

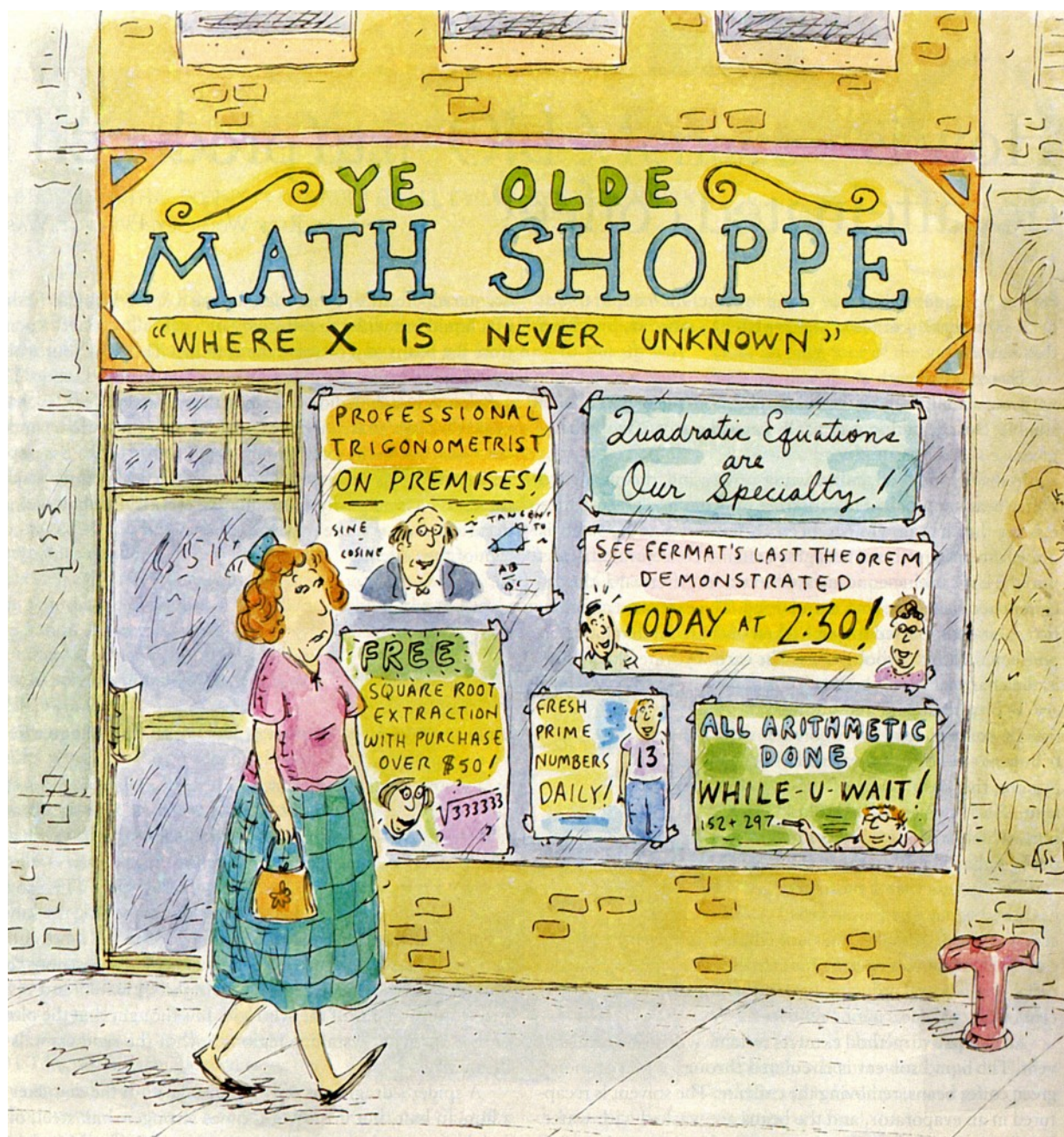
## Lesson 6

### GCSE and Preparatory A-Level Mathematics Conic Sections (Simultaneous Equations IV)

#### 6.1 Sweating The Q Formula

Last lesson you used the Q formula.

From memory, write it down.



## 6.2 An Example Where $a \neq 1$

### Question

Show how to use the Q formula to solve the equation,

$$3x^2 + 6x + 2 = 0$$

### Answer

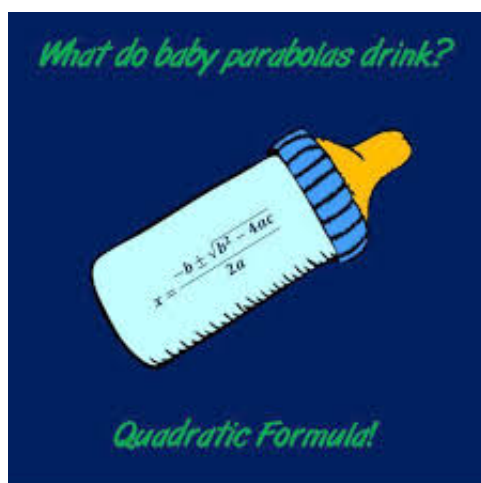
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

with  $a = 3$ ,  $b = 6$  and  $c = 2$  gives

$$\begin{aligned} x &= \frac{-6 \pm \sqrt{6^2 - 4 \times 3 \times 2}}{2 \times 3} \\ &= \frac{-6 \pm \sqrt{36 - 24}}{6} \\ &= \frac{-6 \pm \sqrt{12}}{6} \\ &= \frac{-6}{6} \pm \frac{\sqrt{4 \times 3}}{6} \\ &= -1 \pm \frac{2\sqrt{3}}{6} \\ &= -1 \pm \frac{\sqrt{3}}{3} \end{aligned}$$

### Notes

- ( i ) You should begin by writing down the Q formula
- ( ii ) Write down the value of  $a$ , of  $b$  and of  $c$
- ( iii ) You must show the numbers substituted into the formula.  
Mark schemes give zero marks for the whole question if you don't do this.
- ( iv ) Questions often require the exact answer (square roots left as square roots).
- ( v ) Or they may ask for the answer to a specified number of significant figures.



### 6.3 Exercise

#### Question 1

Show how to use the Q formula to solve the quadratic equation,

$$2x^2 + 8x + 5 = 0$$

and hence that  $x = -2 \pm \frac{\sqrt{6}}{2}$  are the two solutions.

#### Question 2

Show how to use the Q formula to solve the quadratic equation,

$$3x^2 + 2x - 4 = 0$$

and hence that  $x = -\frac{1}{3} \pm \frac{\sqrt{13}}{3}$  are the two solutions.

**Question 3**

*GCSE Examination Question from May 2018, Paper 1H, Q11(b)*

Solve  $3x^2 + 6x - 5 = 0$

Show your working clearly.

Give your solutions correct to 3 significant figures.

[ 3 marks ]

**Question 4**

*GCSE Examination Question from June 2011, Paper 4H, Q21(b)*

Solve  $x^2 + 90x - 1200 = 0$

Give the value of  $x$  correct to 3 significant figures.

[ 3 marks ]

**Question 5**

*National 5 Examination Question from June 2024. Paper 2, Q8, SQA*

Solve the equation  $3x^2 + 8x + 1 = 0$

Give your answers to 2 decimal places.

[ 3 marks ]

**Question 6**

*IGCSE Examination Question from June 2023, Paper 2H, Q21, Edexcel*

Solve the simultaneous equations,

$$2x^2 + 3y^2 = 11$$

$$x = 3y - 1$$

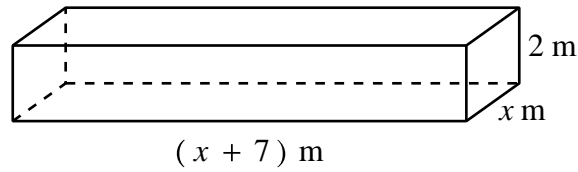
Show clear algebraic working

[ 5 marks ]

**Question 7**

*National 5 Examination Question from May 2023, Paper 2, Q14, SQA*

A storage unit, built in the shape of a cuboid, is shown.



It has length  $(x + 7)$  metres, breadth  $x$  metres and height 2 metres.

The volume of this unit is 45 cubic metres.

( a ) Show that  $2x^2 + 14x - 45 = 0$

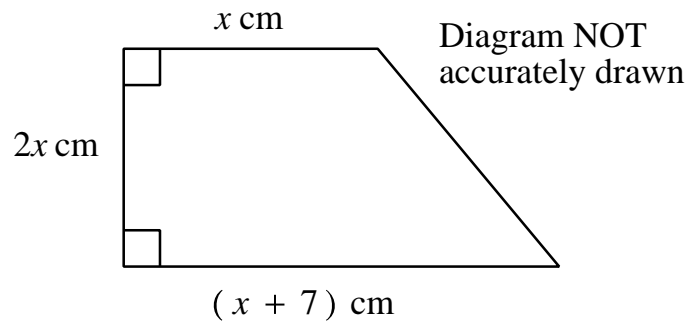
[ 2 marks ]

( b ) Calculate  $x$ , the breadth of the storage unit.  
Give your answer correct to 1 decimal place.

[ 4 marks ]

**Question 8**

*GCSE Examination Question from January 2015, 4H, Q17*



The diagram shows a trapezium.

The trapezium has an area of  $17 \text{ cm}^2$

( a ) Show that  $2x^2 + 7x - 17 = 0$

[ 3 marks ]

( b ) Work out the value of  $x$   
Give your answer correct to 3 significant figures,  
Show your working clearly.

[ 3 marks ]