Outline

The Problem

Picturing th

Some Algeb

The Formula

# Solving a quadratic equation a case study

Steven Hurder

University of Illinois at Chicago www.math.uic.edu/~hurder

Math 589 Presentation - October 30, 2007

#### Outline

The Problen

Solution

Some Algebr

The Formula

1 The Problem

2 Picturing the Solution

3 Some Algebra

4 The Formula

#### The Problem

# A pesky problem

Your paycheck has been held up, and they keep asking, "Are you really a mathematician?"

Outline

#### The Problem

Your paycheck has been held up, and they keep asking, "Are you really a mathematician?"

A pesky problem

Some Algebra

How to convince them?

#### The Problem

Your paycheck has been held up, and they keep asking, "Are you really a mathematician?"

A pesky problem

How to convince them?

What to do?

Outline

#### The Problem

Your paycheck has been held up, and they keep asking,

A pesky problem

"Are you really a mathematician?"

10 7 1160010

The Formula

How to convince them?

What to do?

And then the idea hits you - you'll show them you can solve a quadratic equation!

Sama Algaba

The Formul

### A pesky problem

Your paycheck has been held up, and they keep asking,

"Are you really a mathematician?"

How to convince them?

What to do?

And then the idea hits you - you'll show them you can solve a quadratic equation!

If that doesn't convince the admin type, what will?

Outline

#### The Problem

Solution Solution

Some Algebra

The Formula

### Choosing a quadratic equation

The Formula

# Choosing a quadratic equation

$$1 x^2 = 0$$

Outline

#### The Problem

Solution

Some Algebra

The Formula

# Choosing a quadratic equation

Now, it is only a matter to select a quadratic equation which will impress them.

①  $x^2 = 0$  (nah, too obvious. it would be shameful if this worked)

### Choosing a quadratic equation

- ①  $x^2 = 0$  (nah, too obvious. it would be shameful if this worked)
- $2x^2 2x + 1 = 0$

#### The Problem

Picturing th Solution

Some Algebra

The Formula

# Choosing a quadratic equation

- ①  $x^2 = 0$  (nah, too obvious. it would be shameful if this worked)
- ②  $x^2 2x + 1 = 0$  (more of the same)

# Choosing a quadratic equation

- ①  $x^2 = 0$  (nah, too obvious. it would be shameful if this worked)
- 2  $x^2 2x + 1 = 0$  (more of the same)
- $3 x^2 3x 1 = 0$

### Choosing a quadratic equation

- ①  $x^2 = 0$  (nah, too obvious. it would be shameful if this worked)
- 2  $x^2 2x + 1 = 0$  (more of the same)
- 3  $x^2 3x 1 = 0$  (sort of fancy... just right!)

Outline

The Problen

Picturing the Solution

Cama Almal

The Formul

### Grab your calculators:

A picture may be worth a thousand words, but is it worth a thousand bucks?

Outline

The Problem

Picturing the Solution

------

The Feet 1

### Grab your calculators:

A picture may be worth a thousand words, but is it worth a thousand bucks?

Let's try! If they buy this, we are done. So plot  $y = x^2 - 3x - 1$ 

Outline

The Problem

Picturing the Solution

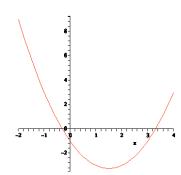
Cama Almaha

The Formul

### Grab your calculators:

A picture may be worth a thousand words, but is it worth a thousand bucks?

Let's try! If they buy this, we are done. So plot  $y = x^2 - 3x - 1$ 



Outline

The Problen

Picturing the Solution

Some Alcohi

The Formul

### Not even close...

"You want money for your one lousy graph?"

Outline

The Problen

Picturing the

Solution

The Formul

The Formul

Not even close...

"You want money for your one lousy graph?"

"Give the solution to 10 decimals, and we'll show you the money!"

Picturing the

Solution

The Formul

### Not even close...

"You want money for your one lousy graph?"

"Give the solution to 10 decimals, and we'll show you the money!"

"Oh, for @#%& sake!"

Some Algebra

The Formula

$$0 = x^2 - 3x - 1$$

Picturing t

Some Algebra

The Formula

### factor, factor, complete...

$$0 = x^2 - 3x - 1$$
  
$$0 = x^2 - 3x + (-3/2)^2 - (3/2)^2 - 1$$

Picturing th

Some Algebra

The Formul

### factor, factor, complete...

$$0 = x^{2} - 3x - 1$$

$$0 = x^{2} - 3x + (-3/2)^{2} - (3/2)^{2} - 1$$

$$0 = (x - 3/2)^{2} - 9/4 - 4/4$$

The Problem

Picturing th

Some Algebra

The Formul

$$0 = x^{2} - 3x - 1$$

$$0 = x^{2} - 3x + (-3/2)^{2} - (3/2)^{2} - 1$$

$$0 = (x - 3/2)^{2} - 9/4 - 4/4$$

$$0 = (x - 3/2)^{2} - 13/4$$

Outline

The Problem

Some Algebra

The Fermanda

Now let's solve it:

$$0 = (x - 3/2)^2 - 9/4 - 4/4 \implies (x - 3/2)^2 = 13/4$$

Outline

The Problem

THE TROBLET

Some Algebra

The Formul

Joine / ligebra

Now let's solve it:

$$0 = (x - 3/2)^2 - 9/4 - 4/4 \implies (x - 3/2)^2 = 13/4$$
$$\implies (x - 3/2) = \pm \sqrt{13/4}$$

0.....

The Problem

The Frobleti

Some Algebra

The Formul

Now let's solve it:

$$0 = (x - 3/2)^{2} - 9/4 - 4/4 \implies (x - 3/2)^{2} = 13/4$$

$$\implies (x - 3/2) = \pm \sqrt{13/4}$$

$$\implies x = 3/2 \pm \sqrt{13/4}$$

Outling

The Problem

Picturing the

Some Algebra

The Formul

Now let's solve it:

$$0 = (x - 3/2)^{2} - 9/4 - 4/4 \implies (x - 3/2)^{2} = 13/4$$

$$\implies (x - 3/2) = \pm \sqrt{13/4}$$

$$\implies x = 3/2 \pm \sqrt{13/4}$$

Think this is enough to get the money?

Outling

The Problem

Picturing the

Some Algebra

The Formul

Now let's solve it:

$$0 = (x - 3/2)^{2} - 9/4 - 4/4 \implies (x - 3/2)^{2} = 13/4$$

$$\implies (x - 3/2) = \pm \sqrt{13/4}$$

$$\implies x = 3/2 \pm \sqrt{13/4}$$

Think this is enough to get the money?

Not likely...

Outline

The Problen

Picturing the

Some Algebra

The Formul

There are two solutions:

Outline

The Problen

Picturing th

Some Algebra

The Formula

There are two solutions:

$$x = 3/2 + \sqrt{13/4}$$
, or

The Problen

Picturing t Solution

Some Algebra

The Formul

There are two solutions:

$$x = 3/2 + \sqrt{13/4}$$
, or

$$x = 3.302775637731994646559610633735247973125648286922623$$

and 
$$x = 3/2 - \sqrt{13/4}$$
, or

$$x = -0.3027756377319946465596106337352479731256482869226$$

Outline

The Probler

Picturing t

\_\_\_\_\_

Some Algebra

The Formula

### Mathematical Proof

The final proof that we are Mathematicians?

The Formula

### Mathematical Proof

The final proof that we are Mathematicians?

Give them the Magic Formula,

$$ax^2 + bx + c = 0 \Longrightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The Formula

### Mathematical Proof

The final proof that we are Mathematicians?

Give them the Magic Formula,

$$ax^2 + bx + c = 0 \Longrightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

and tell them to try this first next time...