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EB Education Revision Guide

How to work with the Quadratic Formula

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The Quadratic Formula

What is it?

You can work out the solutions to any quadratic equation $ax^2 + bx + c$ by using the quadratic formula.

You would use this formula if:

- You are given a quadratic equation which will not factorise easily.
- You are asked to give your answer to a number of decimal places, or significant figures.
- You are asked to give exact answers or surds.

You do need to learn this formula off by heart!

The formula

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

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Using the formula

Example:

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

1. Identify what a, b and c are, They are the coefficient of terms in the equation.
2. Put the values into the equation.
3. Taking care, complete the calculations in stages.
4. Remember you should get two solutions.

Solve $x^2 + 11x + 16 = 0$ to 3 s.f.

a = 1 b = 11 c = 16

$$x = \frac{-11 \pm \sqrt{11^2 - 4 \text{ x } 1 \text{ x } 16}}{2 \text{ x } 1}$$

$$x = \frac{-11 \pm \sqrt{121 - 64}}{2}$$

$$x = \frac{-11 \pm \sqrt{57}}{2}$$

$$x = \frac{-11 + \sqrt{57}}{2} \quad \text{OR} \quad \frac{-11 - \sqrt{57}}{2}$$

x = -1.73 OR -9.27

TOP TIPS:
You should not get a negative number for b^2. Whether b is +ve or –ve, when you square it - you will get a positive number.

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Your turn:

Solve $2x^2 + 3x - 7 = 0$

Give your solutions correct to 3 significant figures.
Show your working clearly.

Solve $x^2 - 7x + 3 = 0$

Give your solutions correct to 3 significant figures.

Mel is using the quadratic formula to solve a quadratic equation.
She substitutes values into the formula and correctly gets

$$\frac{-5 \pm \sqrt{25 - 12}}{6}$$

Work out the quadratic equation that Mel is solving.
Give your answer in the form $ax^2 + bx + c = 0$, where a, b and c are integers.

Solve $2x^2 - 8 = 3x + 5$
Give your answers correct to 3 significant figures.

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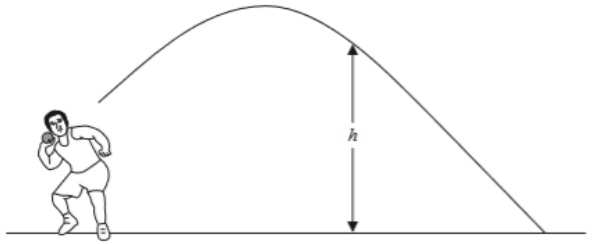
Your turn:



Ivan is a shot putter.
The formula $h = 2 + 6t - 5t^2$ gives the height, h metres, of the shot above the ground t seconds after he has released the shot.

(i) Solve $2 + 6t - 5t^2 = 0$
Give your solutions correct to 3 significant figures.
Show your working clearly.

The shot hits the ground after T seconds.

(ii) Write down the value of T.
Give your answer correct to 3 significant figures.

$T =$ .....

7. The diagram below shows a 6-sided shape.
All the corners are right angles.
All the measurements are given in centimetres.

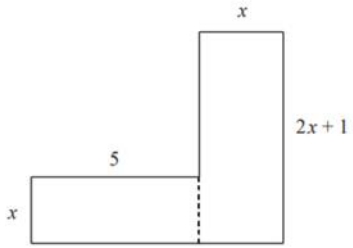


Diagram **NOT** accurately drawn

The area of the shape is 95 cm^2.

(a) Show that $2x^2 + 6x - 95 = 0$

(3)

(b) Solve the equation

$$2x^2 + 6x - 95 = 0$$

Give your solutions correct to 3 significant figures.

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Your turn:

All the measurements are given in centimetres.

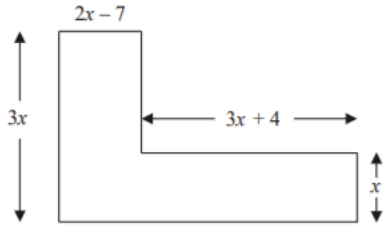

Diagram **NOT** accurately drawn

The area of the shape is 85 cm^2.

(a) Show that $9x^2 - 17x - 85 = 0$

(3)

(b) (i) Solve $9x^2 - 17x - 85 = 0$

Give your solutions correct to 3 significant figures.

x = ... or x = ...

(ii) Hence, work out the length of the shortest side of the 6-sided shape.

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Answers:

Solve $2x^2 + 3x - 7 = 0$

Give your solutions correct to 3 significant figures.
Show your working clearly.

It asks for 3sf – so you know you need to use the formula:

a = 2 b = 3 c = -7

$$\frac{-3 \pm \sqrt{3^2 - (4 \text{ x } 2 \text{ x } -7)}}{2 \text{ x } 2} \qquad \frac{-3 \pm \sqrt{9 + 56}}{4}$$

$$\frac{-3 + \sqrt{65}}{4} \quad \text{or} \quad \frac{-3 - \sqrt{65}}{4}$$

= 1.27 or -2.77

Mel is using the quadratic formula to solve a quadratic equation.
She substitutes values into the formula and correctly gets

$$\frac{-5 \pm \sqrt{25 - 12}}{6}$$

Work out the quadratic equation that Mel is solving.
Give your answer in the form $ax^2 + bx + c = 0$, where a, b and c are integers.

$$\frac{-5 \pm \sqrt{25 - 12}}{6}$$

2a = 6 Therefore a = 3

b = 5

4ac = 12 Therefore 4 x 3 x c = 12

c = 1

$3x^2 + 5x + 1 = 0$

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Answers:

Solve $x^2 - 7x + 3 = 0$

Give your solutions correct to 3 significant figures.

It asks for 3sf – so you know you need to use the formula:

a = 1 b = -7 c = 3

$$\frac{--7 \pm \sqrt{-7^2 - (4 \text{ x } 1 \text{ x } 3)}}{2 \text{ x } 1} \qquad \frac{7 \pm \sqrt{49 - 12}}{2}$$

$$\frac{7+\sqrt{37}}{2} \text{ or } \frac{7-\sqrt{37}}{2}$$

= 6.54 or 0.459

Solve $2x^2 - 8 = 3x + 5$

Give your answers correct to 3 significant figures.

$2x^2$ -8 = 3x +5

-3x, -5 both sides

$2x^2$ -8 – 5 – 3x = 0 $2x^2$ - 3x – 13 = 0

a = 2 b = -3 c = -13

$$\frac{--3 \pm \sqrt{3^2 - (4 \text{ x } 2 \text{ x } -13)}}{2 \text{ x } 2} \qquad \frac{3 \pm \sqrt{9 + 104}}{4}$$

$$\frac{3+\sqrt{113}}{4} \text{ or } \frac{3-\sqrt{113}}{4}$$

= 3.41 or -1.91

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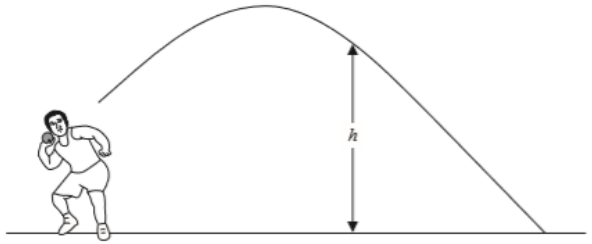
Answers:



Ivan is a shot putter.
The formula $h = 2 + 6t - 5t^2$ gives the height, h metres, of the shot above the ground t seconds after he has released the shot.

(i) Solve $2 + 6t - 5t^2 = 0$
Give your solutions correct to 3 significant figures.
Show your working clearly.

$2 + 6t - 5t^2 = 0$

$-5t^2 + 6t + 2 = 0$

$a = -5 \quad b = 6 \quad c = 2$

$$\frac{-6 \pm \sqrt{6^2 - (4 \times -5 \times 2)}}{2 \times -5} \qquad \frac{-6 \pm \sqrt{36 + 40}}{-10}$$

$$\frac{-6 + \sqrt{76}}{-10} \text{ or } \frac{-6 - \sqrt{76}}{-10}$$

$= -0.272$ or 1.47

The shot hits the ground after T seconds.

(ii) Write down the value of T.
Give your answer correct to 3 significant figures.

$T =$ _____

1.47 as the answer cannot be negative

7. The diagram below shows a 6-sided shape.
All the corners are right angles.
All the measurements are given in centimetres.

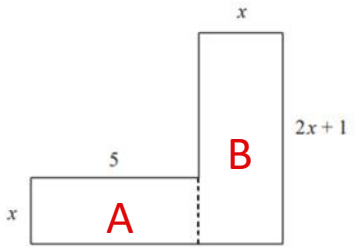


Diagram **NOT** accurately drawn

Area A = $5x$
Area B = $x(2x+1)$
$= 2x^2 + x$

The area of the shape is 95 cm^2.

(a) Show that $2x^2 + 6x - 95 = 0$

Total area = $5x + 2x^2 + x$
so $2x^2 + 5x + x = 95$
$2x^2 + 6x - 95 = 0$

(3)

Answers:

(b) Solve the equation

$$2x^2 + 6x - 95 = 0$$

Give your solutions correct to 3 significant figures.

a = 2 b = 6 c = -95

$\frac{-6\pm\sqrt{6^2-(4 \times 2 \times -95)}}{2 \times 2}$ $\frac{-6\pm\sqrt{36+760}}{4}$

$\frac{-6+\sqrt{796}}{4}$ or $\frac{-6-\sqrt{796}}{4}$

= 5.55 or -8.55

All the measurements are given in centimetres.

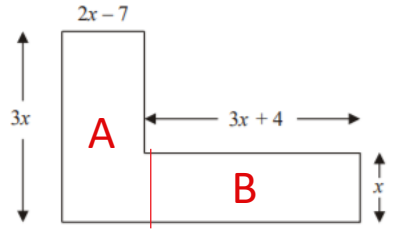


Diagram **NOT** accurately drawn

The area of the shape is 85 cm^2.

(a) Show that $9x^2 - 17x - 85 = 0$

Area A = $3x(2x-7) = 6x^2 - 21x$

Area B = $x(3x + 4) = 3x^2 + 4x$

Total area = $9x^2 - 17x$

$9x^2 - 17x = 85$

$9x^2 - 17x - 85 = 0$

(3)

(b) (i) Solve $9x^2 - 17x - 85 = 0$

Give your solutions correct to 3 significant figures.

a = 9 b = -17 c = -85

$\frac{--17\pm\sqrt{-17^2-(4 \times 9 \times -85)}}{2 \times 9}$ $\frac{17\pm\sqrt{289+3060}}{18}$

$\frac{17+\sqrt{3349}}{18}$ or $\frac{17-\sqrt{3349}}{18}$

$x =$ 4.16 or $x =$ -2.27

(ii) Hence, work out the length of the shortest side of the 6-sided shape. $2x - 7 = 1.32$

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For more help and resources, or to work with us as a tutor, please contact us

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