

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

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

$2\sqrt{6} \cdot \sqrt{2}$   
 $2\sqrt{12}$   
 $2\sqrt{4} \cdot \sqrt{3}$   
 $2 \cdot 2 \cdot \sqrt{3}$   
 $4\sqrt{3}$

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)  $\sqrt[3]{1000 x^3 y^7}$   
 $10 \times (\sqrt[3]{y^7}) \rightarrow \sqrt[3]{y^6} \cdot (\sqrt[3]{y})$   
 $10xy^2 \cdot \sqrt[3]{y}$

$\sqrt[3]{x^{17}} \rightarrow x^{\frac{15}{3}}$   
 $\sqrt[3]{x^{15}} \cdot \sqrt[3]{x^2}$   
 $x^5 \sqrt[3]{x^2}$

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

a)  $35^{\frac{1}{8}}$   
 $1.559583047$   
 $1.5596$

5.1 cont

write  $(16u^{\frac{2}{5}} \cdot \sqrt[5]{-4})^{\frac{5}{4}}$  using only positive exponents.

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

$$x^2 \cdot x^4$$

$$\frac{16^{\frac{5}{4}} (u^{\frac{2}{5}})^{\frac{5}{4}} (V^{-4})^{\frac{5}{4}}}{1} = \frac{32 u^{\frac{1}{2}} V^{-5}}{V^5} = \frac{32 \sqrt{u}}{\sqrt{5}}$$

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

$$\frac{1}{3} + \frac{1}{6}$$

$$\downarrow \frac{2}{6} + \frac{1}{6}$$

$$\frac{3}{6} = \frac{1}{2}$$

$$\frac{1}{3} + \frac{1}{6}$$

$$y^{\frac{1}{2}}$$

$$\sqrt{y}$$

$$\frac{1}{3} + \frac{5}{3}$$

$$y^2$$

$$-y^2$$

$$3 - \frac{5}{3} = \frac{4}{3}$$

$$\frac{7}{3} - 2$$

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

$$(x^{\frac{7}{3}} y^3) (x y^{\frac{5}{6}})^{-2}$$

$$\frac{(x^{\frac{7}{3}} y^3)}{1} \left( \frac{1}{x^2 y^{\frac{5}{3}}} \right)$$

$$= \frac{x^{\frac{7}{3}} y^3}{x^2 y^{\frac{5}{3}}}$$

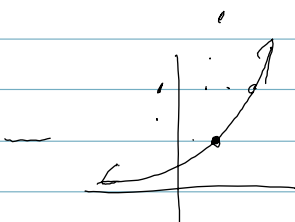
$$= \frac{x^{-\frac{2}{3}} y^{\frac{4}{3}}}{1}$$

## 5.2 Exponential Functions

- Graph + identify transformations of exponential functions

- Use exponential functions to solve application problems.

$$f(x) = 2^x$$



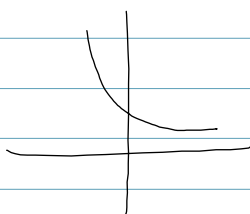
$$f(x) = 2^{x-4}$$

move 4 units.

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

Left 2 up 3

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



$$f(x) = 2^{.5x} = \text{horizontal stretch of } \sqrt[.5]{2}, \quad \frac{1}{.5} = 2$$

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

Exp. growth + Decay Functions

$$y = a \cdot b^x$$

\$20000

$$y = 20000(.92)^x$$

$b > 1$  growth

$0 < b < 1$  Decay.

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.

$$\text{Log}_{10} \rightarrow \text{Log} \rightarrow \text{Common}$$

$$\text{Log}_e \rightarrow \text{Ln} \rightarrow \text{Natural}$$

Log Form

$$\text{Log}_{10} 1000 = 3$$

$$\text{Log}_{10} 1000 = x$$

$$\text{Log} 100,000 = \underline{\underline{5}}$$

$$\text{Log}_{10} x = 6$$

$$10^x = 5$$

$$\text{Ln} 1.3 = 0.2624$$

$$\text{Ln} (-12) = \text{Non Real Answer.}$$

undefined

$$\text{Ln} x = 2$$

$$e^x = 8$$

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

$$\text{Ln} 8 = x$$

$$x = 2.0794$$

Exponential Form

$$10^3 = 1000$$

$$10^x = 1000$$

$$10^x = 100,000$$

$$10^6 = x$$

$$x = 1,000,000$$

$$\text{Log}_{10} 5 = x$$

$$.6989 = x$$

4.t

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

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

$$\log 3 = \sqrt[4t]{\log 1.015}$$

$$\frac{5.4}{5 - 20 \times 0.5}$$

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

$$\downarrow 18.4 \text{ yrs} = t$$

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

## 5.6 Solving Exponential & Logarithmic Equations.

EX1

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

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

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

$$\begin{array}{r} 2x = x-1 \\ -x \quad -x \\ \hline x = -1 \end{array}$$

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?

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

5.6 cont

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

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

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

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

$$3188.1_{\text{yrs}} = t$$

EX 5

Invest \$8000 at 6% per yr, compounded monthly. when will the investment be worth \$22520?

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

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

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

$$\log 2.815 = \log 1.005^{12t}$$

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

$$\left(17.29_{\text{yrs}}\right) \frac{.4495}{12(.0022)} = t$$

5.6 / 5-80 \$5  
skip 30, 45  
10