

14.1 Repeating Decimals as Fractions

$0.266\bar{6}$

(-) $10x = 2.66\bar{6}$
 $x = 0.266\bar{6}$

$9x = 2.4$
 $x = \frac{2.4}{9}$
 $x = \frac{24}{90} = \frac{4}{15}$

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14.2 Square Root of a number

$\sqrt{4} = 2$

$\sqrt{121} = 11$ because $11 \times 11 = 121$
 what about $-11 \times -11 = 121$?

"the principal square root."

$\sqrt{81} = 9$
 $-\sqrt{81} = -9$

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$\sqrt{x^2} \neq x$ $\sqrt{x^2} = |x|$

$\sqrt{(-9)^2} \neq -9$

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14.3 Approximating Square Roots

ignore most of the stuff in the text and go by these notes.

① gross approx $\sqrt{30}$?

$\sqrt{25} = 5$
 $\sqrt{36} = 6$

$\sqrt{20}$ $\sqrt{4} = 2$
 $\sqrt{1} = 1$ 8.?

$2 \times 2 = 4$
 $3 \times 3 = 9$
 $4 \times 4 = 16$
 $5 \times 5 = 25$
 $6 \times 6 = 36$
 $7 \times 7 = 49$
 $8 \times 8 = 64$
 $9 \times 9 = 81$
 $10 \times 10 = 100$

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14.4 Simplifying Square Roots

$\sqrt{a} \sqrt{b} = \sqrt{ab}$

$\sqrt{3} \sqrt{7} = \sqrt{3 \cdot 7} = \sqrt{21}$

$\sqrt{4} \sqrt{9} = \sqrt{4 \cdot 9} = \sqrt{36} = 6$

$2 \cdot 3 = 6$

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$\sqrt{48} = \sqrt{16} \sqrt{3} = 4\sqrt{3}$

$\sqrt{48} = 2 \cdot 2\sqrt{3} = 4\sqrt{3}$

$\sqrt{16} = 4$

$3\sqrt{60} = 3\sqrt{5} \sqrt{4} \sqrt{3}$
 $= 3\sqrt{5} \cdot 2\sqrt{3}$
 $= 6\sqrt{15}$

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$\sqrt{1} = 1$	$\sqrt{10} = 3.16\dots$
$\sqrt{2} = 1.414\dots$	$\sqrt{11} = 3.31\dots$
$\sqrt{3} = 1.7\dots$	$\sqrt{12} = \sqrt{4 \cdot 3} = 3.4\dots$
$\sqrt{4} = 2$	$\sqrt{13} = 3.61\dots$
$\sqrt{5} = 2.2\dots$	$\sqrt{14} = 3.74\dots$
$\sqrt{6} = 2.45\dots$	$\sqrt{15} = 3.87\dots$
$\sqrt{7} = 2.65\dots$	$\sqrt{16} = 4$
$\sqrt{8} = 2.90\dots$	
$\sqrt{9} = 3$	

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14.5 Radicals with variables

$\sqrt{4x-8}$	$\sqrt{12}$ real #? yes
real #?	$\sqrt{-3}$ real #? no

$$4x-8 \geq 0$$

$$4x \geq 8$$

$$x \geq 2$$

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$$\sqrt{x^2} = x$$

$$\sqrt{x^3} = \sqrt{x^2 \cdot x} = \sqrt{x^2} \sqrt{x} = x\sqrt{x}$$

$$\sqrt{x^4} = \sqrt{x^2 \cdot x^2} = \sqrt{x^2} \sqrt{x^2} = x \cdot x = x^2$$

$$\sqrt{x^{10}} = \sqrt{x^5 \cdot x^5} = \sqrt{0 \cdot 0} = 0 = x^5$$

$$\sqrt{x^n} = x^{\frac{n}{2}}$$

$$\sqrt{x^m} = x^7$$

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$$\sqrt{a^8 b^{14}} = \sqrt{a^8} \sqrt{b^{14}} = a^4 b^7$$

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$$-\sqrt{16x^2 y^{12}}$$

$$-\sqrt{16} \sqrt{x^2} \sqrt{y^{12}}$$

$$-4xy^6$$

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$$-\sqrt{4c^{12} d^6}$$

$$-\sqrt{4} \sqrt{c^{12}} \sqrt{d^6}$$

$$-2c^6 d^3$$

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14.6 Odd Powers of Variables

$$\sqrt{x^5} = \sqrt{x^4 \cdot x} = \sqrt{x^4} \sqrt{x} = x^2 \sqrt{x}$$

ex 3

$$\sqrt{28xy^{11}} = \sqrt{4 \cdot 7 \cdot x \cdot y^{10} \cdot y}$$

$$= 2\sqrt{7} \sqrt{x} y^5 \sqrt{y}$$

$$= 2y^5 \sqrt{7xy}$$

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ex 4

$$-5x^3 y \sqrt{18x^5 y^6}$$

$$\downarrow$$

$$\sqrt{9} \sqrt{2} \sqrt{x^4} \sqrt{x} \sqrt{y^6}$$

$$3\sqrt{2} x^2 \sqrt{x} y^3$$

$$(-5)(3)(x^3)(x^2)(y)(y^3) \sqrt{2} \sqrt{x}$$

$$-15x^5 y^4 \sqrt{2x}$$

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#6 pg 403 $\sqrt{24a^{11}} = \sqrt{4 \cdot 6 \cdot a^9 \cdot a^2}$
 $2\sqrt{6} a^3 \sqrt{a}$
 $2a^3 \sqrt{6a}$

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$$\frac{3xy \sqrt{18x^3y^4}}{\sqrt{9} \sqrt{2} \sqrt{x^2} \sqrt{x} \sqrt{y^4}}$$

$$3xy^2 \sqrt{2x}$$

$$9x^2y^3 \sqrt{2x}$$

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14.7 Adding and Subtracting Radicals

$3x+2y=?$ can't add
 $3\sqrt{2}+2\sqrt{5}=?$ can't add

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

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$2\sqrt{5} - 3\sqrt{20}$
 $2\sqrt{5} - 3\sqrt{4}\sqrt{5}$
 $2\sqrt{5} - 3 \cdot 2\sqrt{5}$
 $2\sqrt{5} - 6\sqrt{5}$
 $-4\sqrt{5}$

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$$\sqrt{20} - 2\sqrt{45} - 9\sqrt{5}$$

$$\sqrt{4}\sqrt{5} - 2\sqrt{9}\sqrt{5} - 9\sqrt{5}$$

$$2\sqrt{5} - 2 \cdot 3\sqrt{5} - 9\sqrt{5}$$

$$-13\sqrt{5}$$

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14.8 Multiplying Radicals

$5\sqrt{3} \cdot 6\sqrt{2}$
 $30\sqrt{6}$

$-8\sqrt{10x} \cdot 3\sqrt{2x}$
 $-24\sqrt{20x^2}$
 $-24\sqrt{4 \cdot 5 \cdot x^2}$
 $-24(2)\sqrt{5}(x)$
 $-48x\sqrt{5}$

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$\sqrt{7}(\sqrt{5}+4\sqrt{7})$
 $\sqrt{7}\sqrt{5} + \sqrt{7} \cdot 4\sqrt{7}$
 $\sqrt{35} + 4\sqrt{49}$
 $\sqrt{35} + 4 \cdot 7$
 $\sqrt{35} + 28$

$(6\sqrt{5}-2\sqrt{2})(4\sqrt{5}+5\sqrt{2})$
 $24\sqrt{5} + 30\sqrt{6} - 8\sqrt{6} - 10\sqrt{4}$
 $24 \cdot 3 + 22\sqrt{6} - 10 \cdot 2$
 $72 + 22\sqrt{6} - 20$
 $52 + 22\sqrt{6}$

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$(2\sqrt{5}-3\sqrt{6})(2\sqrt{5}+3\sqrt{6})$
 $(a-b)(a+b) = a^2 - b^2$
 $4\sqrt{25} + 6\sqrt{30} - 6\sqrt{30} - 9\sqrt{36}$
 $4 \cdot 5 - 9 \cdot 6$
 $20 - 54$
 -34

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$$(\sqrt{5}-\sqrt{2})(3\sqrt{5}+2\sqrt{2})$$

$$3\sqrt{25} + 2\sqrt{10} - 3\sqrt{10} - 2\sqrt{4}$$

$$3 \cdot 5 - \sqrt{10} - 2 \cdot 2$$

$$15 - \sqrt{10} - 4$$

$$11 - \sqrt{10}$$

#25

$$(\sqrt{6}-\sqrt{5})(\sqrt{6}+\sqrt{5})$$

$$6 + \sqrt{30} - \sqrt{30} - 5$$

$$6 - 5$$

$$1$$

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14.9 Dividing Radicals

$$\frac{\sqrt{20}}{\sqrt{2}} = \sqrt{\frac{20}{2}} = \sqrt{10}$$

$$\frac{\sqrt{50x^5}}{\sqrt{2x^3}} = \sqrt{\frac{50x^5}{2x^3}} = \sqrt{25x^2} = 5x$$

rationalizing the denominator

$$\frac{3}{\sqrt{18}} = \frac{3}{\sqrt{9 \cdot 2}} = \frac{3}{3\sqrt{2}} = \frac{1}{\sqrt{2}} \left(\frac{\sqrt{2}}{\sqrt{2}} \right) = \frac{\sqrt{2}}{2}$$

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$$\sqrt{\frac{15}{24y^5}} = \sqrt{\frac{3 \cdot 5}{3 \cdot 8y^5}} = \sqrt{\frac{5}{8y^5}}$$

$$= \frac{\sqrt{5}}{\sqrt{4 \cdot 2 \cdot y^4 \cdot y}} = \frac{\sqrt{5}}{2y^2 \sqrt{2y}} \left(\frac{\sqrt{2y}}{\sqrt{2y}} \right) = \frac{\sqrt{10y}}{(2y^2)(2y)}$$

rationalizing the denominator

$$= \frac{\sqrt{10y}}{4y^3}$$

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$$\frac{12xy^3}{\sqrt{18xy^4}} = \frac{12xy^3}{\sqrt{9 \cdot 2 \cdot x \cdot y^4}} = \frac{12xy^3}{3\sqrt{2xy^2}}$$

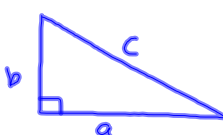
$$\frac{12xy^3}{3y^2 \sqrt{2x}} = \frac{4 \cdot \cancel{3} \cdot x \cdot y^{\cancel{3} \cdot 2}}{\cancel{3} \cdot y^{\cancel{2} \cdot 2} \sqrt{2x}} = \frac{4xy}{\sqrt{2x}} \left(\frac{\sqrt{2x}}{\sqrt{2x}} \right)$$

$$= \frac{4xy\sqrt{2x}}{2x}$$

$$= 2y\sqrt{2x}$$

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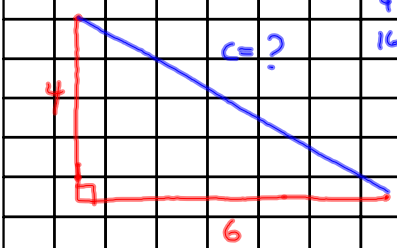
14.10 The Pythagorean Property



$$a^2 + b^2 = c^2$$

a, b are legs
c (across from right angle)
is the hypotenuse

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$$a^2 + b^2 = c^2$$

$$4^2 + 6^2 = c^2$$

$$16 + 36 = c^2$$

$$52 = c^2$$

$$c = \sqrt{52}$$

$$c = 7.21$$

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