Junior Cert Maths

Free Notes

Quadratic Equations

Quadratic Equations

Quadratic equations are equations of the form $ax^2 + bx + c = 0$.

To solve a quadratic equation we must firstly make sure our equation equals zero. For instance if $x^2 + 8x + 8 = -7$ we must bring -7 to the other side of our equation so as it equals 0 i.e. $x^2 + 8x + 15 = 0$

Once our equation equals 0 it can be solved by factorisation. We let both of our factorised
terms equal 0 and solve for x

$x^2 + x - 42 = 0$
$(x - 6)(x + 7) = 0$
$x - 6 = 0 \quad x + 7 = 0$
$x = 6 \quad x = -7$

$3x^2 + 19x + 26 = 0$
$(3x + 13)(x + 2) = 0$
$3x + 13 = 0 \quad x + 2 = 0$
$3x = -13 \quad x = -2$
$x = -13/3$

$x^2 + 7x - 44 = 0$
$(x + 11)(x - 4) = 0$
$x + 11 = 0 \quad x - 4 = 0$
$x = -11 \quad x = 4$

$6x^2 - 29x + 30 = 0$
$(3x - 10)(2x - 3) = 0$
$3x - 10 = 0 \quad 2x - 3 = 0$
$3x = 10 \quad 2x = 3$
$x = 10=3 \quad x = 3/2$

$2x^2 - 15x + 27 = 0$
$(2x - 9)(x - 3) = 0$
$2x - 9 = 0 \quad x - 3 = 0$
$2x = 9 \quad x = 3$
$x = 9/2$

$x^2 - 6x = 0$
$x(x - 6) = 0$
$x = 0 \quad x - 6 = 0$
$x = 0 \quad x = 6$

$12x^2 - 7x - 45 = 0$
$(4x - 9)(3x + 5) = 0$
$4x - 9 = 0 \quad 3x + 5 = 0$
$4x = 9 \quad 3x = -5$
$x = 9/4 \quad x = -5/3$

$2x^2 + 18x = 0$
$2x(x + 9) = 0$
$2x = 0 \quad x + 9 = 0$
$x = 0 \quad x = -9$

If a quadratic equation cannot be factorised we must use the quadratic formula

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

where a, b, c are taken from the quadratic equation $ax^2 + bx + c = 0$
Use your calculator to help you solve these types of quadratic equations.

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

a = 1
b = 5
c = 3

$$\frac{-5 \pm \sqrt{5^2 - 4(1)(3)}}{2(1)}$$

$$\frac{-5 \pm \sqrt{25 - 12}}{2}$$

$$\frac{-5 \pm \sqrt{13}}{2}$$

We Split our equation in two

$$\frac{-5 + \sqrt{13}}{2} \qquad \frac{-5 - \sqrt{13}}{2}$$

Using our calculator we get

x = -0.7 and x = -4.3

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

a = 2
b = -4
c = -3

$$\frac{4 \pm \sqrt{(-4)^2 - 4(2)(-3)}}{2(2)}$$

$$\frac{4 \pm \sqrt{16 + 24}}{4}$$

$$\frac{4 \pm \sqrt{40}}{4}$$

We Split our equation in two

$$\frac{4 + \sqrt{40}}{4} \qquad \frac{4 - \sqrt{40}}{4}$$

Using our calculator we get

x = -2.58 and x = -0.58

Questions

1. Solve for x: $3x^2 + 11x = 4$

$3x^2 + 11x = 4$
$3x^2 + 11x - 4 = 0$

(3x - 1)(x + 4)

3x - 1 = 0 x + 4 = 0
3x = 1 x = -4
x = 1/3

x = 1/3 and -4

2. Solve for x $8x^2$ - 14x + 3 = 0

$8x^2$ - 14x + 3 = 0

(2x - 3)(4x - 1)

2x - 3 = 0 4x - 1 = 0
2x = 3 4x = 1
x = 3/2 x = 1/4

x = 3/2 and 1/4

3. Find the roots of the equation $2x^2$ - 7x - 6 = 0 Give your answers correct to two decimal places

Use the quadratic formula

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

a = 2
b = -7
c=-6

$$\frac{-7 \pm \sqrt{(-7)^2 - 4(2)(-6)}}{2(2)}$$

$$\frac{-7 \pm \sqrt{49 + 48}}{4}$$

$\frac{-7\pm\sqrt{97}}{4}$

Split our equation into two parts

$\frac{-7+\sqrt{97}}{4}$ $\frac{-7-\sqrt{97}}{4}$

Using our calculator we get

x = 4.21 and - 0.71

4(i). Solve the equation x^2 = 3x+2. Give your answers correct to two decimal Places

x^2 - 3x – 2 = 0

Use the quadratic formula

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

a = 1
b = -3
c = -2

$\frac{3\pm\sqrt{(-3)^2-4(1)(-2)}}{2(1)}$

$\frac{3\pm\sqrt{9+8}}{2}$

$\frac{3\pm\sqrt{17}}{2}$

Split our equation into two parts

$\frac{3+\sqrt{17}}{4}$ $\frac{3-\sqrt{17}}{4}$

Using our calculator we get

x = 3.56 and -0.56

4(ii)Hence, or otherwise, find value for p for which p = 3$\sqrt{p}$ + 2
Give your answers correct to one decimal place.

From our previous equation x^2 = 3x + 2 x = 3.56 and -0.56

If we replace x with $\sqrt{p}$

$\sqrt{p}$ = = 3.56 $\sqrt{p}$ = -0.56

p = 12.7 p = 0.3

If we test both of these values back into our equation p = 3$\sqrt{p}$ + 2

we find that only 12.7 satisfies our equation
p = 12.7

5. (i) Solve the equation x^2 - 6x + 4 = 0, giving your answer in the form of a $\pm$ b , where a, b € N

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

a = 1
b = -6
c = 4

$$\frac{6 \pm \sqrt{(-6)^2 - 4(1)(4)}}{2(1)}$$

$$\frac{6 \pm \sqrt{36 - 16}}{2}$$

$$\frac{6 \pm \sqrt{20}}{2}$$

$$\frac{6 \pm 2\sqrt{5}}{2}$$

Split our equation into two parts

$$\frac{6+2\sqrt{5}}{2} \qquad \frac{6-2\sqrt{5}}{2}$$

Dividing both equations across by 2 we get

x = 3 + $\sqrt{5}$ x = 3 - $\sqrt{5}$

(ii) Hence, or otherwise ,find two values for p for which $(3 + p)^2 - 6(3 + p) + 4 = 0$

From our previous equation x^2 - 3x + 4 = 0 x = 3 + $\sqrt{5}$ and x = 3 - $\sqrt{5}$

If we replace x with 3 + p we get the given equation $(3 + p)^2 - 6(3 + p) + 4 = 0$

So x = 3 + p

p + 3 = 3 + $\sqrt{5}$ and p + 3= 3 - $\sqrt{5}$

p = $\sqrt{5}$ and p = - $\sqrt{5}$

(iii) Show that the sum of the two values of p is zero.

$\sqrt{5}$ - $\sqrt{5}$ = 0

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