Quadratic Equations

Consider $(x+a)(x+b)$

$= x^2 + ax + bx + ab$

$= x^2 + (a+b)x + ab$

Factorising is the opposite of expanding

$x^2 + 5x + 6$

$= (x+2)(x+3)$

+1	+6
−1	−6
+2	+3 ✓
−2	−3

Ex1 Solve $x^2 + 5x + 6 = 0$

$(x+2)(x+3) = 0$

Either $x + 2 = 0$ or $x + 3 = 0$

$\underline{x = -2}$ $\underline{x = -3}$

Ex2 $x^2 - 7x + 10 = 0$

$(x-2)(x-5) = 0$

+1	+10
−1	−10
+2	+5
−2	−5 ✓

Either $x - 2 = 0$ or $x - 5 = 0$

$\underline{x = 2}$ $\underline{x = 5}$

Ex 3

$$x^2 + x - 12 = 0$$

$$(x-3)(x+4) = 0$$

+1	−12
−1	+12
+2	−6
−2	+6
+3	−4
−3	+4 ✓

Either $x - 3 = 0$ or $x + 4 = 0$

$\underline{x = 3}$ $\underline{x = -4}$

Ex 4

$$x^2 - 5x - 24 = 0$$

$$(x+3)(x-8) = 0$$

+1	−24
−1	+24
+2	−12
−2	+12
+3	−8 ✓

Either $x + 3 = 0$ or $x - 8 = 0$

$\underline{x = -3}$ $\underline{x = 8}$

Exercise Solve (Grade 5)

1) $x^2 - 5x - 14 = 0$

$(x+2)(x-7) = 0$

Either $x + 2 = 0$ or $x - 7 = 0$

$\underline{x = -2}$ $\underline{x = 7}$

2) $x^2 + 11x + 10 = 0$

$(x+1)(x+10) = 0$

Either $x + 1 = 0$ or $x + 10 = 0$

$\underline{x = -1}$ $\underline{x = -10}$

3) $x^2 + 4x - 21 = 0$

$(x-3)(x+7) = 0$

Either $x - 3 = 0$ or $x + 7 = 0$

$\underline{x = 3}$ $\underline{x = -7}$

4) $x^2 - 2x + 1 = 0$

$(x-1)(x-1) = 0$

Either $x - 1 = 0$ or $x - 1 = 0$

$\underline{x = 1}$ $\underline{x = 1}$

called a double root

Multiple x^2 term (Grade 7)

Ex 1

$$2x^2 + 9x + 10 = 0$$

2×10
$= 20$
$+1 \quad +20$
$+2 \quad +10$
$+4 \quad +5$ ✓

$$2x^2 + 4x + 5x + 10 = 0$$

$$2x(x+2) + 5(x+2) = 0$$

$$(2x+5)(x+2) = 0$$

Either $2x + 5 = 0$ or $x + 2 = 0$

$2x = -5$

$x = -\frac{5}{2}$

$x = -2$

Ex 2

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

3×-8
$= -24$
$+1 \quad -24$
$-1 \quad +24$
$+4 \quad -6$
$-4 \quad +6$ ✓

$$3x^2 - 4x + 6x - 8 = 0$$

$$x(3x-4) + 2(3x-4) = 0$$

$$(x+2)(3x-4) = 0$$

Either $x + 2 = 0$ or $3x - 4 = 0$

$x = -2$

$3x = 4$

$x = \frac{4}{3}$

Exercise Solve

1)

$5 \times 3 = 15$

$+1 \quad +15$

$+3 \quad +5$ ✓

$$5x^2 + 8x + 3 = 0$$

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

$$x(5x+3) + 1(5x+3) = 0$$

$$(x+1)(5x+3) = 0$$

Either $x + 1 = 0$ or $5x + 3 = 0$

$\underline{x = -1}$ $\qquad 5x = -3$

$\underline{x = -\frac{3}{5}}$

2)

4×-5

$= -20$

$+1 \quad -20$

$-1 \quad +20$

$+2 \quad -10$ ✓

$$4x^2 - 8x - 5 = 0$$

$$4x^2 + 2x - 10x - 5 = 0$$

$$2x(2x+1) - 5(2x+1) = 0$$

$$(2x-5)(2x+1) = 0$$

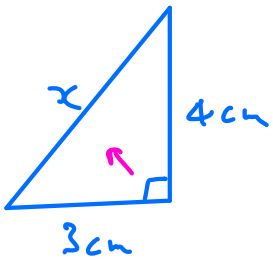
Either $2x - 5 = 0$ or $2x + 1 = 0$

$2x = 5$ $\qquad 2x = -1$

$\underline{x = \frac{5}{2}}$ $\qquad \underline{x = -\frac{1}{2}}$

Pythagoras Without a Calculator

Ex 1

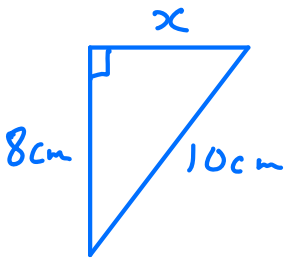


Find x

By Pythagorus

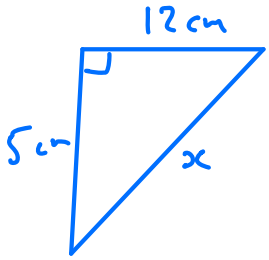
$$3^2 + 4^2 = x^2$$
$$9 + 16 = x^2$$
$$25 = x^2$$
$$\sqrt{25} = x$$
$$\underline{x = 5\text{ cm}}$$

Ex 2



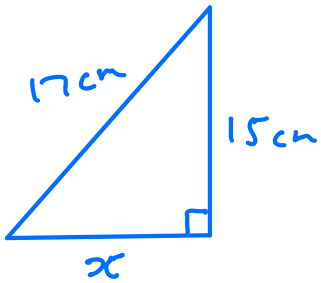
$$x^2 + 8^2 = 10^2$$
$$x^2 = 10^2 - 8^2$$
$$x^2 = 100 - 64$$
$$x^2 = 36$$
$$x = \sqrt{36}$$
$$\underline{x = 6\text{ cm}}$$

Ex 3



$$5^2 + 12^2 = x^2$$
$$25 + 144 = x^2$$
$$169 = x^2$$
$$\sqrt{169} = x$$
$$\underline{x = 13\text{ cm}}$$

Ex 4



$$\begin{array}{r} 17 \\ 17 \\ \hline 119 \\ 170 \\ \hline 289 \end{array} \qquad \begin{array}{r} 15 \\ 15 \\ \hline 75 \\ 150 \\ \hline 225 \end{array}$$

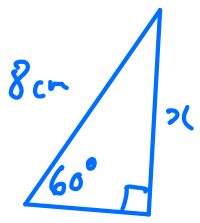
$$x^2 + 15^2 = 17^2$$
$$x^2 = 17^2 - 15^2$$
$$x^2 = 289 - 225$$
$$x^2 = 64$$
$$x = \sqrt{64}$$
$$x = 8\text{ cm}$$

Pythagorean Triples

3, 4, 5   5, 12, 13   7, 24, 25   8, 15, 17

Trig Exact Values

	30°	45°	60°
sin	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$
cos	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$
tan	$\frac{1}{\sqrt{3}}$	1	$\frac{\sqrt{3}}{1}$



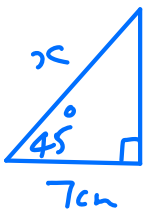
Find x

$$\sin 60^\circ = \frac{x}{8}$$

$$8 \sin 60^\circ = x$$

$$8 \times \frac{\sqrt{3}}{2} = x$$

$$x = 4\sqrt{3} \text{ cm}$$



$$\cos 45^\circ = \frac{7}{x}$$

$$\frac{1}{\sqrt{2}} = \frac{7}{x}$$

$$\underline{x = 7\sqrt{2}}$$