5.1 Radicals and Rational Exponents

Obj: ① Define + apply rational and irrational exponents

② Simplify expressions containing radicals or rational exponents

1 4 9 16 25 36 49 64 81 100 121 144 169 196 225 256 289 324 361 400 441 484 529 576 625

a) $\sqrt{6}\cdot\sqrt{8} = \sqrt{6}\cdot\sqrt{4}\cdot\sqrt{2} = \sqrt{6}\cdot 2\cdot\sqrt{2}$

$2\sqrt{6}\cdot\sqrt{2}$

$2\sqrt{12}$

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

$2\cdot 2\cdot\sqrt{3}$

$4\sqrt{3}$

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

$4\sqrt{3}$

1 8 27 64 125 216 343 512 72 1000

b) $\sqrt{45} - \sqrt{125}$

$\sqrt{9}\cdot\sqrt{5} - \sqrt{25}\cdot\sqrt{5}$

$3\sqrt{5} - 5\sqrt{5}$

$-2\sqrt{5}$

c) $\sqrt[3]{1000x^3y^7}$

$10x\sqrt[3]{y^7} \rightarrow \sqrt[3]{y^6}\cdot\sqrt[3]{y^1}$

$10xy^2\sqrt[3]{y}$

$\sqrt[3]{x^{17}} \rightarrow x^{\frac{15}{3}}$

$\sqrt[3]{x^{15}}\cdot\sqrt[3]{x^2}$

$x^5\sqrt[3]{x^2}$

d) $(6+\sqrt{b})(6-\sqrt{b})$

$36 - 6\sqrt{b} + 6\sqrt{b} - \sqrt{b^2}$

$36 - b$

Nearest ten-thousandth

a) $35^{\frac{1}{8}}$

1.559583047

1.5596

5.1 cont

write $\left(16u^{\frac{2}{5}}v^{-4}\right)^{\frac{5}{4}}$ using only positive exponents.

$16^{\frac{5}{4}}\left(u^{\frac{2}{5}}\right)^{\frac{5}{4}}\left(v^{\frac{-4}{1}}\right)^{\frac{5}{4}}$

$\frac{x^7}{x^5}$

$\frac{32u^{\frac{1}{2}}v^{-5}}{1} = \frac{32u^{\frac{1}{2}}}{v^5} = \frac{32\sqrt{u}}{v^5}$

$x^2 \cdot x^4$

Simplify $y^{\frac{1}{3}}\left(y^{\frac{1}{6}} - y^{\frac{5}{3}}\right)$

$\frac{1}{3}+\frac{1}{6}$ $\quad y^{\frac{1}{3}+\frac{1}{6}} - y^{\frac{1}{3}+\frac{5}{3}}$ $\quad 3 - \frac{5}{3}$

$\frac{2}{6}+\frac{1}{6}$ $\quad y^{\frac{1}{2}} - y^{2}$ $\quad \frac{9}{3}-\frac{5}{3} = \frac{4}{3}$

$\frac{3}{6} = \frac{1}{2}$ $\quad \sqrt{y} - y^2$ $\quad \frac{7}{3} - 2$

$\frac{7}{3} - \frac{6}{3}$

$\left(x^{\frac{2}{3}}y^{3}\right)\left(xy^{\frac{5}{6}}\right)^{-2}$

$\left(\frac{x^{\frac{2}{3}}y^{3}}{1}\right)\left(\frac{1}{x^2y^{\frac{5}{3}}}\right) = \frac{x^{\frac{2}{3}}y^{3}}{x^2y^{\frac{5}{3}}}$

$\frac{x^{-2}}{1}\cdot\frac{y^{-\frac{5}{3}}}{1}$

$x^{\frac{1}{3}}y^{\frac{4}{3}}$

5.2 Exponential Functions

- Graph & identify transformations of exponential functions.

- Use exponential functions to solve application problems.

$f(x) = 2^x$ —

$f(x)$ 2^{x-4} move 4 units.

$f(x) = 2^{x+2} + 3$ Left 2 up 3

$f(x) = 2^{-x}$

$f(x) = 2^{.5x}$ = horizontal streath of $\sqrt[a]{2}$, factor of $\frac{1}{.5} = 2$

$f(x) = 2^{.4x}$ = horizontal streath of 2.5 = $\frac{1}{.4} = 2.5$

Exp. growth & Decay Functions

$y = a \cdot b^x$

$b > 1$ growth

$0 < b < 1$ Decay.

$20,000

$y = 20{,}000(.92)^?$

decrease in value is 8% per yr.

what is the value in 2020?

5.4 Common & Natural Logarithmic functions

- Solve without a cal.
- solve with equivalent equation
- graph functions.

$\log_{10}$ → Log → Common

$\log_e$ → Ln → Natural

Log Form	Exponential Form
$\log_{10} 1000 = 3$	$10^3 = 1000$
$\log_{10} 1000 = x$	$10^x = 1000$
$\log 100{,}000 = 5$	$10^x = 100{,}000$
$\log_{10} x = 6$	$10^6 = x$
	$x = 1{,}000{,}000$
$10^x = 5$	$\log_{10} 5 = x$
	$.6989 = x$

$\ln 1.3 = 0.2624$

$\ln(-12) =$ non Real Answer. undefined

$\ln x = 2$ $\quad e^2 = x \quad x = 7.3891$

$e^x = 8$ $\quad \ln 8 = x \quad x = 2.0794$

5.4 continued

$$\frac{30{,}000}{10000} = \frac{10{,}000\left(1+\frac{.06}{4}\right)^{4t}}{10000}$$

$$3 = \left(1+\frac{.06}{4}\right)^{4t}$$

$$\log 3 = 4t \cdot \log 1.015$$

5.4/5 - 20#5

$$\frac{\log 3}{4 \cdot \log 1.015} = \frac{4t \cdot \log 1.015}{4 \log 1.015}$$

$18.4 \text{ yrs} = t$

$$\frac{\ln 3}{4 \cdot \ln 1.015} = 18.4$$

5.6 Solving Exponential & Logarithmic Equations.

Ex1

$$9^x = 3^{x-1}$$

$$(3^2)^x = 3^{x-1}$$

$$3^{2x} = 3^{x-1}$$

$$2x = x-1$$

$$-x \quad -x$$

$$x = -1$$

Ex2

$$\log 6^x = \log 3$$

$$\frac{x \cdot \log 6}{\log 6} = \frac{\log 3}{\log 6}$$

$$x = 0.6131$$

$$6^x = 3$$

$$\ln 6^x = \ln 3$$

$$\frac{x \cdot \ln 6}{\ln 6} = \frac{\ln 3}{\ln 6}$$

$$x = 0.6131$$

Ex3

$$4^{2x-1} = 5^{1-x}$$

$$\log 4^{2x-1} = \log 5^{1-x}$$

$$(2x-1) \cdot \log 4 = (1-x) \cdot \log 5$$

$$(2x-1) \cdot .6021 = (1-x) \cdot .6990$$

$$1.2042x - .6021 = .6990 - .6990x$$

Ex4

$$y = a \cdot (b)^t$$

carbon-14 5730 yrs/1 half life

Mummy Lost 32% of its carbon 14. ~~How~~ when did person die?

$$.68 = 1\,(.5)^{\frac{t}{5730}}$$

5.6 Cont

$$.68 = (.5)^{\frac{t}{5730}}$$

$$\text{Log}.68 = \text{Log}(.5)^{\frac{t}{5730}}$$

$$\frac{\text{Log}.68}{\text{Log}.5} = \left(\frac{t}{5730}\right)\cdot\frac{\text{Log}.5}{\text{Log}.5}$$

$$(5730).5564 = \frac{t}{5730}\cdot 5730$$

$$3188.1_{yrs} = t$$

EX 5 Invest $8000 at 6% per yr, compounded monthly. When will the investment be worth $22520?

$$A = P\left(1+\frac{r}{n}\right)^{nt}$$

$$\frac{22520}{8000} = \frac{8000\cdot\left(1+\frac{.06}{12}\right)^{12t}}{8000}$$

$$2.815 = (1.005)^{12t}$$

$$\text{Log}\,2.815 = 12t\cdot\text{Log}\,1.005$$

$$.4495 = 12t\cdot(.0022)$$

$$\frac{.4495}{12(.0022)} = t$$

(17.29_{yrs})

5.6/5-80 #5
skip 30, 45
10