

## Activity 36

## The general quadratic formula

1.

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

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

$$x^2 - 3x + \frac{9}{4} = \frac{5}{4} \quad \text{add } \frac{9}{4} \left( \left( \frac{3}{2} \right)^2 \right) \text{ to both sides}$$

$$\frac{(2x-3)^2}{4} = \frac{5}{4} \quad \text{Complete the square } \left( x - \frac{3}{2} \right)^2$$

$$(2x-3)^2 = 5$$

$$2x-3 = \pm\sqrt{5} \quad \text{square root of both sides}$$

$$x = \frac{3 \pm \sqrt{5}}{2}$$

2.

a)

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

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

$$x^2 - 3x + \frac{9}{4} = \frac{41}{4}$$

$$\left( x - \frac{3}{2} \right)^2 = \frac{41}{4}$$

$$x - \frac{3}{2} = \pm \frac{\sqrt{41}}{2}$$

$$x = \frac{3 \pm \sqrt{41}}{2}$$

b)

$$z^2 + 5z - 8 = 0$$

$$z^2 + 5z = 8$$

$$z^2 + 5z + \frac{25}{4} = \frac{57}{4}$$

$$\left( z + \frac{5}{2} \right)^2 = \frac{57}{4}$$

$$z + \frac{5}{2} = \pm \frac{\sqrt{57}}{2}$$

$$z = \frac{-5 \pm \sqrt{57}}{2}$$

```
x^2-3x-8=0
x^2-3*x-8=0
ans+8
x^2-3*x=8
ans+( -3/2 )^2
x^2-3*x+9/4=41/4
factor(ans)
(2*x-3)^2=41
ans*4
(2*x-3)^2=41
sqrt(ans)
|2*x-3|=sqrt(41)
absExpand(ans)
2*x-3=sqrt(41) or 2*x-3=-sqrt(41)
ans[1]
x=sqrt(41)/2+3/2
combine(ans)
x=sqrt(41)+3/2
```

3. a)

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

$$x^2 + 5x = -c$$

$$x^2 + 5x + \frac{25}{4} = \frac{25}{4} - c$$

$$\left( x + \frac{5}{2} \right)^2 = \frac{25}{4} - c$$

$$x + \frac{5}{2} = \pm \sqrt{\frac{25}{4} - c}$$

$$x = \frac{-5 \pm \sqrt{25-4c}}{2}$$

b)

$$x^2 + bx + c = 0$$

$$x^2 + bx = -c$$

$$x^2 + bx + \frac{b^2}{4} = \frac{b^2}{4} - c$$

$$\left( x + \frac{b}{2} \right)^2 = \frac{b^2}{4} - c$$

$$x + \frac{b}{2} = \pm \sqrt{\frac{b^2-4c}{4}}$$

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

4.

$$\begin{aligned}
 x^2 + \frac{b}{a}x + \frac{c}{a} &= 0 \\
 x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 &= \left(\frac{b}{2a}\right)^2 - \frac{c}{a} = \frac{b^2 - 4ac}{4a^2} \\
 \left(x + \frac{b}{2}\right)^2 &= \frac{b^2 - 4ac}{4a^2} \\
 x + \frac{b}{2} &= \frac{\pm\sqrt{b^2 - 4ac}}{2a} \\
 x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
 \end{aligned}$$

The screenshots illustrate the step-by-step solution of the quadratic equation  $x^2 + 5x - 8 = 0$  using a ClassPad calculator.

**Window 1:**

```

x^2+5x-8=0
ans+8
ans+(5/2)^2
factor(ans)
ans*4
sqrt(ans)
absExpand(ans)
ans[1]
combine(ans)
x=(sqrt(57)-5)/2

```

**Window 2:**

```

x^2+b*x+c=0
ans-c
ans+(-b/(2a))^2
factor(ans)
ans*4
sqrt(ans)
2*x+b=sqrt(b^2-4*c)
ans-b
ans/(2)
x=(-b-sqrt(b^2-4*c))/2

```

**Window 3:**

```

x^2+b*a*x+c/a=0
x^2+b*x+c/a=0
ans-c/a
x^2+b*x=-c/a
ans+(-b/(2a))^2
x^2+b*x+b^2/(4*a^2)=b^2/(4*a^2)-c/a
factor(ans)
((2*a*x+b)^2/(4*a^2))=b^2-4*a*c/(4*a^2)
ans*4
((2*a*x+b)^2/(a^2))=b^2-4*a*c/a^2
sqrt(ans)
|2*a*x+b|/a=sqrt(b^2-4*a*c)/|a|
2*a*x+b=sqrt(b^2-4*a*c)
ans-b
2*a*x=-b+sqrt(b^2-4*a*c)
ans/(2*a)
x=(-b-sqrt(b^2-4*a*c))/(2*a)

```