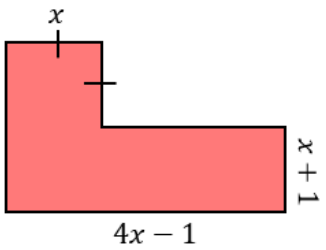
# Solving Harder Quadratic Equations in Context

## (a)

The shape shown has an area of $13\ cm^2$. All lengths on the diagram are in cm.




(i) Show that $5x^2 + 3x - 14 = 0$

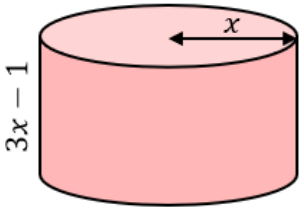
$$x^2 + (4x-1)(x+1) = 13$$
$$x^2 + 4x^2 + 3x - 1 = 13$$
$$5x^2 + 3x - 14 = 0$$

(ii) Hence, find the value of $x$ and the dimensions of the shape.

$$(5x-7)(x+2) = 0$$
$$x > 0, so\ x = 1.4$$
Dimensions are $1.4\ cm, 2.4\ cm, 4.6\ cm$

## (b)

The cylinder shown has a total surface area of $78\pi\ cm^2$. All lengths on the diagram are in centimetres.




(i) Show that $4x^2 - x - 39 = 0$

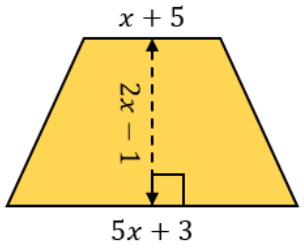
$$2\pi x^2 + 2\pi x(3x-1) = 78\pi$$
$$2x^2 + 6x^2 - 2x = 78$$
$$8x^2 - 2x - 78 = 0$$
$$4x^2 - x - 39 = 0$$

(ii) Hence, find the value of $x$ and the height of the cylinder.

$$(x+3)(4x-13) = 0$$
$x > 0\ so\ x = 3.25$ and height is $8.75\ cm$

## (c)

The trapezium shown has an area of $30\ cm^2$. All lengths on the diagram are in centimetres.




(i) Show that $6x^2 + 5x - 34 = 0$

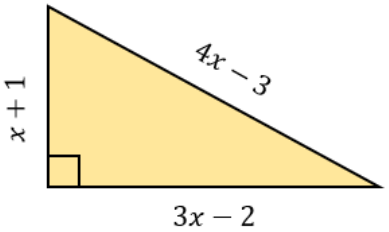
$$\frac{x+5+5x+3}{2} \times (2x-1) = 30$$
$$(3x+4)(2x-1) = 30$$
$$6x^2 + 5x - 4 = 30$$
$$6x^2 + 5x - 34 = 0$$

(ii) Hence, find the value of $x$ and the dimensions of the trapezium.

$$(6x+17)(x-2) = 0$$
$x > 0, so\ x = 2$ and dimensions are $7\ cm, 13\ cm, 3\ cm$

## (d)

A right-angled triangle has sides of lengths $(x+1)\ cm$, $(3x-2)\ cm$ and $(4x-3)\ cm$ as shown.




(i) Show that $3x^2 - 7x + 2 = 0$

$$(4x-3)^2 = (x+1)^2 + (3x-2)^2$$
$$16x^2 - 24x + 9 = x^2 + 2x + 1 + 9x^2 - 12x + 4$$
$$6x^2 - 14x + 4 = 0$$
$$3x^2 - 7x + 2 = 0$$

(ii) Hence find the value of $x$ and the length of the hypotenuse.

$$(3x-1)(x-2) = 0$$
$x = \frac{1}{3}$ or $x = 2$, but lengths cannot be negative so $x = 2$

Hypotenuse is $5\ cm$