.477)$

$\sqrt{49} < \sqrt{55} < \sqrt{64}$ $7 < \sqrt{55} < 8$

Differ by 15 *55 is 6 more than 49* *so* $\sqrt{55} \approx 7 + \frac{6}{15}$ *7.4* $(\sqrt{55} = 7.416)$

Works for cube roots too:

$\sqrt[3]{64} < \sqrt[3]{100} < \sqrt[3]{125}$ $4 < \sqrt[3]{100} < 5$

Differ by 62 *100 is 25 less than 125* *so* $\sqrt[3]{100} \approx 5 - \frac{25}{62}$ *4.597* $(\sqrt[3]{100} = 4.64)$

Assignment = worksheet

Why didn't Krok like to go sailing with the baseball uniform Designer?

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28

L	$\sqrt{8}$	***I***	$\sqrt{45}$	***A***	$\sqrt{50}$
T	$\sqrt{12}$	***O***	$\sqrt{98}$	***S***	$\sqrt{48}$
E	$\sqrt{125}$	***A***	$\sqrt{20}$	***S***	$\sqrt{72}$
Y	$\sqrt{63}$	***E***	$\sqrt{144}$	***W***	$\sqrt{32}$
D	$\sqrt{75}$	***A***	$\sqrt{200}$	***S***	$5\sqrt{18}$
A	$2\sqrt{1000}$	***P***	$\sqrt{1000000}$	***E***	$3\sqrt{128}$
L	$4\sqrt{80}$	***H***	$-3\sqrt{54}$	***A***	$-7\sqrt{40}$
S	$2\sqrt{500}$	***T***	$-4\sqrt{24}$	***Z***	$3\sqrt{175}$

ANSWERS

(18)	$7\sqrt{2}$	(19)	$6\sqrt{7}$
(14)	$5\sqrt{5}$	(13)	$24\sqrt{3}$
(12)	$2\sqrt{2}$	(3)	$24\sqrt{2}$
(4)	$5\sqrt{2}$	(9)	$15\sqrt{2}$
(28)	$4\sqrt{3}$	(5)	$16\sqrt{5}$
(20)	$2\sqrt{3}$	(23)	1000
(25)	$3\sqrt{5}$	(16)	$20\sqrt{10}$
(8)	$3\sqrt{7}$	(10)	$-8\sqrt{6}$
(1)	$6\sqrt{2}$	(21)	$30\sqrt{3}$
(7)	$10\sqrt{2}$	(11)	$-14\sqrt{10}$
(6)	$4\sqrt{2}$	(24)	$20\sqrt{5}$
(22)	$2\sqrt{5}$	(26)	$15\sqrt{7}$
(27)	12	(2)	$-9\sqrt{6}$
(15)	$5\sqrt{3}$	(17)	-88

U	$3\sqrt{28}$				
K	$8\sqrt{27}$				
B	$-8\sqrt{121}$				
C	$5\sqrt{108}$				

Now try Page 218 #11, 12, 17, 18