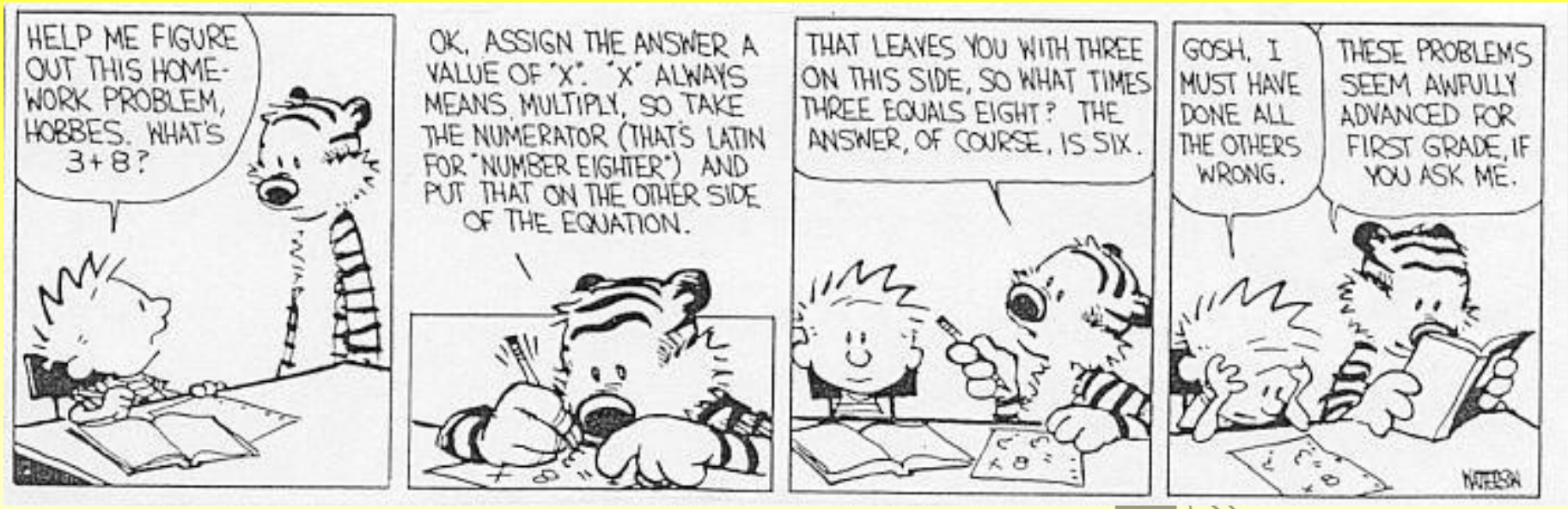
ST. JEAN DE BREBEUF MATHEMATICS



CHAPTER 6.4

TOOLS AND STRATEGIES TO SOLVE EQUATIONS INVOLVING EXPONENTS

CHAPTER 6.4 TOOLS AND STRATEGIES TO SOLVE EQUATIONS INVOLVING EXPONENTS

There are a variety of tools and strategies that can be used to solve equations involving exponential expressions. The choice may depend on where the variable appears

To solve an equation where the variable is an *exponent*, use **systematic trial** or **graphing technology**

To solve an equation with more than one exponential expression, use graphing technology

CHAPTER 6.4 TOOLS AND STRATEGIES TO SOLVE EQUATIONS INVOLVING EXPONENTS

EXAMPLE 1 *Solving for a Variable with an Exponent*

To solve an equation where the variable is raised to an exponent, *n*, take the n^{th} root of both sides of the equation

Solve $\mathbf{x^3 = 8}$

$$x^3 = 8$$

$$\left(x^{\cancel{3}}\right)^{\frac{1}{\cancel{3}}} = (8)^{\frac{1}{3}}$$

$$x = \sqrt[3]{8}$$

$$\boxed{x = 2}$$

STEPS FOR SOLVING EQUATIONS OF THE FORM $x^n = a$

1. Raise both sides by the exponent **1/n**

2. Use your calculator to evaluate

GENERAL STEPS

$$x^n = a$$

$$(x^n)^{1/n} = a^{1/n}$$

$$x = a^{1/n}$$

CHAPTER 6.4 TOOLS AND STRATEGIES TO SOLVE EQUATIONS INVOLVING EXPONENTS

EXAMPLE 1 *Solving for a Variable with an Exponent*

PRACTICE

(a) $\frac{3x^3}{3} = \frac{375}{3}$ *Isolate x^3*

→ ***Divide*** *both sides by* ***3***

$x^3 = 125$

$(x^3)^{\frac{1}{3}} = (125)^{\frac{1}{3}}$ ***Raise*** *each side by* ***1 / 3***

$x = \sqrt[3]{125}$

$\boxed{x = 5}$

STEPS FOR SOLVING EQUATIONS OF THE FORM $x^n = a$

1. Raise both sides by the exponent **1/n**
2. Use your calculator to evaluate

GENERAL STEPS

$x^n = a$

$(x^n)^{1/n} = a^{1/n}$

$x = a^{1/n}$

CHAPTER 6.4 TOOLS AND STRATEGIES TO SOLVE EQUATIONS INVOLVING EXPONENTS

EXAMPLE 1 *Solving for a Variable with an Exponent*

PRACTICE

(b) $\frac{5}{4}x^2 = 20$

Isolate x^2

→ ***Divide*** *both sides by* ***5 / 4***

$$\frac{\frac{5}{4}x^2}{\left(\frac{5}{4}\right)} = \frac{20}{\left(\frac{5}{4}\right)}$$

$$x^2 = 16$$

$$\left(x^2\right)^{\frac{1}{2}} = (16)^{\frac{1}{2}}$$

Raise *each side by* ***1 / 2***

$$x = \sqrt[2]{16}$$

$$\boxed{x = 4}$$

STEPS FOR SOLVING EQUATIONS OF THE FORM $x^n = a$

1. Raise both sides by the exponent **1/n**
2. Use your calculator to evaluate

GENERAL STEPS

$$x^n = a$$

$$(x^n)^{1/n} = a^{1/n}$$

$$x = a^{1/n}$$

CHAPTER 6.4 TOOLS AND STRATEGIES TO SOLVE EQUATIONS INVOLVING EXPONENTS

EXAMPLE 1 *Solving for a Variable with an Exponent*

PRACTICE

(c) $(x+1)^2 = 25$

*Isolate **x + 1** first!*

$\left[(x+1)^{\frac{2}{2}}\right]^{\frac{1}{2}} = (25)^{\frac{1}{2}}$

→ ***Raise*** *both sides by **1 / 2***

$x + 1 = 5$

$x = 5 - 1$

$\boxed{x = 4}$

$\sqrt[2]{25} = 5$

STEPS FOR SOLVING EQUATIONS OF THE FORM $x^n = a$

1. Raise both sides by the exponent **1/n**
2. Use your calculator to evaluate

GENERAL STEPS

$x^n = a$

$(x^n)^{1/n} = a^{1/n}$

$x = a^{1/n}$

CHAPTER 6.4 TOOLS AND STRATEGIES TO SOLVE EQUATIONS INVOLVING EXPONENTS

EXAMPLE 2 *Solving for a Variable with an Exponent Using Algebraic Methods*

A cylindrical storage container with a volume of $V = 5000\ m^3$ has a radius equal to its height. The volume, *V*, is related to the radios, *r*, according to the equation $\mathbf{V = \pi r^3}$.

Determine the radius and the height of the container to the nearest tenth of a metre.

$$V = \pi r^3$$

Isolate r^3 *first!*

$$\frac{5000}{\pi} = \frac{\pi r^3}{\pi}$$

→ ***Divide*** *both sides by* π

$$1591\ .549 = r^3$$

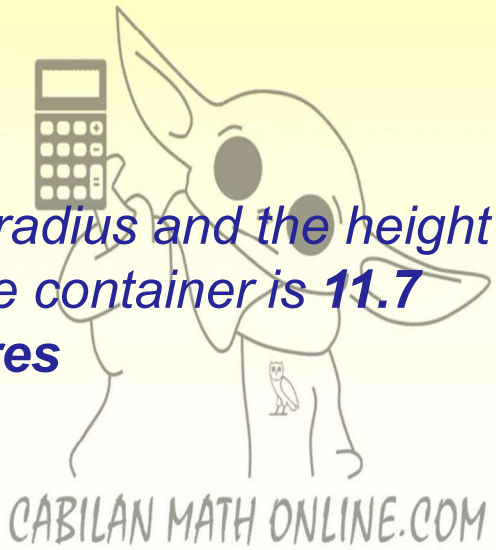
$$(1591\ .549)^{\frac{1}{3}} = (r^3)^{\frac{1}{3}}$$

Raise *both sides by* ***1 / 3***

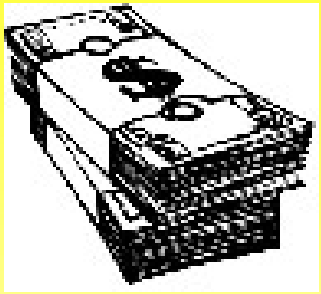
$$\sqrt[3]{1591\ .549} = r$$

$$11\ .7 = r$$

The radius and the height of the container is ***11.7 metres***



CHAPTER 6.4 TOOLS AND STRATEGIES TO SOLVE EQUATIONS INVOLVING EXPONENTS



EXAMPLE 3 *Solving for a Variable Exponent Using Systematic Trial*

Lena has inherited **$1000**. She decides to invest it into an account that pays **7.5%** per year, compounded *annually*. The amount of the account, *A*, can be determined using the equation **$A = 1000(1.075)^n$**, where *n* is the number of years the money is invested.

Using *systematic trial*, approximate how many years it will take for Lena's money to double in value.

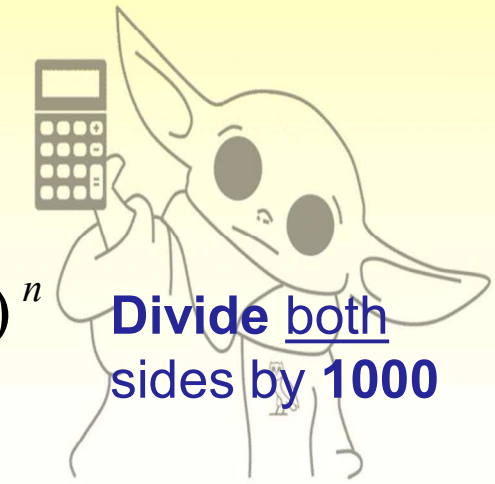
*If Lena has **$1000**, double its value is* **A** **$2000**

$$A = 1000\ (1.075\ )^n$$

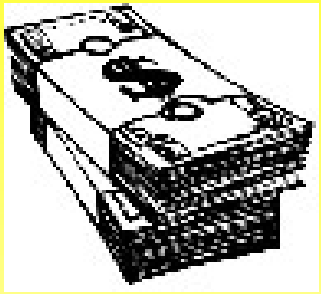
$$\frac{2000}{1000} = \frac{1000\ (1.075\ )^n}{1000}$$

Divide both sides by **1000**

$$2 = (1.075\ )^n$$



CHAPTER 6.4 TOOLS AND STRATEGIES TO SOLVE EQUATIONS INVOLVING EXPONENTS



EXAMPLE 3 *Solving for a Variable Exponent Using Systematic Trial*

*If Lena has **$1000**, double its value is* **$2000**

$$A = 1000\ (1.075)^n$$

$$\frac{2000}{1000} = \frac{1000\ (1.075)^n}{1000}$$

$$2 = (1.075)^n$$

*For systematic trial, we substitute different values for **"n"** until we get close to **2***

*Try **n = 9***

$A = (1.075)^n$

$A = (1.075)^9$

$A = \mathbf{1.92}$

TOO LOW!!!

*Try **n = 10***

$A = (1.075)^n$

$A = (1.075)^{10}$

$A = \mathbf{2.06}$

TOO HIGH!!!

*It would take between **9 and 10 years** for Lena's money to double.*

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HOMEWORK

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